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Digital India: Challenges and Opportunities

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Abstract

The Digital India drive is a dream project of the Indian Government to remodel India into a Knowledgeable, economically strong, digitaily empowered society, with good governance for citizens by bringing synchronization and coordination in public accountability, digitally connecting and delivering the government programs and services to mobilize the capability of information technology across government departments.Digitalization of business and delivery of services leads to ease of access, transparency and reduction in transaction cost such as e-Governance, e-Kranti-Electronic delivery of services. The 'Digital India' programme, an initiative of honourable Prime Minister Mr.NarendraModi, will emerge new progressions in every sector of economy and generates innovative endeavours for Next, and this campaign started by PM is very impressive in economic development. So, Digital India is a step by the government to inspire and connect Indian Economy to such a knowledge savvy world. Digitalization provides efficient services in agriculture, education, and healthcare, Banking, Financial Service and Insurance.ICT play a vital role in Banking, Financial Services and Insurance. The digitalization creates IT jobs for the skilled youth results in income level that contribute to economic growth. The program motto is *"Power to Empower"*.The programtargets to make Government services available to people digitally and enjoy the benefit of the newest information and technological innovations, and provide all services to people in paperless mode. The program runs under The Ministry of Electronics and Information Technology. Hence, an attempt has been made in this paper to understand with advancement in mobile application, a requirement of customer has created a threat to the theft of data due to cyber-attack. Digital India–as a campaign where technologies and connectivity will come together to make an impact on all aspects of e-governance and improve the quality of life of citizens.This has to be address with a holistic policy on cyber security measures to protect the privacy of data.

Keywords - *Digital India, Digital Technology,Challenges of Digital India, cyber-attack,E-governance,Opportunities of Digital India,e-Kranti.*

I. Introduction:

A National e- Governance plan approved in 2006 has not insured effective progress in electronic manufacturing and e-Governance in country. Digital India is an ambitious programme to transform India into a digitally empowered economy. Our honourable Prime Minister Mr.NarendraModi has introduced this programme from 1 July 2015.The motive behind this concept is to build participative, transparent & responsible system. It focuses on providing high speed internet services to its citizens &make services available in relative both for online & mobile platform. This programme has been envisaged and coordinated by the department of electronics and information technology in collaboration with central and state governments. Digital India mission's main aim is to bridge the connectivity gap between rural and urban areas. Digitization is an inclusive technique of preservation and access to knowledge contents, also it changes the ways in which collections are used and accessed. It is a social transformation started by the massive adoption of digital technologies to generate process, share and manage digital information. An attempt has been made in this paper to understand Digital India as a campaign where technologies & connectivity will come together for good governance.Digital India is set of

revolutionise the nation through electronic delivery of services including e-education, e-healthcare and technology for planning.

II. Research Methodology

The data is secondary data collected from Journals,Magazine, Reference book, Annul reports, Recommendations of Councils, Web content of Government organization that relates to subject matter.

III. Objectives

1. To Study the concept of Digital India Programme
2. To find out opportunities in Digital India
3. To explore various areas of Digital India
4. To analysis the challenges that act as barriers to Digital India

IV.Projects Under Digital India Programme

1. Digital locker System: - DigiLocker is the national Digital Locker System launched by Govt. of India. 1 GB of free space in the locker to securely store resident documents. DigiLocker is a platform for issuance and verification of documents & certificates in a digital way, thus eliminating the use of physical documents.Indian citizens who sign up for a DigiLocker account get a dedicated cloud storage space that is linked to their Aadhaar (UIDAI) number. Organizations that are registered with Digital Locker can push electronic copies of documents and certificates (e.g. driving license, Voter ID, School certificates) directly into citizens lockers. Citizens can also upload scanned copies of their legacy documents in their accounts. These legacy documents can be electronically signed using the eSign facility.
2. Broadband Highway:- This covers three sub components, namely Broadband for All – Rural, All - Urban and National Information Infrastructure (NII).NII would integrate the network and cloud infrastructure in the country to provide high speed connectivity and cloud platform to various government departments up to the panchayat level.
3. Universal Mobile Access: - in the coming years, network technologies like 3G, 4G and upcoming 5G will storm the speed. General public will access the online government services with the help of handheld devices. Nation is ready to be well-connected, efficient and more productive in every aspect.
4. Online Registration System: - Online Registration System (ORS) is a framework to link various hospitals across the country for Aadhaar based online registration and appointment system, where counter based OPD registration and appointment system through Hospital Management Information System (HMIS) has been digitalized. The application has been hosted on the cloud services of NIC. Portal facilitates online appointments with various departments of different Hospitals using eKYC data of Aadhaarnumber,this application provides online registration, payment of fee and appointment, online diagnostic report etc.
5. Bharat Net:- a high speed digital highway to connect all 2.5 lakh gram panchayats of the Country.
6. National Scholarship Portal: - this initiative aims at making the scholarship process easy. From submitting the application, verification, sanction, everything related to government scholarship can be done on this single portal online.
7. Electronics Development Fund: - this policy aims to promote research and development, innovation and product development.
8. e-Kranti :-The Vision of e-Kranti is"Transforming e-Governance for Transforming Governance". e-kranti will fully focused on digital knowledge programme where education,

health, rights, financial and many more services will be delivered on very high bandwidth Physical boundaries no longer are a limitation when almost everyone and everything is a digital.The implementation of e-Kranti is vital for Digital India and for the delivery of e-governance, easy governance and good governance in the country.

9. Electronics Manufacturing: - this milestone will create a huge base for electronics manufacturing in India with the aid of digital technologies and skills. The empowerment of manufacturing through the internet of things will enable intelligent workshops that demonstrate data driven operational excellence and decentralised production control system within and beyond the physical factory walls.
10. MyGov Platform:- It acts as a medium for citizens to exchange ideas/ suggestions with the Government. Through this platform, the Government of India gets feedback, inputs, advice and ideas from citizens for policy decisions, new initiatives like Digital India, SwachhBharat, Clean Ganga, Make in India, Skill Development, etc. MyGov is growing steadily, with over 15.8 lakh users already registered. MyGov has conducted over 750 activities and is receiving more than ten thousand (10,000) posts per week on various issues.
11. Information for All: - websites and mobile apps will convey data and realistic participation and through social media. Everything is connected through virtual networks. Swift work flow and no delays due to wait in queues.

India ranks 79 on the networked readiness index 2019, a key component of the world economic forum's. The global information technology report 2019 .This report accesses the factors, policies and institutions that enable a country to fully leverage ICT for increase prosperity and crystalizes them into a global ranking of network readiness.

V. Challenges in the way of digital India are:-

Digital India mission has been announced but it is facing multiple challenges in successful implementation. Few of the challenges are

1. Telecom infrastructure, IT infrastructure in the form of apps, software is insufficient.
2. High level of digital illiteracy is the biggest challenge in the success of digital India programme. Low digital literacy is key hindrance in adaptation of technologies .
3. Illiteracy level is still high in India and similar share of youth is not enrolled in secondary education.
4. Only 15 out of 100 household have access to the internet.
5. "Universal access" does not, however, guarantee a working network. Even in its major cities, India's mobile network so stressed that many times its broken, with call failures and drop a common complaint.
6. Integration of technology and language is one of the main challenges the mission would face in its implementation.
7. Cyber security is a major issue in the way of digital payments a wider adoption of digital payments will invariably change the dimensions of risk, crime and security as well. Digital pickpockets pose a range of threats to individuals, institutions and economic stability itself.
8. Making Digital India scheme known and creating an awareness among common masses about its benefits is also a great challenge.
9. The biggest challenge faced by Digital India programme is slow and delayed infrastructure development. India's digital infrastructure is comprehensively inadequate to tackle growing increase in digital transactions.
10. India has 1600 languages and dialects. Non availability of digital services in local languages is a great barrier in digital literacy.

Today digitalization can be seen as a tool of transformation which extends beyond over lifestyle to the way we transact across all sectors, be this communication, media, healthcare, retail and manufacturing. We are increasingly seeing the use of digital technology. The cabinet approved a blueprint for the digital India programme, which envisages all government services be delivered electronically by 2018. It will also provide high speed internet as a core utility down to the gram panchayat level. Actual programmes and road maps like bharat net and national optic fibre network (NOFN) have delivered quantifiable objectives and milestones. The fibre optic cables and the trenching have been covered around 80000 km during this time while optic fibre has reached till 24000 GPS. There are many projects under e-governance which are doing really well. E-passport, online land registration projects like bhumi in Karnataka, ration cards and food distribution services in some states are good examples. Land registration, college admissions, commercial tax department, driving licences, vehicle registration certificates and processing of intra-department files at the state secretariat have been digitised. Various projects like digi-locker, mygov.in, e sigh framework, swacchbharat mission mobile app, national scholarship portal, e-hospital, digitize India platform, bharat net, electronic development fund, centre of excellence on internet of things (IOT) have been formed under the digital India programme.

VI.Opportunities in the digital India

I. Employment:-The introduction and advancement in Information and Communication Technology has a greater impact on employment, as it creates more jobs in the IT sector, which may be related to software development, Outsourcing, hardware manufacturing and other IT related businesses. In addition, the impact of these technologies has been realized on other service sectors, like in trade, industry, financial and health care services.Job creation with an estimated overall cost of INR 1,000 billion in ongoing schemes and INR 130 billion for proposed and new schemes, Digital India aims to create 17 million direct and 85 million indirect jobs by 2020.Introduction of digital skill programs at an institutional level: Skill training and digital literacy should be introduced as part of institutional trainings in schools, colleges and universities across India. Curriculum and interactive programmes should be mandated to ensure adequate digital skills of all graduates.

II. Ecological Impacts of Digitization: During the last few decades, healthy living has become the major concern of society. There has been an increased focus on health related matters. There are many ecological benefits of digitization. Saving paper equates to saving trees and using less overall supplies, which could position an organisation ahead of its competitors in terms of its positive user sentiment. With digital documents and a document solution programme, organisation will no longer have to worry about using hours or even days of time looking for lost documents. Instead, everything will be available instantly via a computer search. Digitization can help organisation to take advantage of new technologies and allow staff to access records in and location it turns help in making ecological sustainable society as the person does not use vehicle to go here and there and it controls pollution.

III.Economic and Social Impacts Of Digitization:

The process of digitization, knowledge to an ever greater amount is being produced, processed, communicated and preserved digitally. Digitization, despite being expensive at the initiative level such asdesigning a website, scanning of documents, fast hardware, software packages and good connection etc., its saves much of the production cost and reasonable in comparison to the conventional form of distributing system of information. With the usage of digital technology, such as pricing, reliability, speed and ease of use determine the level of digitization, which in turn has a proven impact on reducing unemployment, improving quality

of life and boosting citizens, access to public services. For digitization, a number of libraries, museums and publishers have been scanning their older documents and rare images for many years and made them available through World Wide Web.

VII. Conclusion:

The vision of digital India is grand. It is a huge step towards building a truly empowered nation. If successful, it transform citizen access to multimedia information,content and services. Digital India is one of the most exciting initiatives in the country. The programme focuses on e-governance solutions that leverage technology to improve the way the government interacts with citizens. It ensures benefits especially in the areas of broadband expansion, electronic manufacturing and e-governance. But there are many challenges in the way of digitization. It include lack of proper infrastructure, illiteracy, limited access to internet etc. government is making efforts to remove these hindrances by investment in digital infrastructure, improving digital literacy and providing online services to citizens. Tech giants from all over the world are willing to actively participate in this dream campaign. In nutshell, this programme is useful to every citizen success of this programme will make India digitally empowered and leader in usage of IT in delivery of services related to various domains such as digital marketing, health, education, agriculture, banking etc.. Let us all look forward for the successful implementation for this project for the brighter and prosperous India.

References

1. Condon, H. (2013). Digitization allows companies to go green. November 7, 2013, from http://www.papersave.com/blog/bid/117544/Digitization-allows-companies-togo-green
2. 2.http://meity.gov.in/sites/upload_files/dit/files/Digital%20India.pdf
3. 6.Vanita,KarunaSachdevaDigitalIndia-Opportunitiesand Challenges,
4. 7.Wamda. (2013). How digitization spurs economic growth and job creation around the world.RetrievedNovember,13,2013,from
5. http://www.bgr.in/news/fujitsu-to-bring-social-apps-to-boost-digitalindia-drive/
6. https://en.wikipedia.org/wiki/Digital_India
7. https://networkreadinessindex.org/

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INSECTICIDE DIMETHOATE INDUCED TOXICITY AND ALTERED PROTEIN CONTENT IN FRESHWATER FISH, *PUNTIUS TICTO* : A BIOCHEMICAL ASPECTS

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ABSTRACT : The last three decades, use of modern organic synthetic pesticides has increased in agriculture sector in order to improve crops yield with low labour and effort. Various pesticides such as insecticides, herbicides, fungicides etc. are being used intensively in agriculture leading to numerous health-related problems due to unsystematic applications of the same. These chemicals influence almost every system of environment especially aquatic ecosystems. Pesticides residues reach into the aquatic environment by surface run-off causing risk hazards for aquatic flora and fauna, fishes being one of the most affected organisms. These pesticide residues enter in non-targeted animals via food chain threatening the ecological balance and biodiversity of the nature. Long-term exposure of dimethoate induces biochemical changes in the protein content of fish.

Dimethoate is widely used insecticide that relentleely causes toxic effects in the various aquatic organisms especially in fishes. The effect of dimethoate on certain metabolism of protein was evaluated in the liver, gills and muscle of the [illegible] during sub lcthal toxicity exposure to 30 days. The present findings suggest that accumulation of dimethoate [illegible]ed the protein content in the liver, gills and muscles of *Puntius ticto*.

Key words : Insecticide, dimethoate, fish, biochemical, protein.

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INTRODUCTION

Fish constitutes a valuable commodity from the point of view of human consumption. Aquatic pollution undoubtedly has direct effects on fish health, reproduction and survival. Pesticides are regarded as serious pollutants of the aquatic environment because of their environmental persistence and tendency to be concentrated in aquatic organisms.

Proteins are the important biopolymers of great interest and importance. They play not only a key role informing and maintaining the structure of the cell but also as enzyme and hormones that catalyze numerous reactions and integrate the body functions.

The major metabolites are namely [illegible], fat and carbohydrates etc. They are prime important [illegible]mine nutritive value of fish. Occurrence of pesticide residues in [illegible]odies has exposed biota and particularly fish [illegible]mited extent of danger. Therefore, it is necessary to evaluate nature and extent of alterations in metabolites of fish.

A change in biochemical constituents [illegible]ives an indication, help to understand the type [illegible]s and its mode of action. Despite the fact [illegible]iving organisms, fish also has its own detoxi[illegible]nism to encounter the toxic effects; how[illegible]oxic substance enters in the body, certain [illegible]e and weaken the mechanism concerned. The [illegible]ay be at cellular or molecular level, but ultim[illegible]end to

physiological, pathological and biochemical changes.

In fishes, biochemical changes are induced by the pollutant, before they acquire drastic cellular and systematic malfunctions. Since fishes are important sources of protein; it will be more rewarding to have a thorough understanding of pesticide effects in fishes, in order to improve fish conservation and fishery development. In India few attempts have been made to study the mode of action of pesticides, their involvement in physiological disturbances, biochemical changes and histopathological abnormalities.

Abdelmeguid *et al* (2002) observed histochemical and biochemical changes in liver of *Tilapia zalii* as result of water pollution. Shobha Rani *et al* (2000) observed decline in glycogen and glucose level in various tissue of *Tilapia mossambica* during sodium arsenate intoxication. Durga and Veeraiah (2002) studied the effect of cypermethrin on protein metabolism of the fish, *Labeo rohita* and observed that the total protein level decreased in all the tissues tested where as the free amino acid levels were increased. Rawat *et al* (2002) observed uninterrupted decreased in the glycogen content with increase in the concentration and exposure period in *H. fossilis* to endosulfan.

Khare and Singh (2002) reported steady decline in protein content in the gill of *Clarias batrachus* exposed to malathion. Shinde *et al* (2002) observed decrease in the lipid, protein, and cholesterol content in ovaries of *Notopterus notopterus* after exposure of heavy metal. Seth and Saxena (2003) observed harmful biochemical effects of fenvalerate at sublethal concentrations in fish, *Channa punctatus*. Mushigeri and David (2004) observed the effect of fenvalerate on biochemical contents in freshwater fish, *Cirrhinus mrigala*. Ghanbahandur *et al* (2005) observed the effect of nuvan on protein contents of gill, liver in the fish, *Rasbora daniconius*. Patil and Nanaware (2005) observed the effect of phytotoxin on the biochemical constituents of freshwater fish, *Cyprinus carpio*. Abdul Naveed *et al* (2006) studied on toxicity of lihocin on the activities of glycolytic and glycogenic enzymes of fish; *Channa punctatus* and observed that the level of glycogen and pyruvate declined while glucose and latic acid levels increased. Ramesh and Sarvanan (2008) observed decrease in the plasma level of fish, *Cyprinus carpio* exposed to chloropyrifors. Rathod *et al* (2009) studied toxic effect of dimethoate on the protein, lipid and glycogen content in muscle, gill, liver and kidney of fish, *Arias dussumieri*.

There was a paucity of information on the toxicity of pesticides on biochemical constituen[illegible]s. In the present investigation, an effort has b[illegible] to study the effect of pesticides on biochemica[illegible] such as protein, ascorbic acid, lipid and gly[illegible] liver and muscle of *Puntius ticto and C[illegible]us.*

MATERIALS AND ME[illegible]

For biochemical study, the live spe[illegible] *Puntius ticto* were collected from Shivana riv[illegible] gaon, 26 km away from Aurangabad (M.S.)[illegible] to the laboratory. The fishes were maintai[illegible]aria and were acclimatized for fo[illegible]fter acclimatization healthy fishes, showi[illegible]ities were selected for biochemical estim[illegible]

The test fishes, *Puntius ticto* we[illegible] three sublethal concentrations of dimetho[illegible] (30 days) exposure, showed that the[illegible]cant decrease in the level of protein cont[illegible]nd muscle at 1.3 ppm, 0.65 ppm and 0.[illegible]ate exposure. Simultaneously, a control [illegible]lso maintained. On 30th day's exposure [illegible] each experimental group were sacrificed, li[illegible]uscle were dried in oven at 75 °C to 80 °C [illegible]ght was obtained and blended into d[illegible]. T[illegible]ese powders were used for the esti[illegible]arious biochemical components such as pr[illegible]ethods applied for estimations are as follow[illegible]

Estimation of total protein

100 mg of tissue was homogeni[illegible]cold distilled water. 5 ml of 30% TCA was[illegible]led to precipitate the protein. Precipitate[illegible]ed fter centrifugation at 3000 rpm for[illegible]s. The supernatant was discarded. The pe[illegible]tely washed with distilled water to remov[illegible] TCA. Precipitated protein was redissolve[illegible] and estimated by the method of Lowry[illegible]sing folin phenol reagent. The protein wa[illegible]ns of mg/100 mg dry weight of the tiss[illegible]

RESULTS

In the present investigation[illegible] in the biochemical constituents in body ti[illegible]shes, *Puntius ticto* were exposed to dime[illegible]rm (30 days) exposure at different subl[illegible]ons have been recorded for protein. T[illegible]ed changes in the biochemical constitue[illegible]en represented in the form of percent[illegible] of biochemical constituent. The data[illegible] to various statistical analysis and the[illegible]rd deviation and standard error of the m[illegible]d. Students 't' test was used to find o[illegible]he level of significance was used in the [illegible],

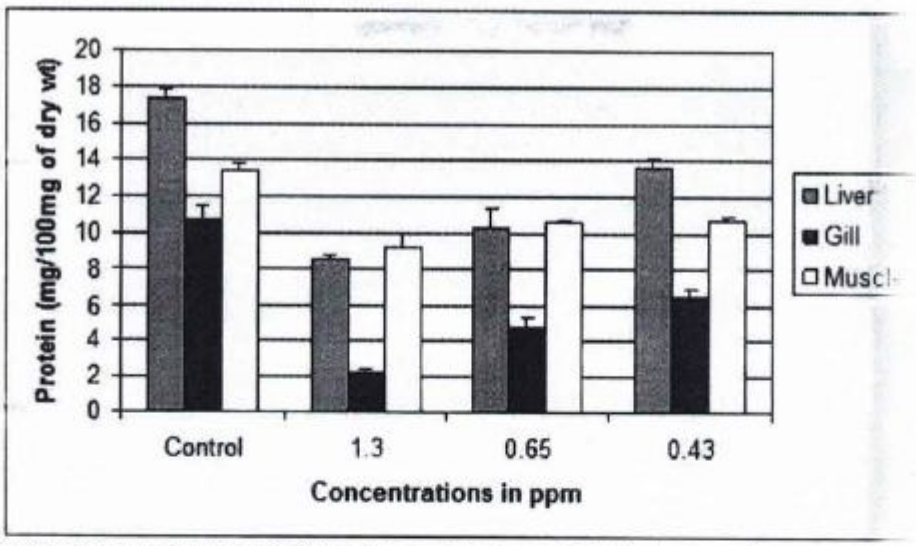

Fig. 1 : Effect of dimethoate on protein content in different tissues of freshwater fish, *Puntius ticto* after exposure to ... atrations for 30 days.

Table 1 : Effect of dimethoate on protein content in different tissues of freshwater fish, *Puntius ticto* after exposure to ... ncentrations for 30 days.

S.No.	Tissues	Control	1.3 ppm (1/5)	% changes	0.65 ppm (1/10)	% changes	0.43 pp...	...s
1	Liver	17.3213±0.5297	8.6045'''±0.2648	50.3237	10.2867''±1.0594	40.6121	13.6511	
2	Gill	10.7455±0.7007	2.1817''±0.2648	79.6964	4.7814'±0.5297	55.5028	6.4636	
3	Muscle	13.3758±0.5053	9.2162'±0.7946	31.0975	10.6537'±0.1059	20.3506	10.745	

1. The values are expressed in mg/100 mg dry weight (mean ± S.D).
2. ± indicates S.D.
3. *P < 0.005, **P < 0.01, ***P < 0.001

P<0.05, P<0.01, P<0.001) according to Fisher and Yates (1963).

Protein

Protein recorded in control group of fishes, *Puntius ticto* were 17.3213 mg in liver, 10.7455 mg in gill and 13.3758 mg in muscle. The fishes, *Puntius ticto* were exposed to three sublethal concentrations of dimethoate for long term (30 days) exposure, showed that there was significant decrease in the level of protein content in liver, gill and muscle at 1.3 ppm, 0.65 ppm and 0.43 ppm dimethoate exposure. In liver decrease recorded were 50.3237%, 40.6121% and 21.1889% as compared with their control values. In gill decrease recorded were 79.6964%, 55.5028% and 39.8482% as compared with their control value. In muscle decrease rescored were 31.0975%, 20.3506% and 19.6646% as compared their control values. These variations are recorded in Table 1 and Fig. 1.

DISCUSSION

Complex composition and cumulative action of synthetic chemicals and industrial effluent from different discharge sources causes huge amount of stress on the recipient ecosystem (Madhyastha, 1996). During exposure, organism goes through a sh... metabolic process to overcome the toxic effe... all protective measures. Toxic effect o... ds to changes in biochemical and physi... ns in the organisms. In order to investig... siological and biochemical changes have bee... during the course of the present study.

During stress, an organism nee... ot energy which can be supplied from reserve ... n protein cholesterol lipid etc. If the ... n only stored glycogen is as source ... n stress is strong then energy stored ... of lipid, protein cholesterol may be used. The ... lso affects the metabolic or physiological acti... e animals particularly those organs in whic... on, oxidation and hydrolization process... e liver is the main site for all the a... r detoxification of toxic materials. M... re broken down in liver cells due to w... cells by get damaged more severely than ... ells. This causes changes in biochemical ... . These changes are studied by earlier of w...

Naik *et al* (2004) reported th... rotein,

glycogen and lipid content shows significant depletion in the tissue of the tannery effluent treated fish, *Cyprinus carpi*. Agrahari *et al* (2006) reported decrease in total protein content of liver, muscle, brain and gill of fish *Channa punctatus* exposed *to monocrotophos* at sublethal concentrations (0.46, 0.96, and 1.86 ppm) for 30 days. Ghanbhadur *et al* (2005) reported variations in protein content of gill and liver of fish, *Rasbora daniconius*.

Tripathi and verma (2004) observed that, the exposed fish *Clarias batrachus* to fenvalerate induced a significant decline in protein contents in liver, brain and skeletal muscle.

Khare and Singh (2002) exposed *Clarias batrachus* to sublethal concentration of malathion for 7, 15 and 30 days and reported that gradual decrease in protein content of gill during the experimental period.

In the present study, protein content in different tissues showed decreased values in treated fishes, *Puntius ticto* . Decrease in protein content may be attributed to the impairment to protein synthesis or increase in the rate of its degradation to amino acid. The fall in protein level during dimethoate exposure may be due to increased catabolism and decreased anabolism of protein, (Khare and Singh, 2002). Similar results have been reported by number of workers (Tripathi *et al*, 2003; Rao and Padmavati, 2004; Sirohi and Saxena, 2006; Neelamegam *et al*, 2006). The alteration in protein value may be due to some structural changes in the liver, the arrangement of hepatic cords leading to alteration of liver metabolism. Decrease in protein content could possibly due to protein break down and suggests that decreased protein is due to damage of hepatic tissue and an intensive proteolysis.

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REFERENCES

Abdelmeguid N, Kheirallah A M, Abou-Shababa, Adham K and Abdel-Moneim (2002) Histochemical and biochemical changes in liver of *Tilapia zilii* G As a consequence of water pollution. *Online J. Biol. Sci.* **2**(4), 224-229.

Abdul Naveed, Venkateshwarlu P and Janaiah C (2006) Toxicity of lihocin on the activities of glycolytic and glycogenic enzymes of fish, *Channa punctatus*. *Nature Envrion. Poll. Techn.* **5**(1), 79-88.

Agrahari S, Krishna G and Pandey K C (2006) Biomarker of monocrotophos in a freshwater fish. *Channa punctatus* (Bloch). *J. Environ. Biol.* **27**(2), 453-457.

Durga P and Veeraiah K (2002) Effect of ... protein metabolism of the fish, *Labeo rohita* (... *Appl. Sci.* **21**(1), 27-32.

Ghanbahadur G, Raut S, More A and Wa... Effect of organophosphate (nuvan) on protein ... and liver in the fish *Rasbora daniconius*. *Him. J.* ... 1), 63-64.

Khare Aruna and Singh Sudha (2002) Impac... protein content in the freshwater fish *Clarias* ... *Environ. Monit.* **12**(2), 129-132.

Lowry O M, Rosebrought N J, Farr A C ... (1951) Protein estimation with Folin Pheno... *n.* **193**, 265-275.

Madhyastha M N (1996) Recent approach... *Indian J. Comparative Animal Physi...*

Mushigeri S B and David M (2004) Accum... related changes in lactate and succina... in functionally different tissues of the ... *ovigala* (Hamilton). *J. Baisc and clin...* ...*l.* **15**, 143-52.

Naik S J K, Devi V V and Piska S (2004) T... on carbohydrate, protein, lipid constitu... of *Cyprinus carpio* (Linnaeus). *J. Aqu...* ..., 177-1...

Neelamegam P, Rajendran A, Maruthanayag... Study the protein variations induce... *Cyprinus carpio* using PICI6F877 mi... *Res.* **65**, 655-658.

Patil R G and Nanaware S G (2005) Studies o... from *Sapindus laurifolius* on the nutri... fish, Cyprinus *carpio*. *Him. J. Env. Z...*

Ramesh M and Saravanan M (2008) Haema... responses in a freshwater fish, *Cypri...* chloropyrifors. *Int. J. Integrative Biol...*

Rao M B and Padmavathi V V (2004) The ... the total carbohydrate and total prot... tissues of *Catla catla*. *J. Biol.* **19** (2)...

Rathod D S, Lokhande M V and Shembek... of dimethoate on the Biochemical co... of fish *Arius dussumieri*. *Shodh, Sni...* 147-150.

Rawat D K, Bais V S and Agrawal N C (20... liver glycogen and endosulfan toxicity ... (Bloch). *J. Environ. Biol.* **23**(2), 205-...

Setha N and Saxena K K (2003) Hem... freshwater fish *Channa punctatus* ... *Environ. Contam. Toxicol.* **71**, 1192...

Shinde V R, Veeresh M U and Kulkarni R S ... heavy metal exposure to the fish, *Not...* *J. Environ. Biol.* **23**(2), 137-141.

Shobha Rani A, Sudharsan R, Reddy T N, ... N (2000) Effect of sodium arsenite ... level in freshwater teleost fish. *Tila...* **19**(1), 129-131.

Sirohi V and Saxena K K (2006) Toxi... biochemical contents of fresh water ... *fish. Aquat. Sci.* **1**(2), 112-116.

Tripathi G and Verma P (2004) Endosul... changes in the freshwater fish, *Clarias* ... *Sci.* **17**, 47-56.

Tripathi P K, Srivastava V K and Singh ... dimethoate (organophosphate on met... teleosts fish, *Channa punctatus*. *Asi...*

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Ce–Dy substituted barium hexaferrite nanoparticles with large coercivity for permanent magnet and microwave absorber application

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Abstract

M-type barium hexaferrites (BaM) with the substitution of Ce–Dy ions were synthesized using the sol-gel auto-ignition method. The prepared materials were explored for their application as a permanent magnet and microwave absorbing material. The structural properties, phase evaluation, micro-strain, morphological analysis, magnetic behaviour, microwave absorbing properties and optical properties were studied by employing various techniques. The structural parameters and phase identification obtained by Rietveld refinement confirmed the formation of an M-type hexaferrite structure for pure BaM, whereas Ce–Dy substitution induced secondary phases of cubic CeO_2 and ortho $DyFeO_3$. Crystallite size obtained from Williamson–Hall plots increased from 27.1 nm to 30.8 nm with the introduction of Ce–Dy ions in BaM. The nanocrystalline nature of the prepared samples was confirmed using scanning and transmission electron microscopy techniques. Fourier transform infrared spectra of all the samples were recorded in the wavenumber range of 400–4000 cm^{-1} and also supported the x-ray diffraction findings by confirming the formation of samples with hexaferrite structures. Coercivity of the BaM hexaferrites improved from 4430 to 5721 Oe with the Ce–Dy substitution. A Ce–Dy substituted BaM hexaferrite sample of 3 mm thickness showed a maximum reflection loss of

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−16.3 dB around 16.7 GHz. Permittivity and permeability studies were carried out to understand the microwave absorption behaviour.

Keywords: permanent magnet, hexaferrites, microwave absorption, magnetic properties, dielectric properties

(Some figures may appear in colour only in the online journal)

1. Introduction

Microwave absorbing materials (MAMs) attract tremendous interest due to their applicability to aviation (military stealth applications) and ability to inhibit electromagnetic interference, thus ensuring human health safety from hazards due to electromagnetic radiation. MAMs are generally applied as coatings that avoid/reduce the incident wave reflection, which is considered as absorption. Most of the reflection/absorbing characteristics lie in the material's properties itself. Thus, recently, a considerable amount of research has focused on MAMs materials to determine the impedance-matching and attenuation properties necessary for microwave absorption [1–6]. Dielectric materials possess admirable attenuation properties, particularly in the high-frequency region of 8–18 GHz, but they possess low impedance matching because of insignificant magnetic permeability ($\mu_r \approx 1 + 0\,j$) [7]. Thus, MAMs are generally composed of magnetic materials with better magnetic permeability to counter impedance matching ($\mu_r = \varepsilon_r$) to obtain excellent absorption of microwaves [8, 9]. In general, magnetic materials of high coercivity (>500 Oe) possess a large number of applicabilities, such as permanent magnets, magnetic recording media and high-frequency electromagnetic wave absorbers. Hard magnetic materials are generally composed of rare-earth and metallic elements (CoPt, FePt, $SmCo_5$, $Nd_2Fe_{14}B$ and Sm_2Co_{17}) [7]. These materials possess a giant magnetocrystalline anisotropy, high coercivity and magnetization. However, they are expensive, and the scarcity of the constitutive metals makes it necessary to search for suitable alternatives like rare-earth free materials [10].

M-type barium hexaferrite, $BaFe_{12}O_{19}$ (abbreviated as BaM), with a coercivity of 1000–6000 Oe, permeability of 4–35 in the microwave frequency region and a dielectric constant of 10–20 at 10 GHz frequency has tremendous potential to be used as MAMs [11]. Apart from this, BaM also has applications in many other technological devices, including radar, micro strip antennas, memory and transformer cores, etc. They are extensively explored due to their distinctive properties like exceptional chemical solidity, high electrical resistivity, coercivity, Curie temperature and, at the same time, lower manufacturing costs compared to other rare-earth-containing compounds [12–14]. The structure of hexaferrite is more complex compared to other ferrite structures such as spinel and garnet. As demonstrated in figure 1, hexaferrite has a magneto-plumbite crystal structure with 64 ions in one unit cell. Among the 64 ions, the unit cell contains 38 oxygen ions, two barium ions and 24 Fe^{3+} ions. The 24 Fe^{3+} ions scatter to five distinct sites, i.e. octahedral 12k, 2a and $4f_2$ sites, a tetrahedral $4f_1$ site and a trigonal pyramidal 2b site [15–17]. The various iron sites and relative orientation of their spin moments are responsible for magnetism. Sixteen Fe^{3+} ions at 2a, 2b and 12k sites possess spin-up, whereas eight Fe^{3+} ions at $4f_1$ and $4f_2$ retain a spin-down configuration. These eight spin-down ions will cancel with eight spin-up ions and eight spin-up ions remain after cancellation with spin-down ions. With regard to the electronic arrangement of Fe^{3+} ions there are five unpaired electrons in the 3d orbital, where each Fe^{3+} ion has $5\mu_B$ magnetic momenta. The overall net magnetic moment of BaM hexaferrite is $20\mu_B$ [11]. Hence, other cation substitution at the Fe^{3+} site plays a significant role in governing the magnetic properties of BaM hexaferrite.

The magnetic properties, viz. saturation magnetization, coercivity and retentivity, of BaM hexagonal ferrite can be modified by incorporating various ions for Fe^{3+} [18–22]. Further, these properties can be controlled by preparation methods, sintering temperature, time, etc. A literature review suggests that there are various methods used for the synthesis of hexaferrite, such as a hydrothermal process [19], solid state reaction [23], the sol-gel method [24, 25], the microwave adsorption method [26] and the co-precipitation method [27]. In the present investigation, it is expected that Ce–Dy cations will affect the structural and magnetic properties of BaM hexaferrite by generating differences in the spin up/down. The results are thoroughly discussed to understand the variation in structural, electrical, magnetic and microwave absorption characteristics of Ce–Dy substituted BaM hexaferrite.

2. Materials and methods

The sol-gel method was adopted to synthesize the Ce–Dy doped BaM hexaferrite nanoparticles with the general chemical formula $BaCe_xDy_xFe_{12-2x}O_{19}$ (x = 0.00, 0.25, 0.50, 0.75 and 1.0). High purity (>99%) (Sigma-Aldrich) barium nitrate ($Ba(NO_3)_2.6H_2O$), cerium nitrate ($Ce(NO_3)_3.9H_2O$), dysprosium nitrate ($Dy(NO_3)_3.9H_2O$) and ferric nitrate ($Fe(NO_3)_3.9H_2O$) with citric acid ($C_6H_8O_7.H_2O$) were taken as starting materials. The weighing of the starting materials was calculated based on their molecular weight. The nitrates to citric acid ratio was kept at 1:3, where the amount of citric acid was obtained from the molecular weight of the ferrite compound and citric acid [24]. All the starting materials were mixed in double distilled water with their desired stoichiometric proportion. The whole mixture was kept on a hot plate with a magnetic stirrer. The mixture was continually stirred at a constant temperature of 90 °C and liquid ammonia was slowly poured in to maintain the pH at a constant value of 7. After continuously stirring and heating for 2–3 h the mixture

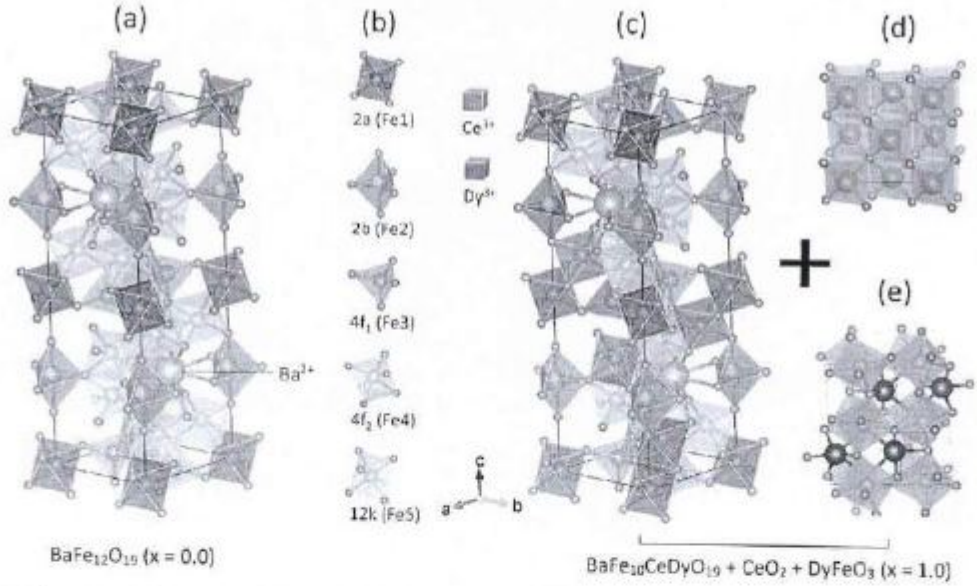

Figure 1. The crystal structure of pure and Ce–Dy substituted $BaFe_{12}O_{19}$ obtained from Rietveld refinement output. (a) A unit cell of $BaFe_{12}O_{19}$ containing two formula units for $x = 0.0$. The two large green spheres are Ba atoms and the small blue spheres are O atoms. Coloured spheres enclosed by polyhedra formed by O atoms represent Fe^{3+} ions in different nonequivalent sites. (b) Different nonequivalent sites: 2a (blue), 2b (pink), $4f_1$ (orange), $4f_2$ (aqua) and 12k (blue). (c) A unit cell of Ce^{3+} and Dy^{3+} substituted $BaFe_{12}O_{19}$ for $x = 1.0$, where green and plum coloured polyhedrals represent crystallography site occupancy of Dy^{3+} and Ce^{3+} ions. (d) The unit cell of the CeO_2 phase, and (e) the unit cell of the $DyFeO_3$ phase. Purple coloured spheres in part (c) refer to Dy atoms, whereas atoms enclosed in polyhedrals are the Fe atoms.

became viscous and sol was formed, and after some time it converted into dried gel. Using the process of self-ignition the dried gel was burnt and converted into a fine ash with a dark brown colour. The homogeneous mixtures were obtained after grinding the burnt ash for 1 h and sintered at 1000 °C for 6 h. After a final sintering the powders were again ground to obtain the fine particles of Ce–Dy doped BaM hexaferrites. The formation of Ce–Dy doped M-type BaM hexaferrites can be represented by the chemical reaction given below:

$$\begin{aligned}&Ba(NO_3)_2\cdot 6H_2O + x\left[Ce(NO_3)_3\cdot 9H_2O\right]\\&\quad + x\left[Dy(NO_3)_3\cdot 9H_2O\right] + (12-x)\left[Fe(NO_3)_3\cdot 9H_2O\right]\\&\quad + C_6H_8O_7\cdot H_2O \rightarrow BaCe_xDy_xFe_{12-2x}O_{19}\\&\quad + HNO_3 + H_2O + CO_2\uparrow.\end{aligned}$$

Phase identification and structural parameters of Ce–Dy doped BaM hexaferrites were studied using x-ray diffraction (XRD) patterns. XRD studies were performed on powder samples using Cu-K_α radiation ($\lambda = 1.5406$ Å) in the 2θ range of 20–80° by keeping the scanning rate at 2° min^{-1}. Surface morphology of the samples was investigated using a scanning electron microscope (FE-SEM, JSM-6360, Jeol). Microstructure and interplaner spacings of the prepared samples were evaluated using transmission electron micrographs (TEM). Fourier transform infrared spectra (FTIR) of all the samples were recorded at room temperature in the frequency range of 400–4000 cm^{-1} using a Perkin Elmer spectrometer. To record the FTIR spectra, fine powder of each sample was mixed with KBr (ratio 1:250 by weight) for uniform distribution of particles in the KBr pellet. The mixture was pressed in the form of right circular pellets (thickness nearly 1 mm) using a cylindrical die. Optical measurements were carried out using UV visible spectra on a UV-2102 PCS spectrometer. Magnetic properties were examined using the data obtained from a vibrating sample magnetometer (Lake Shore Model 7307) at room temperature for an applied field of 10000 Oe. The microwave measurements, complex transmission (S21) and reflection (S11) coefficients were performed using an ATM technology waveguide system and HP PNA E8364B vector network analyzer in the frequency range of 2–18 GHz. The samples used for measurement were prepared by dispersing powder into a paraffin wax with a mass fraction of 70% and by pressing the sample into a compact coaxial shape. The dielectric properties (dielectric constant and dielectric loss) were estimated with the assistance of an LCR-Q meter as a function of frequency.

The permeability measurements on the toroid-shaped samples were conducted as a function of temperature and frequency. The initial permeability measurements of the toroid samples were taken using a HP-4284 A LCR precision meter.

3. Results and discussion

3.1. Rietveld analysis

Figures 2(a)–(e) depict the Rietveld refined XRD patterns of M-type BaM samples substituted by rare-earth Ce–Dy ions. XRD analysis reveals that for the sample $x = 0.0$, all the Bragg's reflections are perfectly matched with the pure BaM phase of a standard theoretical pattern indexed

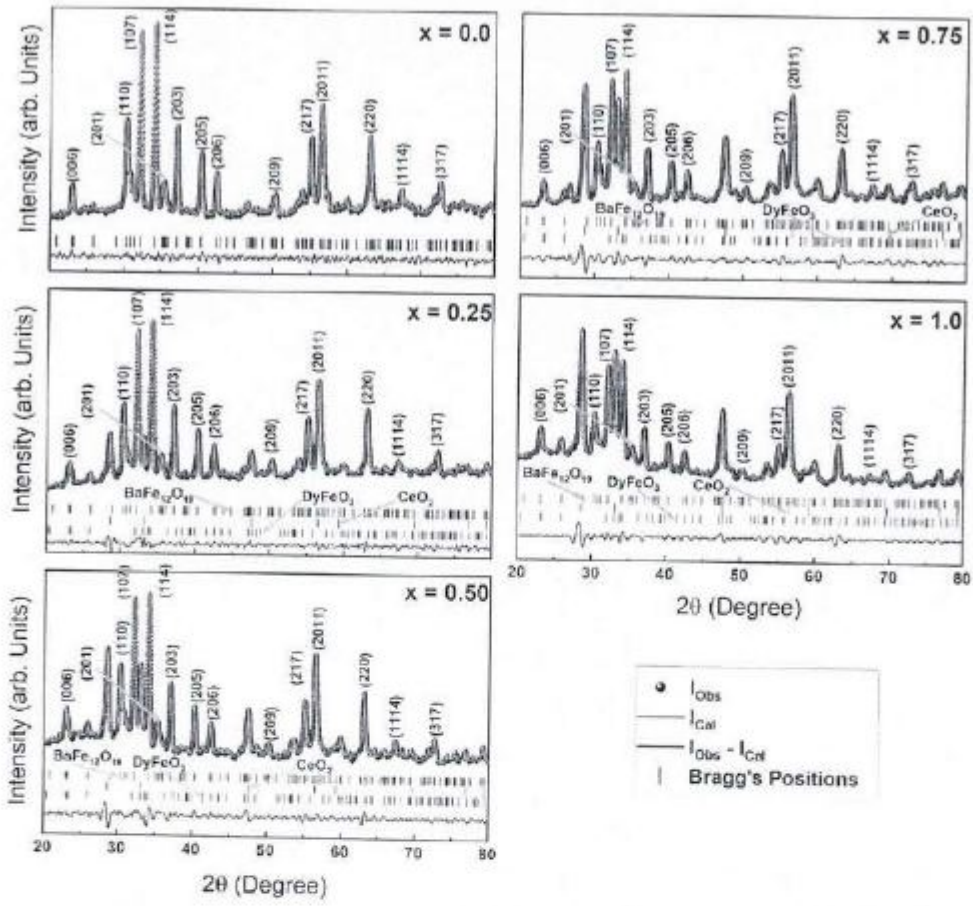

Figure 2. Rietveld refined XRD patterns of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites, revealing single-phase formation of hexaferrite for $x = 0.0$, and secondary phases of $DyFeO_3$ and CeO_2 that appeared with the Ce–Dy substitution.

by JCPDS-96-100-8842 with the space group *P63/mmc* belonging to the hexagonal structure. For the samples $x \geqslant 0.25$, the addition of rare-earth Ce–Dy ions introduces the secondary phases of cubic CeO_2 (JCPDS card No. 96-900-9009) with the space group *Fm-3m* and orthorhombic $DyFeO_3$ (JCPDS card 96-200-3126) with the space group *Pnma*. XRD profiles of the samples were fitted for different phases using Full-Proof software. A small shift in the XRD peaks position, as well as variation in relative intensities, is associated with the occupancy of the substituted Ce–Dy ions at the various crystal lattice sites. The sharpness and narrow size of the reflection peaks clearly indicates the high crystallinity and fine grain size of the hexaferrite. The blue solid spheres in figures 2(a)–(e) represent the observed intensity, the red line belongs to the calculated intensity and the blue vertical lines show the Bragg's position for the Rietveld refined patterns. The lowest dark-brown-coloured solid line represents the difference in observed and calculated intensities. The majority of the peaks of all the samples are indexed to the lattice planes belonging to the M-type hexagonal structure. Atomic fractional positions were kept fixed, whereas lattice parameters, occupancies, scale factors, shape parameters, background, etc were kept free during refinement, and corrected by the Thompson–Cox–Hastings pseudo-Voigt function. The reliability factors, such as 'R_P' (profile factor), 'R_{exp}' (expected profile factor), 'R_{WP}' (weighted profile factor) and the goodness factor (χ^2) obtained from Rietveld refinements, are listed in table 1. Similarly, the relevant lattice parameters (a and c) obtained from XRD analysis are given in table 1. As seen in table 1, the goodness factor lies between 1.01 and 1.198 indicating the good quality fit of the $BaCe_xDy_xFe_{12-2x}O_{19}$ crystal structure. The representative crystal structures for pure $BaFe_{12}O_{19}$ ($x = 0.0$) and $BaFe_{10}CeDyO_{19}$ ($x = 1.0$) were acquired through the Rietveld refined data and are shown in figure 1. This crystal structure representation is helpful in understanding the occupancy of Ce and Dy ions in BaM hexaferrite. The lattice parameters 'a' and 'c' show an increasing trend with the addition of Ce–Dy rare-earth ions in BaM hexaferrites. In general, these variations are related to the ionic radii of the substituted cations and their percentage in the composition. In the present case both Ce^{3+} (ionic radii 1.03 Å) [28] and Dy^{3+} (ionic radii 0.91 Å) [29] cations replace the Fe^{3+} ions with small fractions (0.67 Å). The replacement of higher ionic radii cations in place of Fe^{3+} ions expands the crystal lattice and accordingly increases the lattice parameters. The values of the c/a ratio range between 3.939 and 3.929, which

Table 1. Rietveld refined parameters; goodness factor 'χ^2', expected profile R-factor 'R_{exp}', weighted profile R-factor 'R_{wp}', profile factor 'R_p', lattice constants (a and c), c/a ratio and volume (v) of $BaCe_xDy_xFe_{12-2x}O_{19}$.

x	χ^2	R_{exp} (%)	R_{wp} (%)	R_p (%)	a (Å) (±0.002)	c (Å) (±0.005)	c/a	V (Å^3) (±0.05)
0.0	1.01	2.390	2.410	1.920	5.884	23.180	3.939	694.99
0.25	1.20	2.327	2.548	1.459	5.888	23.184	3.938	695.98
0.50	1.03	1.239	1.275	0.944	5.893	23.189	3.935	697.31
0.75	1.08	1.087	1.129	0.895	5.897	23.193	3.933	698.41
1.0	1.15	1.300	1.400	0.867	5.903	23.196	3.929	699.99

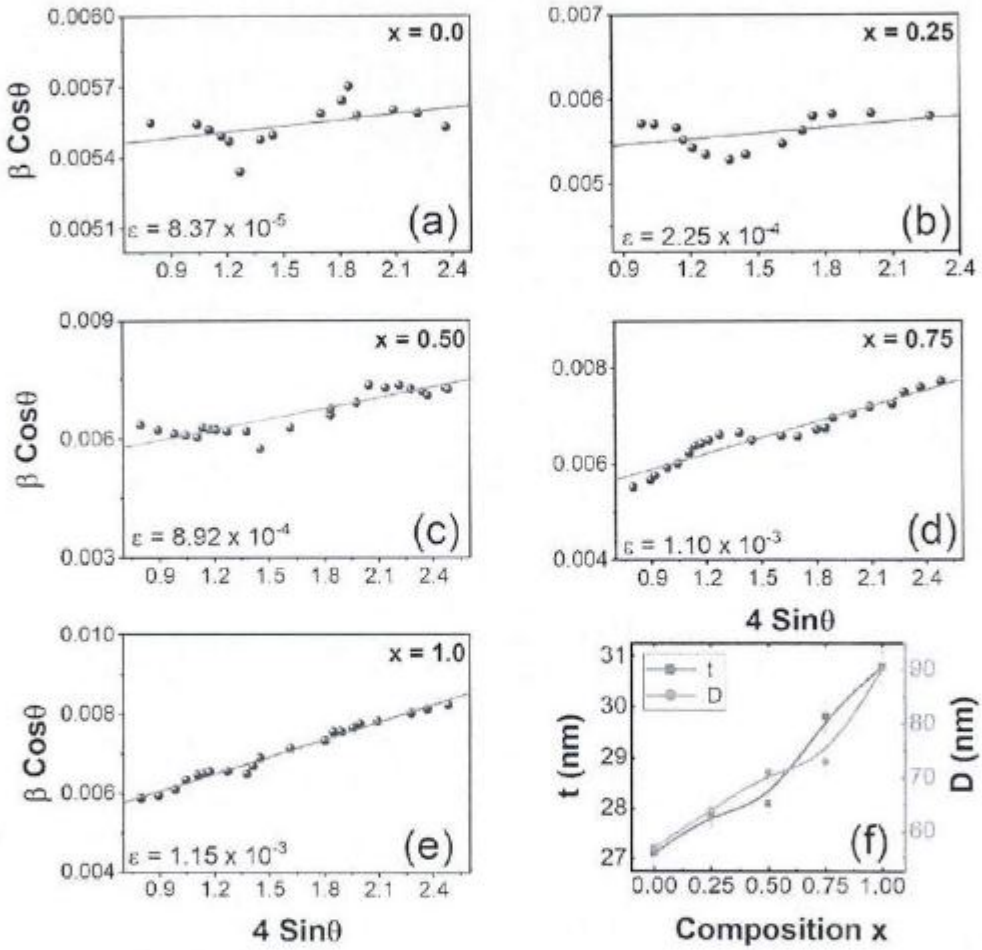

Figure 3. Strain analysis: (a)–(e) W–H plots of $BaDy_xGd_xFe_{12-2x}O_{19}$ hexaferrites and (f) variation of crystallite size 't' and grain size 'D' with Ce–Dy substitution 'x' for $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites.

are lower than that of 3.98 and thus confirmed the formation of the M-type hexagonal structure of the prepared samples [30]. The unit cell volume for the hexagonal structure was calculated using the formula [31];

$$V = \sqrt{3} \times a^2 \times \frac{c}{2} = 0.866a^2c, \quad (1)$$

where v is the volume, and a and c are the lattice parameters. As can be seen from table 1 the cell volume increased from 694.99 (±0.05) to 699.99 (±0.05) Å^3 with the addition of Ce–Dy to BaM hexaferrites.

3.2. Strain analysis

The Williamson–Hall (W–H) method was employed to study the micro-strain (ε) observed in the crystal lattice and crystallite size (t). Figures 3(a)–(e) show the linearly fitted W–H plots of all the samples using the positions and full width at half maxima (FWHM) of Bragg's peaks observed in XRD plots. The slope of the W–H plots gives the strain induced in the crystal lattice and the y-intercept gives the crystallite sizes of the samples through the following relation [32]:

$$\beta\cos\theta = \frac{K\lambda}{t} + 4\varepsilon\sin\theta \quad (2)$$

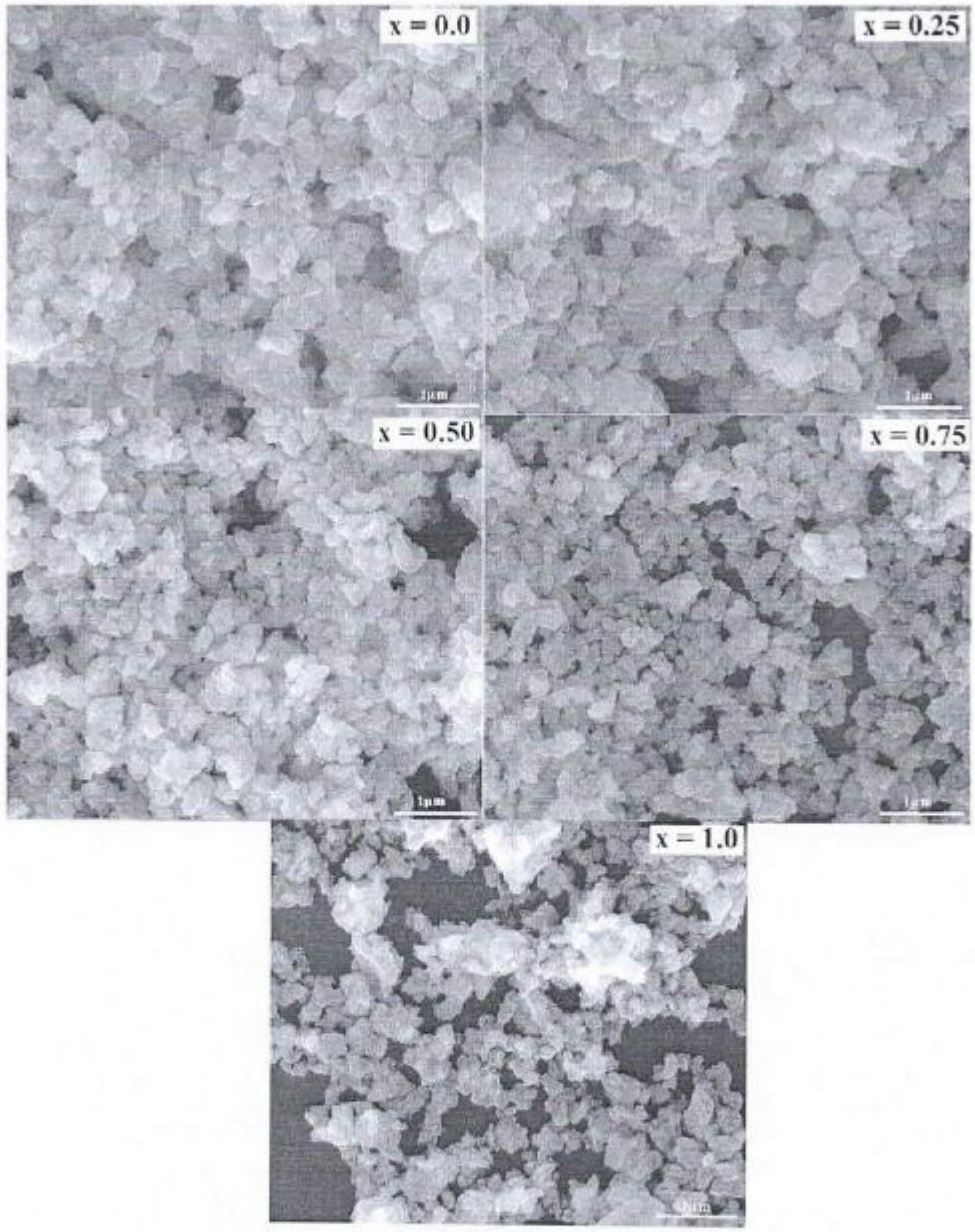

Figure 4. SEM micrographs of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites for all the substitution levels of Ce–Dy ions.

where K is the shape factor (0.95), λ is the wavelength, ε is strain distribution, t is crystallite size, θ is Bragg's angle and β is FWHM. Strain values increased gradually from 8.367×10^{-5} ($\pm 0.2 \times 10^{-5}$) to 1.145×10^{-3} ($\pm 0.1 \times 10^{-3}$) indicating that the BaM hexaferrite lattice experienced tensile strain. The substitution of Ce–Dy ions in BaM hexaferrites increased the crystallite size from 27.1–30.8 (± 1) nm (figure 3(f)).

3.3. Surface morphology

SEM images were captured for the different concentrations of $Ce^{3+}-Dy^{3+}$ co-substituted BaM hexaferrites and are represented in figure 4. Some of the grains are observed in a hexagonal platelet-like shape with a smooth surface and sharp edges. Close observation of the SEM images shows that the grains are agglomerated to some extent. This agglomeration between the grains is related to the magnetic interactions formed among them. The introduction of $Ce^{3+}-Dy^{3+}$ cations in M-type BaM hexaferrites had an effect on the surface morphology and grain size of the samples. The average grain size, estimated using Image J software, was increased from 64.9–90.3 (± 2) nm. The variation in average grain size with Ce–Dy substitution is presented in figure 3(f), which is in good agreement with the particle size obtained from the XRD analysis. Figures 5(a) and (c) represent the TEM images of typical

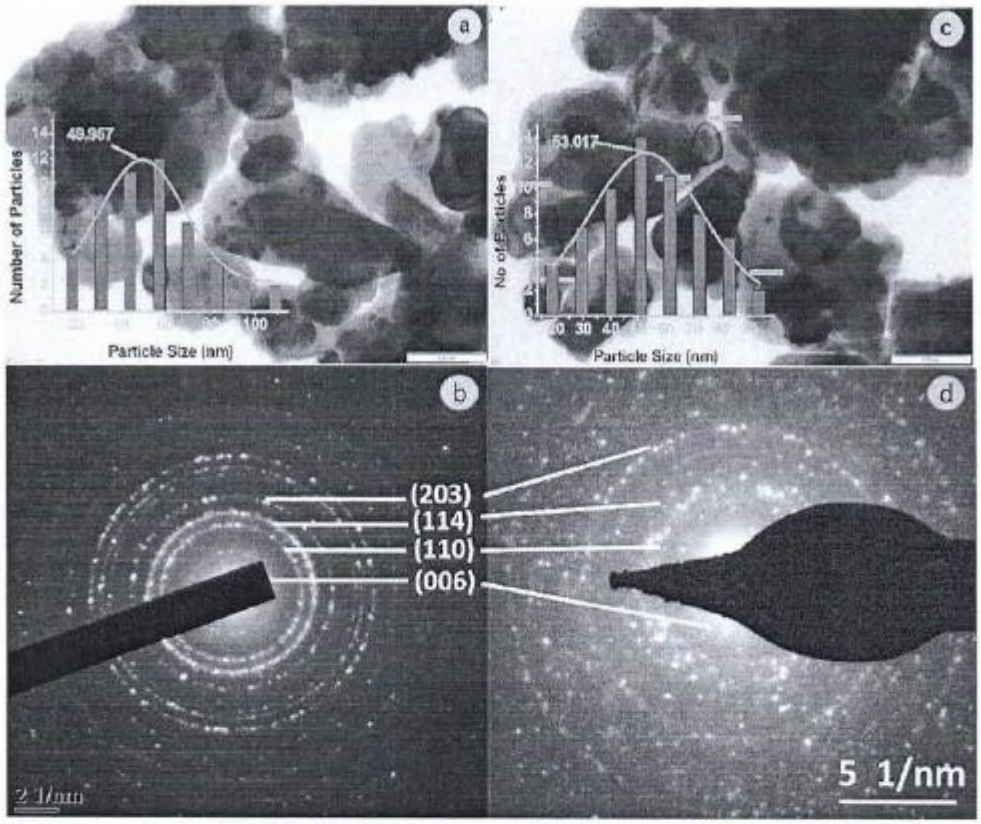

Figure 5. TEM analysis: (a) and (c) are the TEM images for $x = 0.0$ and $x = 1.0$ samples, respectively. The insets in parts 'a' and 'c' are the particle size distribution histograms. (b) and (d) The corresponding SAED patterns of $x = 0.0$ and $x = 1.0$ samples, respectively. Sharp diffraction spotty rings in the SAED patterns are analyzed and marked with the lattice planes corresponding to the BaM hexaferrite structure.

samples ($x = 0.00$ and $x = 1.0$) of $BaCe_xDy_xFe_{12-2x}O_{19}$. Particle size distribution histograms are shown in the insets of the TEM images. The average particle size for the $x = 0.0$ is obtained as 49.96 ($\pm$1) nm, and this increased with Ce–Dy substitution to 53.02 ($\pm$1) nm for $x = 1.0$. The variation in particle size may be associated with the existence of some of the Ce^{3+} and Dy^{3+} ions at grain boundaries at higher levels of substitution [33]. Several researchers reported particle sizes from TEM analysis in the range 45–300 nm [34–36]. However, it is to be noted that the TEM size is not representative, since the method is highly selective and local. Figures 5(b) and (d) show the selected area diffraction pattern (SAED) patterns for $x = 0.00$ and $x = 1.00$, respectively. The Debye ring patterns superimposed with bright spots were observed in SAED patterns indicating the polycrystalline nature of the prepared samples. The SAED patterns were indexed to the lattice planes (006), (107), (203), (205), (217), (221), (2011) and (317), which are in accordance with the lattice planes observed in XRD patterns.

3.4. Fourier transform infrared spectra

Infrared spectra are very useful for finding the locations of band positions inside materials. The presence of different vibrational and stretching groups in the samples was investigated using FTIR spectra recorded in the wavenumber range of 400–4000 cm^{-1} (figures 6(a) and (b)). The FTIR spectra give detailed information of the structural changes that occurred in the $BaCe_xDy_xFe_{12-2x}O_{19}$ samples due to substitution with Ce–Dy ions. Absorption bands, ν_1 and ν_2, observed in the range 500–750 ($\pm$10) cm^{-1} (figure 6(b)), represent the bending vibrations of Fe–O bonds at tetrahedral A- and stretching vibrations of Fe–O bonds at B-octahedral sites [37–39]. In the spectral region, the Fe–O bonds cannot be distinguished. It is clear from the data that incomplete calcination was performed, and hence other phases are present in the material. The bands that are observed for all the samples near 1350–1480 ($\pm$10) cm^{-1} are attributed to the NO_3^- ions and metal–oxygen–metal bonds (i.e. Fe–O–Fe). The bands that appeared at 1400–1700 ($\pm$10) cm^{-1} are associated with the carboxyl group (COO^-), and such bands could also be due to the adsorption of moisture on the surface of the nanoparticles. Vibration at 2400 cm^{-1} is related to the C–O group, and the bands around 3480 cm^{-1} represent the stretching vibrations of O–H groups [40]. The bands around 3480 cm^{-1} are mainly due to the humidity or adsorbed water during the synthesis of the samples using aqueous solution [41].

3.5. Magnetic properties

Room temperature magnetic behaviour of all the samples was studied using a vibrating sample magnetometer with an

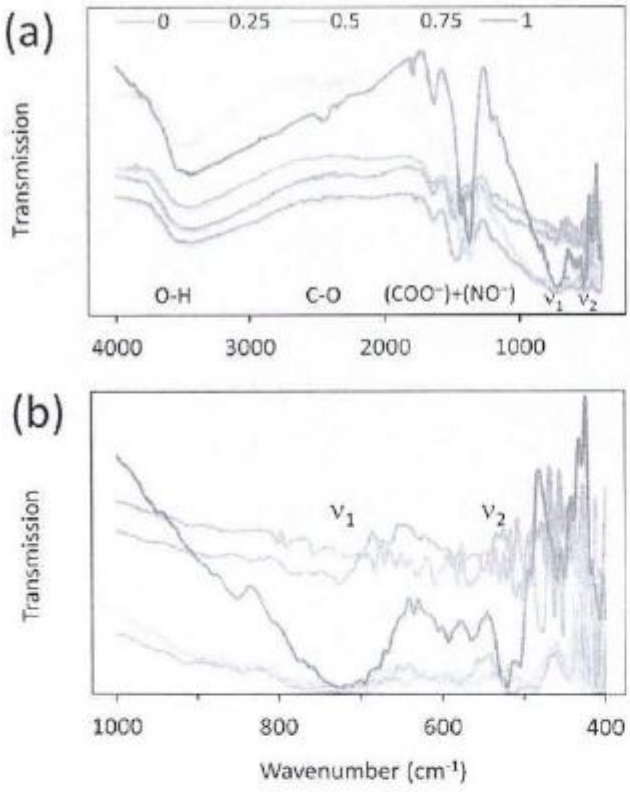

Figure 6. IR spectra of all the samples of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites measured in the wave number ranges (a) 400–4000 cm^{-1} and (b) 400–1000 cm^{-1}. IR bands corresponding to various compounds are shown by the grey shaded area.

applied magnetic field reaching up to 1 T. Figure 7(a) represents the variation in magnetization (M) with the magnetic field (H). The magnetization curves indicate that all the samples show hysteresis behaviour with high coercivity (Hc). It is to be noted that the magnetization plots were not saturated since the applied magnetic field of 1 T was not sufficient to saturate the samples. Figure 7(b) represents the variation in magnetization at 1 T, remnant magnetisation (Mr) and Hc with Ce–Dy substituted BaM hexaferrites. With M at 1 T, Mr decreased, whereas Hc increased with the replacement of Fe^{3+} ions by $Ce^{3+}-Dy^{3+}$ ions in BaM hexaferrites. The pure BaM hexaferrite showed a lower magnetization value of 36.3 (±2) emu g^{-1}, which is lower than the expected value. Such a low value could be related to the synthesis conditions, including the sintering temperature and synthesis method. The sol-gel method was used in the present work to synthesize the material followed by sintering at 1000 °C. The introduction of Ce–Dy ions reduced Ms from 36.3 (±2) to 26.3 (±2) emu g^{-1} and Mr from 21.8 (±2) to 15.5 (±1) emu g^{-1}. This decreasing behaviour of M at 1 T and Mr can be described on the basis of a decrease in the super-exchange interaction between magnetic ions [42, 43]. It is reported that the introduction of rare-earth elements leads to the alteration of a few ferric (Fe^{3+}) ions into ferrous (Fe^{2+}) ions to sustain charge electronegativity. The super-exchange interaction of $Fe^{2+}-O^{2-}-Fe^{3+}$ ions is weaker compared to $Fe^{3+}-O^{2-}-Fe^{3+}$, which is accountable for the dilution of saturation magnetization and the decrease in remnant magnetization [44–46]. Another possibility for the dilution in M at 1 T and Mr could also be related to the spin canting. As mentioned in the introduction, the Fe^{3+} ions have five distinct interstitial sub-lattices, two spin-down ($4f_1$ and $4f_2$) and three spin-up (2a, 2b and 12k) in BaM hexaferrite. Most of the Ce^{3+} and Dy^{3+} are likely to be substituted for spin-up (2a, 2b and 12k) sublattices of Fe ions, as shown in figure 1(c), which caused an unbalanced distribution of Fe^{3+} leading to a decrease in magnetization. Similar behaviour of saturation magnetization with the introduction of rare-earth elements is also reported in the literature [42–46]. Furthermore, the non-magnetic secondary phases that are observed with the substitution of Ce^{3+} and Dy^{3+} could also have adverse effects on the magnetic characteristics of BaM hexaferrite.

In the present investigation coercivity (figure 7(b)) increased from 4250 to 5751 (±100) Oe with the substitution of Ce^{3+} and Dy^{3+} ions in BaM hexaferrites. As discussed in the previous paragraph magnetization decreased with the Ce–Dy substitution, and this could explain the increase in the Hc. Also, the increase in coercivity could be related to the increment in magneto crystalline anisotropy with Ce–Dy substitution.

3.6. Complex permeability and permittivity

The dielectric and magnetic characteristics of a material can be explained by studying complex permeability (μ' and μ'') and permittivity (ε' and ε'').

The permeability was calculated using the relation [47]:

$$\mu' = L/L_0 \tag{3}$$

where $L_0 = 4.6N^2 d \log\left(\frac{OD}{ID}\right) \times 10^{-9}$H.

L_0 is the air-core inductance, N is the number of turns and d is the thickness of the toroid.

The permeability has two parts in a dynamic electromagnetic field, i.e. the real part (μ') and the imaginary part (μ'') as defined by [48]:

$$\mu' = \frac{Bm}{\mu_0 Hm}\cos\theta$$

$$\mu'' = \frac{Bm}{\mu_0 Hm}\sin\theta.$$

In general, the real part associates with the storage capacity of magnetic and electric energies, whereas the imaginary parts indicate the energy loss. These characteristics mutually control the lossy behaviour of a material as an electromagnetic wave passes through it. Variations in real and imaginary permittivity are presented in figures 8(a) and (b). It is evident that the real and imaginary part of the undoped sample is greater than that of the doped samples. This behaviour is related to the intrinsic electric dipole and interfacial polarization [48]. The increasing percentage of Ce–Dy ions in M-type BaM hexaferrites decreases both real and imaginary permittivity values. At the lower-frequency side all the samples have a constant

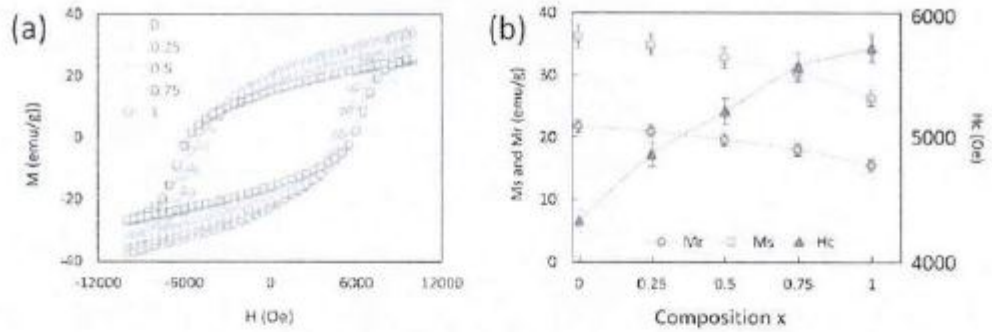

Figure 7. (a) The variation in magnetization 'M' with an applied magnetic field 'H', and (b) variation in saturation magnetization 'Ms' (i.e. magnetization at 1 T), remnant magnetization 'Mr' and coercivity 'Hc' for Ce–Dy substituted $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites.

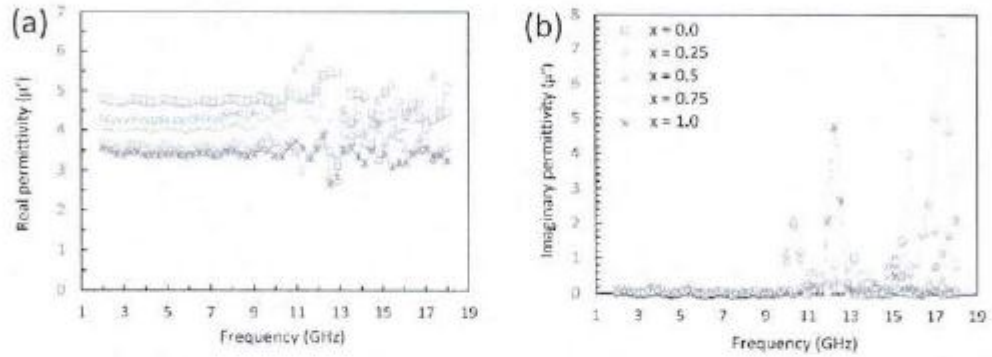

Figure 8. (a) Real and (b) imaginary parts of permittivity of all the samples of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrite measured in the GHz frequency range.

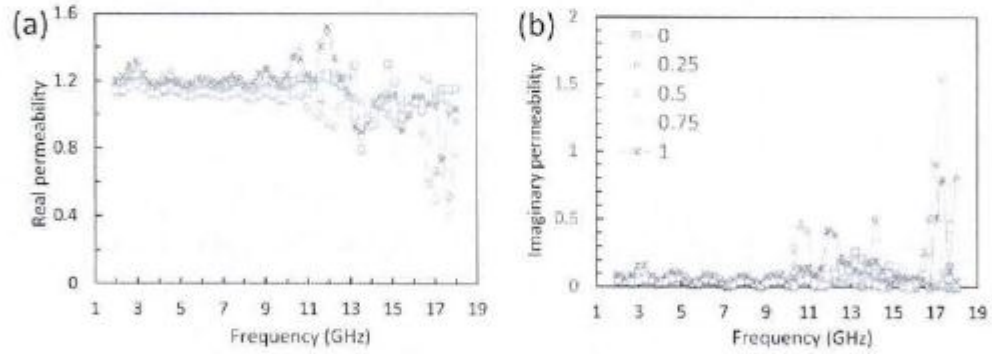

Figure 9. (a) Real and (b) imaginary parts of permeability of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrite measured in the GHz frequency range.

value, but at higher frequency there are some resonance peaks in the real and imaginary part permittivity which are very useful for high absorption. It is observed from figure 8(b) that at the lower-frequency side all the samples have almost the same value of imaginary permittivity, but at higher frequency some resonance peaks are observed. The maximum imaginary permittivity of the resonance peak of 7.5 is observed at 17.5 GHz for $x = 0.75$.

Figures 9(a) and (b) depict the real (μ') and imaginary (μ'') parts of permeability measured in the frequency range 2–18 GHz. It is important to note that μ' and μ'' showed significant differences amongst the five samples with different substitution concentrations, demonstrating that doping exerts an effect on permeability. Values of μ' lie in the range of 0.4–1.5 for all the samples. The maximum real permeability value 1.5 is observed for the sample $x = 1.0$. Similarly, the maximum imaginary permeability value 1.7 is observed for $x = 0.75$. At the higher-frequency side multi-resonance peaks in μ'' may be beneficial for broad bandwidth of microwave absorption [49].

3.7. Dielectric constant and loss

Dielectric measurements such as the dielectric constant (ε') and dielectric loss tangent ($\tan\delta$) for Ce–Dy substituted M-type BaM hexaferrites were studied as a function of

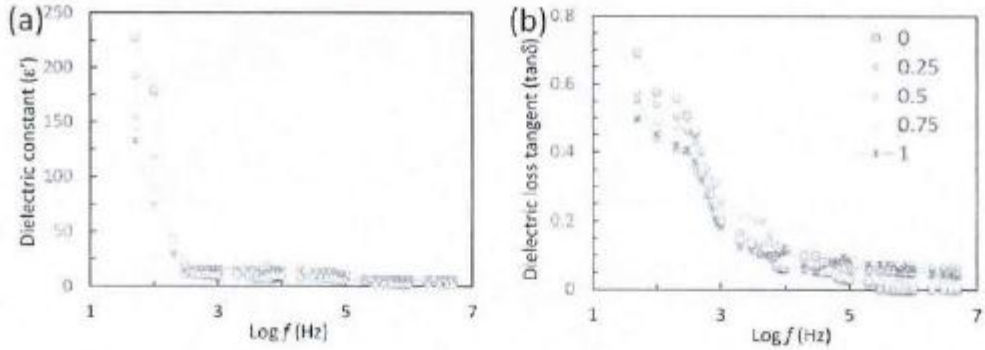

Figure 10. Variation in the dielectric constant (ε') and dielectric loss tangent (tanδ) as a function of the logarithm of frequency for Ce–Dy substituted $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites.

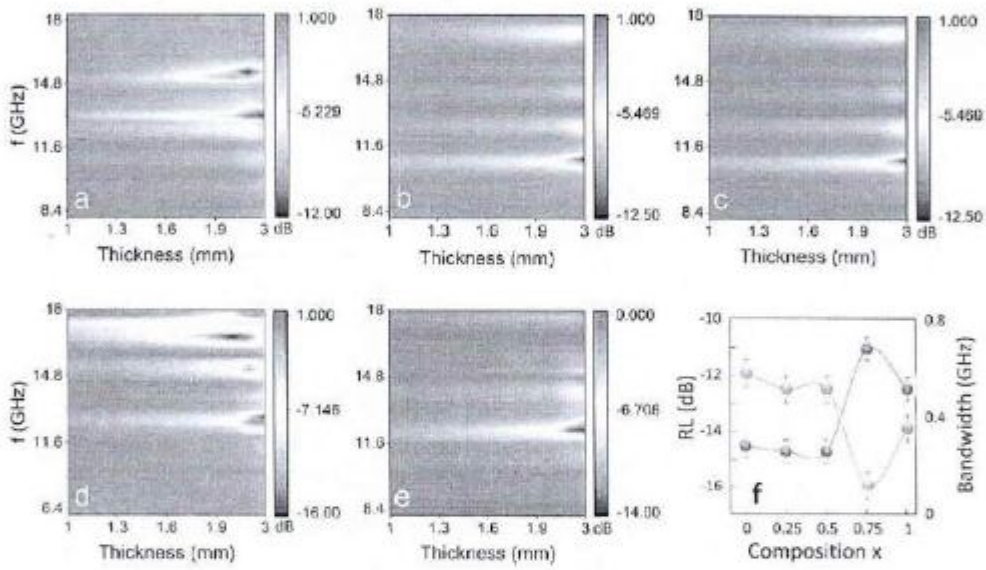

Figure 11. Microwave absorption properties of $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites, where (a) $x = 0.00$, (b) $x = 0.25$, (c) $x = 0.50$, (d) $x = 0.75$ and (e) $x = 1.0$. (f) The variation in RF and bandwidth with composition x.

frequency (50 Hz–5 MHz). Here, ε' was obtained through the relation:

$$\varepsilon' = \frac{cd}{A\varepsilon_0} \tag{4}$$

where c, d and A are the capacitance, thickness and area of the pellet, respectively, and ε_0 is the permittivity of free space (8.859×10^{-12} F m^{-1}). The variation in ε' shown in figure 10(a) displays normal dielectric behaviour of hexagonal ferrites, where ε' possesses larger values at lower frequencies and decreased as the frequency increased. Koops' theory [50] explains this behaviour of a dielectric constant with frequency by considering the inhomogeneous dielectric medium with two Maxwell–Wegner type layers [51, 52]. The dielectric material, such as $BaCe_xDy_xFe_{12-2x}O_{19}$ hexaferrites, is composed of the greatly conducting grains disjointed by the low-conduction grain boundaries. The dielectric polarization mechanism in ferrites is similar to the conduction mechanism [53], where poorly conducting grain boundaries play a main part at lower frequencies, thereby ε' showed higher values at lower frequencies. On the other hand, conducting grains are activated at higher frequencies. In the low-frequency region the doping of Ce and Dy causes low values of dielectric properties compared to $x = 0.0$ (pure barium ferrite). This could be related to the increase in grain size with Ce–Dy substitution. The increase in grain size reduced the number of grain boundaries, thereby decreasing the possibility of electron hopping. This causes the decrease in the dielectric constant and dielectric loss of Ce-Dy substituted BaM hexaferrite.

3.8. Microwave properties

Reflection loss (RL) calculations for all the samples of $BaCe_xDy_xFe_{12-2x}O_{19}$ for different sample thicknesses 1, 1.1, 1.2, 1.3, 1.4, 1.5, 1.6, 1.7, 1.8, 1.9, 2, 2.5 and 3 mm were carried out and are shown in figures 11(a)–(e). All the compositions showed almost identical variations in RL in the low-frequency region. The various maxima and minima of the peaks for all the compositions occur at higher frequencies. The bandwidth gives a frequency range where the RL is lower than −10 dB;

this means 90% of the microwave is absorbed in this frequency bandwidth. The best MAM should possess low reflection with wide-frequency bandwidth. The RLs mostly depend on the thickness of the sample. Furthermore, minimum reflection, RL_{min}, of the microwave power occurred as the sample thickness, t, of the absorber approximates a quarter of the propagating wavelength multiplied by an odd number [54], that is

$$t_m = n\frac{\lambda_m}{4} \tag{5}$$

where $n = (1, 3, 5, 7, 9\ldots)$, so that $n = 1$ corresponds to the first dip at low frequency.

In the present investigation it is observed that for all samples the peak of RL ccurs in the higher-frequency region. The various doping compositions cause variations in the amplitude of the RL.

It is observed from figures 11(a)–(e) that RL increased with thickness and Ce–Dy substitution. There is no type of absorption peak for the sample of thickness 1 mm except for the $x = 0.75$ sample. The sample $x = 0.75$ possesses a higher value of RL due to the higher dielectric and magnetic losses at the higher frequency Ku microwave band. As shown in figure 11(a)–(e) at the Ku frequency band the sample $x = 0.75$ showed four absorption peaks at different thicknesses. Figure 11(f) depicts the variation in the maximum RL and bandwidth for the 3 mm thickness sample for all the investigated samples. In $x = 0.75$, for the sample thickness of 2 mm, the absorption peak possesses a maximum -10 dB bandwidth of 0.36 ($\pm$0.02) GHz and an RL -15.9 ($\pm$0.1) dB at the frequency 12.87 ($\pm$0.05) GHz. Whereas the 3 mm thickness of the same sample possesses another absorption peak at 16.72 ($\pm$0.05) GHz with a maximum RL of -16.3 ($\pm$0.1) dB with bandwidth of 0.70 ($\pm$0.02) GHz. This behaviour indicates that the RL strongly depends on thickness and substitution content.

The microwave absorption characteristics can depend on many factors, including permeability and permittivity properties of the materials. According to the transmission line theory, the RL associated with microwave absorption characteristics can be determined by the complex permittivity and permeability with respect to the absorber thickness d [55]:

$$\mathrm{RL} = 20 \times \log\left|\frac{Z_{in} - Z_0}{Z_{in} + Z_0}\right| \tag{6}$$

$$Z_{in} = Z_0 \times \left(\frac{\mu_r}{\varepsilon_r}\right)^{1/2} \times \tan h\left[j \times \frac{2\pi df}{c} \times (\mu_r\varepsilon_r)^{1/2}\right] \tag{7}$$

where Z_{in} is the input impedance of the absorber material, $Z_o = (\mu_e/\varepsilon_o) = 377\ \Omega$ is the impedance of the free space, ε_r and μ_r are the complex relative permittivity and permeability, respectively, f is the frequency of the incident electromagnetic wave and c is the velocity of light in vacuum. Two conditions are important to attain excellent absorbing (or low reflection) properties; (a) the electromagnetic wave should enter into the absorbing material to a greater extent, and (b) the electromagnetic wave entering into the absorbing materials should be attenuated at maximum [56]. The variation in RL characteristics of BaM hexaferrite with the Ce–Dy substitution could be related to the variation in permeability and permittivity.

4. Conclusions

Rietveld refinement of XRD patterns confirmed the formation of an M-type hexagonal structure with additional phases of CeO_2 and $DyFeO_3$ for the Ce–Dy substituted samples. The tensile type lattice strains are observed in the samples, which increased with the Ce–Dy substitution as determined by the W–H analysis. Crystallite size obtained from the XRD data and particle size estimated from TEM confirmed the nanocrystalline nature of all the prepared samples. The average grain size obtained from SEM analysis increased from 56.9 to 90.3 nm with the substitution of Ce–Dy ions in BaM. The introduction of Ce–Dy ions in BaM reduced the saturation and remnant magnetizations, whereas coercivity increased. The 3 mm thickness sample of $x = 0.75$ composition possessed the maximum band width of 0.70 GHz with an RL of -16.3 dB in the Ku frequency band of 16.7 GHz. The complex parts of permittivity and permeability of the BaM decreased, whereas the imaginary part increased with Ce–Dy substitution. High coercivity and RL make these materials suitable for application in permanent magnets as well as in microwave absorbers.

Data availability statement

All data that support the findings of this study are included within the article (and any supplementary files).

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Conflict of interest

The authors declare no conflict of interest.

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References

[1] Wei H, Zhang Z, Hussain G, Zhou L, Li Q and Ostrikov K 2020 Techniques to enhance magnetic permeability in microwave absorbing materials *Appl. Mater. Today* 19 100596

[2] Lee S, Jo I, Kang S, Jang B, Moon J, Park J B, Lee S, Rho S, Kim Y and Hong B H 2017 Smart contact lenses with graphene coating for electromagnetic interference shielding and dehydration protection *ACS Nano* 11 5318–24
[3] Shahzad F, Alhabeb M, Hatter C B, Anasori B, Man Hong S, Koo C M and Gogotsi Y 2016 Electromagnetic interference shielding with 2d transition metalcarbides (MXenes) *Science* **353** 1137–40
[4] Kang J, Kim D, Kim Y, Choi J B, Hong B H and Kim S W 2017 High-performance near-field electromagnetic wave attenuation in ultra-thin and transparent graphene films *2D Mater.* **4** 025003
[5] Ghasemi A, Liu X, Morisako A and Shirsath S E 2013 Magnetic and reflection loss characteristics of $SrFe_{12-x}(Sm_{0.5}Dy_{0.5})_xO_{19}$/multiwalled carbon nanotube nanocomposite *IEEE Trans. Magn.* 49 4218–21
[6] Trukhanov S V, Trukhanov A V, Kostishyn V G, Panina L V, Trukhanov A V, Turchenko V A, Tishkevich D I, Trukhanova E L, Yakovenko O S and Yu. Matzui L 2017 Investigation into the structural features and microwave absorption of doped barium hexaferrites *Dalton Trans.* **46** 9010–21
[7] Buschow K H J and De Boer F R 2003 *Physics of Magnetism and Magnetic Materials* (New York: Kluwer Academic/Plenum Publishers)
[8] Sun X, He J, Li G, Tang J, Wang T, Guo Y and Xue H 2013 Laminated magnetic graphene with enhanced electromagnetic wave absorption properties *J. Mater. Chem. C* **1** 765–77
[9] Wu M, He H, Zhao Z and Yao X 2000 Electromagnetic and microwave absorbing properties of iron fibre-epoxy resin composites *J. Phys. D: Appl. Phys.* **33** 2398–401
[10] Trusov L A, Gorbachev E A, Lebedev V A, Sleptsova A E, Roslyakov I V, Kozlyakova E S, Vasiliev A V, Dinnebier R E, Jansen M and Kazin P E 2018 Ca-Al double substituted strontium hexaferrites with giant coercivity *Chem. Commun.* **54** 479–82
[11] Pullar R C 2012 Hexagonal ferrites: a review of the synthesis, properties and applications of hexaferrite ceramics *Prog. Mater. Sci.* **57** 1191–334
[12] Prathap S, Madhuri W and Meena S S 2018 Effect of non-stoichiometry in lead hexaferrites on magnetic and dielectric properties *Mater. Chem. Phys.* **220** 137–48
[13] Yang Y, Wang F, Shao J, Batoo K M and Huang D 2017 Microstructure and magnetic properties of Zr-Mn substituted M-type Sr-La haxaferrites *Appl. Phys. A* **123** 1–8
[14] Dadfar M R, Seyyed Ebrahimi S A and Masoudpanah S M 2015 *J. Supercond. Nov. Magn.* **28** 89–94
[15] Shirsath S E, Kadam R H, Batoo K M, Wang D and Li S 2021 Co–Al-substituted strontium hexaferrite for rare earth free permanent magnet and microwave absorber application *J. Appl. Phys.* **54** 024001
[16] Khan M, Islam M U, Xu Y, Ashiq M N, Ali I, Iqbal M A and Ishaque M 2014 Structural and magnetic properties of Pr-Ni substituted $Ca_{0.5}Ba_{0.5}Fe_{12}O_{19}$ hexaferrite nanoparticles *Ceramic Int.* **40** 6487–93
[17] Ali I, Islam M U, Islam M S, Awan M S and Ahmad M 2013 Effect of Ga-Cr substitution on structural and magnetic properties of hexaferrites ($BaFe_{12}O_{19}$) synthesized by sol-gel auto-combustion *J. Alloys Compd.* **547** 118–25
[18] Topkaya R, Auwala I and Baykal A 2016 Effect of temperatre on magnetic properties of $BaY_xFe_{12-x}O_{19}$ hexaferrites *Ceramic Int.* **42** 16296–302
[19] Chen D, Liu Y, Li Y, Yang K and Zhang H 2013 Microstructre and magnetic properties of Al doped barium ferrite with sodium citrate as a chelating agent *J. Magn. Magn. Mater.* **337** 65–69
[20] Almessier M A, Slimani Y, Korkmaz A D, Gungunes H, Nawaz M, Shirsath S E, Baykal A and Ercan I 2019 Ca^{2+}/Mg^{2+} co-substituted strontium nanohexaferrites: magnetic investigation and Mossbauer analysis *J. Sol-Gel Sci. Technol.* **92** 239–51
[21] Baykal A, Güngüneş H, Sözeri H, Amir M, Auwal I, Asiri S, Shirsath S E and Demir Korkmaz A 2017 Magnetic properties and Mössbauer spectroscopy of Cu-Mn substituted $BaFe_{12}O_{19}$ hexaferrites *Ceram. Int.* **43** 15486–92
[22] Trukhanov A V *et al* 2020 Pecularities of the magnetic structure and microwave properties in $Ba(Fe_{1-x}Sc_x)_{12}O_{19}$ ($x < 0.1$) hexaferrites *J. Alloys Compd.* **822** 153575
[23] Tran N, Kim H S, Phan T L, Yang D S and Lee B W 2018 Electronic structure and magnetic properties of $Ba_{1-x}Sr_xCoFe_{12}O_{19}$ hexaferrites *Ceram. Int.* **44** 12132
[24] Shirsath S E, Wang D, Jadhav S S, Mane M L and Li S 2018 Ferrites obtained by sol-gel method *Handbook of Sol-Gel Science and Technology* ed L Klein, M Aparicio and A Jitianu (Berlin: Springer) pp 695–735
[25] Almessiere M A, Slimani Y and Baykal A 2019 Impact of Nd-Zn cosubstitution on the microstructure and magnetic properties of $SrFe_{12}O_{19}$ nano hexaferrite *Ceram. Int.* **45** 963–9
[26] Ashiq M N, Iqbal M J, Haq M N, Gomez P H and Qureshi A M 2012 Synthesis, magnetic and dielectric properties of Er-Ni doped Sr-hexaferrite nanomaterials for application in high density recording media and microwave devices *J. Magn. Magn. Mater.* **324** 15–19
[27] Ataie A, Heshmati-Manesh S and Kazempour H 2002 Synthesis of barium hexaferrite by the co-precipitation method using acetate precursor *J. Mater. Sci.* **37** 2125–8
[28] Liu C *et al* 2019 Investigation of Ce-Zn co-substituted on the crystal and ferromagnetic properties of M-type strontium hexaferrites $Sr_{1-x}Ce_xFe_{12-x}Zn_xO_{19}$ compounds *J. Alloys Compd.* **785** 452–9
[29] Neupane D, Wang L, Adhikari H, Alam J and Mishra S R 2017 Synthesis and characterization of co-doped $SrFe_{12-x}(DyAl)_xO_{19}$ hexaferrite *J. Alloys Compd.* **701** 138–46
[30] Shezad M, Liu X, Feng S, Kan X, Wang W, Liu C, Shehzad T J and Rehman K M 2020 Characterizations analysis of magneto-structural transitions in Ce-Co doped SrM based nano $Sr_{1-x}Ce_xFe_{12-x}Co_xO_{19}$ hexaferrite crystallites prepared by ceramic route *J. Magn. Magn. Mater.* **497** 166013
[31] Hussain S and Maqsood A 2007 Influence of sintering time on structural, magnetic and electrical properties of Si–Ca added Sr-hexa ferrites *J. Magn. Magn. Mater.* **316** 73
[32] Kaur G A, Shandilya M, Rana P, Thakur S and Uniyal P 2020 Modification of structural and magnetic properties of $Co_{0.5}Ni_{0.5}Fe_2O_4$ nanoparticles embedded polyvinylidene fluoride nanofiber membrane via electrospinning method *Nano-Struct. Nano-Objects* **22** 100428
[33] Kadam R H, Desai K, Shinde V S, Hasim M and Shirsath S E 2016 Influence of Gd^{3+} ion substitution on the $MnCrFeO_4$ for their nanoparticle shape formation and magnetic properties *J. Alloys Compd.* **657** 487–94
[34] Satpute S S, Wadgane S R, Kadam S R, Mane D R and Kadam R H 2019 Y^{3+} substituted Sr-hexaferrites: sol-gel synthesis, structural, magnetic and electrical characterization *Ceramica* **65** 274–81
[35] Parker R 1980 Ferrite *Proc. ICF-3* 375
[36] Lee S W, An S Y, Shim I-B and Kim C S 2005 Mossbauer studies of La-Zn substitution effect in strontium ferrite nanoparticles *J. Magn. Magn. Mater.* **290** 231
[37] Baniasadi A, Ghasemi A, Nemati A, Ghadikolaei M A and Paimozd E 2014 Effect of Ti–Zn substitution on structural,

magnetic and microwave absorption characteristics of strontium hexaferrite *J. Alloys Compd.* **583** 325–8
[38] Shirsath S E, Kadam R H, Mane M L, Ghasemi A, Yasukawa Y, Liu X and Morisako A 2013 Permeability and magnetic interactions in Co^{2+} substituted $Li_{0.5}Fe_{2.5}O_4$ alloys *J. Alloys Compd.* **575** 145–51
[39] Shirsath S E, Mane M L, Yasukawa Y, Liu X and Morisako A 2014 Self-ignited high temperature synthesis and enhanced super-exchange interactions of $Ho^{3+}-Mn^{2+}-Fe^{3+}-O^{2-}$ ferromagnetic nanoparticles *Phys. Chem. Chem. Phys.* **16** 2347–57
[40] Rostami M, Moradi M, Alam R S and Mardani R 2016 Characterization of magnetic and microwave absorption properties of multi-walled carbon nanotubes/Mn-Cu-Zr substituted strontium hexaferrite nanocomposites *Mater. Res. Bull.* **83** 379–86
[41] Sivakumar P, Ramesh R, Ramanand A, Ponnusamy S and Muthamizhchelvan C 2011 Synthesis and characterization of nickel ferrite magnetic nanoparticles *Mater. Res. Bull.* **46** 2208–11
[42] Auwal I A, Güngüneş H, Güner S, Shirsath S E, Sertkol M and Baykal A 2016 Structural, magneto-optical properties and cation distribution of $SrBi_xLa_xY_xFe_{12-3x}O_{19}$ ($0.0 \leqslant x \leqslant 0.33$) hexaferrites *Mater. Res. Bull.* **80** 263–72
[43] Shirsath S E, Jadhav S B, Toksha B G, Patange S M and Jadhav K M 2011 Influence of Ce^{3+} ions on the structural and magnetic properties of $NiFe_2O_4$ *J. App. Phys.* **110** 013914
[44] Ali I, Islam M U, Awan M S, Ahmed M, Ashiq M N and Naseem S 2013 Effect of Tb^{3+} substitution on the structural and magnetic properties of M-type hexaferrites synthesized by sol-gel autocombustion technique *J. Alloys Compd.* **550** 564–72
[45] Liu X, Wang W, Yang S, Yu Z, Gu B and Du Y 2002 Structural and magnetic properties of La^{3+} substituted strontium hexaferrite particles prepared by sol-gel method *Phys. Status Solidi* a **193** 314–9
[46] Liu X, Wang W, Yang S, Yu Z, Gu B and Du Y 2002 Influence of La^{3+} substitution on the structural and magnetic properties of M- type strontium ferrites *J. Magn. Magn. Mater.* **238** 207–14
[47] Birajdar A A, Shirsath S E, Kadam R H, Patange S M, Lohar K S, Mane D R and Shitre A R 2012 Role of Cr^{3+} ions on the microstructure development, and magnetic phase evolution of $Ni_{0.7}Zn_{0.3}Fe_2O_4$ ferrite nanoparticles *J. Alloys Compd.* **512** 316–22
[48] Stergiou C and Litsardakis G 2012 Design of microwave absorbing coating with new Ni and La doped hexaferrite *IEEE* **48** 1516–9
[49] Kaur P, Bahel S and Narang S B 2018 Broad band microwave absorption of $Sr_{0.85}La_{0.15}(MnZr)_xFe_{12-2x}O_{19}$ hexagonal ferrite in 18–40 GHz frequency range *J. Magn. Magn. Mater.* **460** 489–94
[50] Koops C G 1951 On the dispersion of resistivity and dielectric constant of some semiconductors at audio-frequencies *Phys. Rev.* **83** 121
[51] Maxwell J C 1929 *Electricity and Magnetism* vol 1 (Oxford: Oxford University Press) section 328
[52] Wagner K W 1913 Zur theorie der Unvollkommenen Dielektrika *Ann. Phys.* **40** 817–55
[53] Rezlescu N and Rezlescu E 1974 Dielectric properties of copper containing ferrites *Phys. Status Solidi* a **23** 575
[54] Shukla V 2019 Review of electromagnetic interference shielding materials fabricated by iron ingredients *Nanoscale Adv.* **1** 1640–71
[55] Tabatabaie F, Faith M H, Saatchi A and Ghasemi A 2009 Microwave absorption properties of Mn and Ti doped strontium hexaferrite *J. Alloy. Compd.* **470** 332
[56] Zhang Z, Liu X, Wang X, Wu Y and Li R 2012 Effect of Nd-Co substitution on magnetic and microwave absorption properties of $SrFe_{12}O_{19}$ hexaferrite *J. Alloy. Compd.* **525** 114–9

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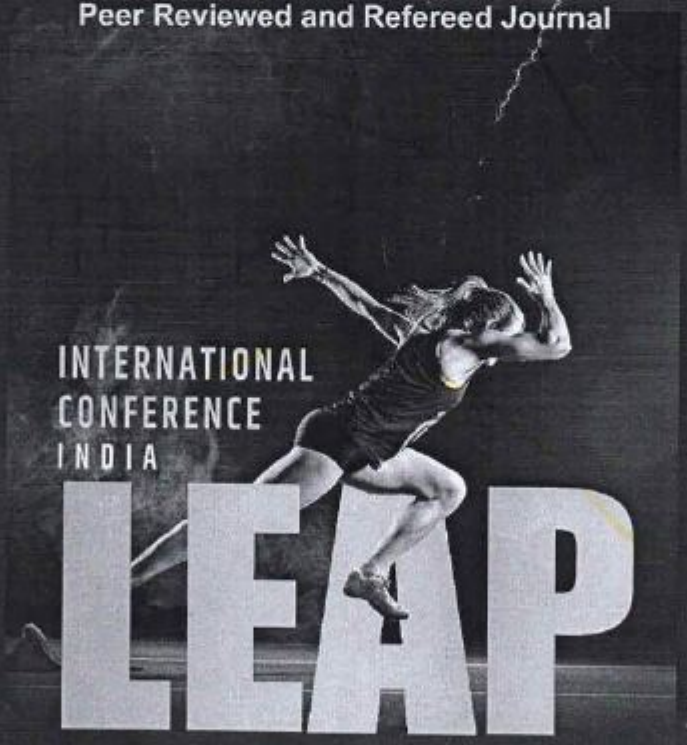

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ROLE OF SPORTS PSYCHOLOGY IN SPORTS PERFORMANCE

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ABSTRACT

Sport psychology is that the understanding of how the mind influences an athlete's performance in their chosen sport. Within the principles of sport psychology are various concepts like how do athletes like better to learn, what's their personality, how can they attain states of relaxation and concentration (narrow and broad focus), how does an athlete learn to see a successful performance, do they understand and overcome their limiting beliefs and the way does an athlete develop high levels of self-awareness. The importance of sport psychology has been realized for many years, however many coaches and athletes pay insufficient attention to how it can help them to realize high perform better. Many coaches and athletes still overly specialize in the physical aspect of sporting performance at the detriment of the non-physical. To conclude we will say that sports psychology plays an important role in enhancing the performance of the players.

Keywords : Sports psychology, sports performance.

INTRODUCTION

In the past, it was assumed that these skills were genetically based, or acquired early in life. Now, it is commonly accepted that athletes and coaches are capable of learning a broad range of psychological skills that can play a critical role in learning to achieve high performance.

1.2 Role of Sports Psychology

The importance of a sports psychologist as an integral member of the coaching and health care teams is widely known. Sports psychologists can teach skills to assist athletes enhance their learning process and motor skills, deal with competitive pressures, fine-tune the extent of awareness needed for optimal performance, and stay focused amid the various distractions of team travel and within the competitive environment. Psychological training should be an integral a part of an athlete's holistic training process, administered in conjunction with other training elements. This is best accomplished by a collaborative effort among the coach, the game psychologist, and therefore the athlete; however, a knowledgeable and interested coach can learn basic psychological skills and impart them to the athlete, especially during actual practice.

There is a strong force guiding athletes to those super performances. It is the subconscious mind. The athlete must allow their subconscious to become the dominant drive once they perform. When the athlete is in a position to regulate their subconscious, they become better at tapping their mental power to perform more

consistently at a high level. Only when tapping into your mind's power will your body be ready to operate pure instinct and more consistently under stress. The result's more opportunities to realize peak performances. Elite athletes are constantly looking to enhance their performance to accumulate a foothold on their competitors. No matter how physically prepared an athlete is, it's their mental preparedness that creates the difference when competing against one another. Conditioning the mind is simply as important as reconditioning the body. Think of your attitude because the ultimate secret weapon that provides you a foothold.

1.3 Sport Psychology enhances an athlete's mental game.

The essential goal is to establish a method and an approach that fuels success. At the center of this concept is strengthening an athlete's inner belief that they can achieve greatness. Achieving your goals begins at the subconscious level, where all of our memories, beliefs, and experiences are stored. Although there are many different methods and approaches to working with athletes, it is only when change is created at the subconscious level that real transformation occurs. When working on the subconscious level, athletes can effectively program their minds to achieve success by releasing old ideas that limit performance to experience positive and lasting results.

Sport Psychology can help you to :

- Anchor positive states for easy future access.
- Explore and examine the thoughts and beliefs that are creating the current experiences.
- Program effective auto suggestions for enhancing optimal states.
- Reverse and release limiting thoughts that are blocking you from achieving peak performance.

Preparing for Competition :

Psychological skills to help the athlete manage the competitive performance environment include:

1. Learning relaxation skills (e.g. progressive relaxation; slow, controlled, deep abdominal breathing; or autogenic training
2. Mastering all of the attentional styles (types of concentration)
3. Imagery (both visualisation and kinesthetics)
4. Appropriate self-talk and
5. Developing a pre competition mental routine to be employed immediately prior to competition on game day (these routines are short [1–2 minutes] and use all of the mental skills just presented).

1.4 Conclusion :

Within the principles of sport psychology are various concepts like how do athletes like better to learn, what's their personality, how can they attain states of relaxation and concentration (narrow and broad focus), how does an athlete learn to see a successful performance, do they understand and overcome their limiting beliefs and the way does an athlete develop high levels of self-awareness. The importance of sport psychology has been realized for many years, however many coaches and athletes pay insufficient attention to how it can help them perform better. To conclude we will say that sports psychology plays an important role in enhancing the performance of the players.

REFERENCES

Mood and human performance: Conceptual, measurement, and applied issues, Hauppauge, NY: Nova Science 2007 Cyber Psych & Behavior, 4(3): p. 335-339 2001 .1993.

Core, R. C. (1970). Spores Psychology, Concept and Applications: (Second Edition). Dubuque, Iowa: Win C. Brown Publishers

Singer, R. N. (1980). Sports Psychology. An Overview. In W. F. Straub, Sports Psychology: An Analysis of Athlete & Behaviour. New York. Movement PUblications.

Pargman, D. (ed.) Psychological Basis of Sport Injuries. Mortgantown, WV:Fitness Information Technology, 1993.

Heil, J. Psychology of Sport Injury. Champaign, IL: Human Kinetics Publishers, Psych of Sport &Exerc, 8(1): p. 47-72 2007

Donohue, B., Dickens, Y., Lancer, K., Covassin, T., Hash, A., Miller, A. and Genet, J. (2004). Improving athletes' perspectives of sport psychology consultation: a controlled evaluation of two interview methods. Behavior Modification, 28, 182-193

Voight, M. and Callaghan. The use of sports psychology services at NCAA Division I Universities from 1998-1999. The Sport Psychologist, 15, 91-102.

Sanchez, X., Godin, P. and DeZanet, F. (2005). Who delivers sport psychology services? Examining the field reality in Europe. The Sport Psychologist, 19, 81-92.

Ikulayo, P.B. (1990). Understanding Sports Psychology. EAITCN PRESS. BOX 4614 Marina Lagos, Nigeria.

Caron, A.V. (1990). Group dynamics in sport and physical activity: Social Psychological and performance consequences. International journal of sport psychology, 21, 286-304.

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आठ आठवडयाचा कॉम्प्लेक्स प्रशिक्षण कार्यक्रमाचा लांब उडी खेळाडूच्या कार्यमानावर होणा—या परिणामाचा अभ्यास

डॉ.सचिन सुभाषराव चामले
शारिरीक शिक्षण संचालक,
कै.रसिका महाविद्यालय,देवणी ता.देवणी जि.लातूर महाराष्ट्र

सारांश

सदर संशोधनामध्ये आठ आठवडयाचा कॉम्प्लेक्स प्रशिक्षण कार्यक्रमाचा लांब उडी खेळाडूच्या कार्यमानावर होणा—या परिणामाचा अभ्यास करण्यासाठी प्रायोगिक संशोधन पध्दतीचा वापर करण्यात आला आहे. संशोधनासाठी प्राय प्रायोगिक अभिकल्पामधील पूर्व व उत्तर चाचणी असमतुल्य गट अभिकल्पाचा वापर करण्यात आला आहे. संशोधनासाठी उदगीर शहरातील महाराष्ट्र उदयगिरी महाविद्यालयाच्या मैदानावर ऑलंपीक स्पोंटस अॅकेडमी मधे प्रशिक्षण घेत असलेल्या आठरा ते पंचवीस वयोगटातील ५० पुरूष खेळाडूपैंकी ४० पुरूष खेळाडूची लॉट्री पध्दतीने निवड करून त्यापैकी २० पुरूष खेळाडू नियंत्रित गट व २० पुरूष खेळाडू प्रायोगिक गटासाठी अशा पध्दतीने २ गटात विभागणी केली आहे. प्रशिक्षण सुरू होण्यापुर्वी व संपल्यानंतर लांब उडी कार्यमान तपासणीसाठी पुर्व व उत्तर चाचणी म्हणून लांब उडीच्या खेळाडूंना ३ संधी देवून त्यापैकी १ उत्तम संधीची नोंद करून कार्यमान तपासण्यात आले. मिळालेल्या माहितीचे विश्लेषण करण्यासाठी वर्णनात्मक सांख्यिकी मधील मध्यमान, प्रमाण विचलन, या संख्याशास्त्रीय साधनाचा वापर करण्यात आला. या वरून असे दिसूल आले की, लांब उडी खेळाडूच्या नियंत्रित गटाच्या पुर्वचाचणीचे मध्यमान ३६८.२५ सेमी (± ५५.६०) व उत्तर चाचणीचे मध्यमान ३६८.२० सेमी (± ५४.५९) एवढे आहे. तसेच लांब उडी खेळाडूच्या प्रायोगित गटाच्या पूर्व चाचणीचे मध्यमान ४०५.३५ सेमी (± ४४.८६) व उत्तर चाचणीचे मध्यमान ४१०.८० सेमी (± ४६.२९) एवढे आहे. नियंत्रित गटाच्या कार्यमानातील बदलाचा मध्यमान — ०.०५ सेमी (± ०२.२३) व प्रायोगिक गटाच्या कार्यमानातील बदलाचा मध्यमान ५.५४ सेमी (± ०२.९४) एवढा आहे. कॉम्प्लेक्स प्रशिक्षण कार्यक्रमाचा परिणाम अभ्यासण्यासाठी अनुमानात्मक सांख्यिकीय मधील इनडिपेन्डट सॅम्पल टी टेस्ट या संख्याशास्त्रीय साधनाचा वापर करून नियंत्रित व प्रायोगिक गटाच्या कार्यमानातील बदलाची तुलना करण्यात आली यावरून असे दिसून आले की, प्राप्त टी मुल्य हे ६.६५ असून ०.०५ या सार्थकता स्तरावर सार्थक फरक दिसून आला (p=0.001). वरील माहितीच्या विश्लेशणावरून असा निष्कर्ष आला की, लांब उडी कार्यमानासाठी कॉम्प्लेक्स प्रशिक्षण कार्यक्रम परिणामकारक आहे.

महत्वाचे शब्द : लांब उडीचे कार्यमान, कॉम्प्लेक्स प्रशिक्षण कार्यक्रम

प्रस्तावना:

आजच्या या वैज्ञानिक व जलद युगामध्ये इतर गोष्टीप्रमाणे क्रीडा बाबीनासुध्दा महत्व प्राप्त झाले आहे. अॅथलेटिक्स या क्रीडाप्रकारामधील सर्वच प्रकारातील खेळाचे जागतिक उच्चांक तसेच लांब उडी या क्रीडाप्रकाराचे जागतिक उच्चांक सुध्दा दिवसेदिवस वाढत चाललेले दिसून येत आहेत. या जागतिक उच्चांकापर्यत या आपल्या भारतीय खेळाडूंना पोहचवायचे असेल तर आपणास विविध प्रशिक्षण पध्दतीचा वापर करणे आवश्यक आहे.

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शारिरीक सुदृढताही प्रशिक्षणाने विकसीत केली जाते. प्रशिक्षण हे कोणत्याही खेळासाठी महत्वपूर्ण असा भाग असून ती एक व्यवस्थित व पध्दतशीर प्रक्रिया आहे. आपले शरीर प्रशिक्षणाशी कसे जुळवून घेते. या आकलन शक्तीवर सर्व पध्दती आधारलेले आहेत. या विविध पध्दतीमधे एक सलग प्रशिक्षण, फार्टलेक प्रशिक्षण, मध्यांतर प्रशिक्षण, सर्किट ट्रेनिंग, वेट ट्रेनिंग, प्लायोमेट्रीक ट्रेनिंग आणि कॉम्प्लेक्स प्रशिक्षण, इत्यादी अशा प्रशिक्षण पध्दतीचा वापर करून क्रीडा कार्यमान व कौशल्य कार्यमानात वाढ होवू शकते असा क्रीडा मार्गदर्शक, क्रीडा प्रशिक्षक यांचा अनुभव आहे.

कॉम्प्लेक्स प्रशिक्षण पध्दती म्हणजे ही एक अशी प्रशिक्षण पध्दती आहे की, त्यामध्ये दोन वेगवेगळया व्यायाम प्रकार एकत्र करून तयार केलेले व्यायामाचे सत्र म्हणजे कॉम्प्लेक्स प्रशिक्षण पध्दती होय. कॉम्प्लेक्स प्रशिक्षणामध्ये कार्य करत असताना काही संच हे प्लायोमेट्रीक व्यायाम प्रकार व काही संच हे उच्च प्रतिरोध व्यायाम प्रकार या दोन्हीचे एकत्रीकरण केलेले असते. उदा. पाच संच बॉक्स जम्पंच्या नंतर पाचा संच बारबेल बरोबर लंजेस करणे. तसेच कॉम्प्लेक्स प्रशिक्षण हे कमी वेळेत व कमी जागेत चांगले कार्य घडवून आणते आणि कॉम्प्लेक्स प्रशिक्षणामुळे तीव्रता ही चांगल्या प्रकारे वाढवण्यास मदत करते.

विशिष्ट तंत्रशुध्द पध्दतीने व उडयाच्या साहयाने खेळाडूच्या पायातील स्पोटक ताकदीत वाढ होवून त्या खेळाडूच्या कार्यमानावर परिणाम होईल का ? या गोष्टीची पडताळणी प्रयोगातून घेण्यासाठी संशोधकाने प्रस्तुत संशोधनासाठी कॉम्प्लेक्स प्रशिक्षण कार्यक्रमाचा लांब उडी खेळाडूच्या कार्यमानावर होणा—या परीणामाचा अभ्यास करणे आवश्यक वाटले.

संशोधन पध्दती व साधने:—

सदर संशोधनासाठी प्रायोगिक संशोधन पध्दतीचा वापर केला गेला आहे.

जनसंख्या व न्यादर्ष:—

प्रस्तुत संशोधनासाठी उदगीर येथील महाराष्ट्र उदयगीरी महाविद्यालयाच्या मैदानावर चालणा—या ऑलिंम्पिक स्पोर्टस ॲकेडमी प्रशिक्षण घेत असलेल्या एकुण ५० पुरूष खेळाडूपैकी ४० पुरूष खेळाडूची लॉट्री पध्दतीने निवड करून त्यापैकी २० खेळाडूची नियंत्रित गटासाठी व २० खेळाडूची प्रायोगिक गटासाठी निवड करण्यात आली व अशा पध्दतीने त्यांचे २ गटात विभागणी करण्यात आली.

अभिकल्प:—

प्राय प्रायोगिक अभिकल्पामधील पुर्व चाचणी उत्तर चाचणी असमतुल्य नियंत्रित गट अभिकल्पाचा वापर करण्यात आला. व त्यापध्दतीने त्याचा आराखडा तयार करण्यात आला.

०१ ब ०३ ०१ व ०२ पूर्व चाचणी
०२ ग ०४ ०२ व ०४ उत्तर चाचणी

C नियंत्रित गट X प्रायोगिक गट

चले:—

स्वाश्रर्यी चले — ८ आठवडयाचा कॉम्प्लेक्स प्रशिक्षण कार्यक्रम
आश्रर्यी चले — लांब उडी मधील कार्यमान
बाहय चले — मानसशास्त्री, आहार, दैनंदिनी व इतर

संशोधन साधने :—

खेळाडूंचे लांब उडीचे कार्यमान

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संशोधन कार्यपध्दती:—

प्रस्तुत संशोधनासाठी संशोधकाने नियंत्रित गट व प्रायोगिक गटाचे पुर्वकार्यमान तपासणीसाठी खेळाडूंना लांब उडीच्या ३ संधी देण्यात आल्या त्यापैकी एका उत्तम संधीची नोंद करून कार्यमान तपासण्यात आले. त्यानंतर प्रायोगिक गटास ८ आठवयाचा कॉम्प्लेक्स प्रशिक्षण कार्यक्रम देण्यात आला. हा प्रशिक्षण कार्यक्रम आठवडयातून ४ दिवस सायंकाळच्या सत्रात राबवला गेला आहे. ८ आठवडयाच्या प्रशिक्षणानंतर दोन्ही गटाच्या खेळाडूंच्या लाबउडीचे उत्तर कार्यमान तपासण्यासाठी खेळाडूंना लांब उडीच्या ३ संधी देण्यात आल्या आणि त्यापैकी एका उत्तम संधीची नोंद करून कार्यमान तपासण्यात आले. मिळालेल्या माहितीचे विश्लेषण करण्यासाठी वर्णनात्मक सांख्यिकी आणि अनुमानात्मक सांख्यिकी या संख्याशास्त्रीय साधनाचा वापर करण्यात आला.

कोष्ठक क्र. ०१

लांब उडी खेळाडूच्या कार्यमानाचे पूर्व उत्तर चाचणीचे वर्णनात्मक सांख्यिकी

	गट	एकुण खेळाडू	मध्यमान (सेमी)	प्रमाण विचलन
पूर्व चाचणी	नियंत्रित गट	२०	३६५.२५	५५.६
	प्रायोगिक गट	२०	४०५.३६	४४.८६
उत्तर चाचणी	नियंत्रित गट	२०	३६८.२	५४.५९
	प्रायोगिक गट	२०	४१०.८	४६.२९

कोष्ठक कमांक १ वरून असे दिसून येते की, लांब उडी खेळाडूच्या नियंत्रित गटाच्या पूर्व चाचणीचे मध्यमान ३६८.२५ सेमी (± ५५.६०) व उत्तरचाचणीचे मध्यमान ३६८.२० सेमी (± ५४.५९) एवढे आहे. तसेच लांब उडी खेळाडूच्या प्रायोगिक गटाच्या पूर्व चाचणीचे मध्यमान ४०५.३६ सेमी (± ४४.८६) व उत्तर चाचणी चे मध्यमान ४१०.८ सेमी (± ४६.२९) एवढे आहे.

कोष्ठक क्र. ०२

लांब उडी खेळाडूच्या कार्यमानातील फरकाचे वर्णनात्मक सांख्यिकी

गट	एकुण खेळाडू	मध्यमान (सेमी)	प्रमाण विचलन
नियंत्रित गट	२०	०.०५	२.२३५४८
प्रायोगिक गट	२०	५.५४	२.९४६४५

कोष्ठक कमांक २ वरून असे दिसून येते की, नियंत्रित गटाच्या लांब उडीच्या खेळाडूंच्या कार्यमानाच्या मध्यमानात ०.०५ सेमी (± ०२.२३) घट झाली व प्रायोगिक गटाच्या लांब उडीच्या खेळाडूच्या कार्यमानाच्या मध्यमानात ५.५४ सेमी (± ०२.९४) ने वाढ झाली.

कोष्ठक क्र. ०३

लांब उडी खेळाडूच्या कार्यमानातील फरकाचे अनुमानात्मक सांख्यिकी

स्वतंत्र न्यादर्श चाचणी	
लेव्हेनी चाचणी	टी टेस्ट फॉर इक्विलीटी ऑफ मिन्स

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	एफ	स्वाधीनता स्तर	टी मूल्य	स्वाधीनता मात्र	स्वाधीनता स्तर (टू टेल)	मध्यमानाती फरक	मध्यानातील फरकाची प्रमाणत्रुटी
इक्वल व्हरायंस्न ॲंड्यूम	०.२१२	०.६४८	६.६५	३८	०.००१	५.५	०.८२७०१
इक्वल व्हरायंस्न नॉट ॲंड्यूम			६. ६५०	३५.४३०	०.००१	५.५	०.८२७०१

कोष्ठक क्रमांक ३ वरून असे दिसून येते की, नियंत्रित व प्रायोगिक गटाच्या मध्यमानातील फरक ५.५० सेमी असून हा फरक स्वतंत्र न्यादर्श चाचणीच्या (इंनडिपेन्ड सॅम्पल टी टेस्ट) मध्यमानातून तपासला असता टी मूल्य ६.६५ सेमी आहे. हे टी मूल्य ०.०५ या सार्थकता स्तरावर सार्थक आहे. ($p = 0.001$)- यावरून असे सिध्द होते की, नियंत्रित गटापेक्षा प्रायोगिक गटाच्या लांब उडीच्या कार्यमानात झालेली वाढ ही संख्याशास्त्रीय दृष्टीकोनातून सार्थक आहे.

चर्चा:— (जेमर १९८७) यांनी वेट ट्रेनिंग आणि प्लायोमेट्रीक ट्रेनिंगचा उभ्याने लांब उडी, उभ्याने उंच उडी, आणि ४० मिटर स्प्रिंट यावर होणा—या परीणामाचा अभ्यास केला यावरून त्यांना वेट ट्रेनिंग आणि प्लायोमेट्रीक ट्रेनिंगचा उभ्याने लांब उडी, उभ्याने उंच उडी, आणि ४० मिटर स्प्रिंट यावर सार्थक परिणाम आढळून आला. (कांगणे २००२) यांनी प्लायोमेट्रीक प्रषिक्षणाचा टीम हॅंडबॉल खेळाडूच्या निवडक कौशल्य कार्यमानावर होणा—या परिणामाचा अभ्यास केला. यावरून त्यांना प्लायोमेट्रीक प्रशिक्षणाचा टीम हॅंडबॉल खेळाडूच्या निवडक कौशल्य कार्यमानावर सार्थक परिणाम आढळून आला. (कार्टर, केमीनस्की आणि डयूकस २००५) मध्ये यांनी उंच प्रतिच्या प्लायोमेट्रीक व्यायाम प्रकाराचा महाविद्यालयीन बेसबॉल खेळाडूच्या फेकीच्या कार्यमानावर व खांदयाच्या ताकदीवर होणा—या परिणामाचा अभ्यास केला. यावरून त्यांना प्रायोगिक गटावर प्लायोमेट्रीक प्रशिक्षणाचा सार्थक परिणाम आढळून आला. वरील चर्चेनुसार असे आढळून आले की, प्रायोगिक गटावर प्रशिक्षणाचा सार्थक फरक आढळून आला. तसेच सदर संशोधनामध्ये प्रायोगिक गटावर कॉम्प्लेक्स प्रशिक्षण कार्यक्रमाचा लांब उडीच्या खेळाडूच्या कार्यमानावर सार्थक परिणाम आढळून आला.

निष्कर्ष:—

कॉम्प्लेक्स प्रशिक्षण कार्यक्रम हा लांब उडी कार्यमान वाढवण्यासाठी उपयुक्त आहे.

संदर्भ:—

चौधरी (२००२), आसनाचा आणि लेझिम कार्यक्रमाचा माध्यमिक शाळेतील मुलांच्या निवडक शारिरीक तदुंरूस्तीच्या घटकावर होणा—या परिणामाचा अभ्यास.

कांगणे (२००२) प्लायोमेट्रीक प्रशिक्षणाचा टीम हॅंड बॉल खेळाडूच्या निवडक कौशल्य कार्यमानावर होणा—या परिणामाचा अभ्यास.

Best and kahn. (2008). Research In Education. Prencice hall, New Delhi.

Gandhi,I.(1982),Messagetransacts;International congress of sport science Patiala, NSNIS university sports 1 (6) 113-114.

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Jeremiah J. Libby (1998), The comparison of complex and compound training program on volleyball players.

Kansal, D.(2008). Applied Measurement Evalation And sport selecation . Dvs Publication , New Delh

Singh , A.(2010). A comparative study of motor performance level among categorized skilled hockey players, International Journal of Educational Administration, Volume2,403-41

Fleck, S. and Kontor, D. (1986) Complex training. National Strength and Conditioning Association Journal, 8(5), 66-68.

Jenson, R.L. and Ebben, W.P. (2003) Kinetic analysis of complex training rest interval effect on vertical jump performance. Journal of Strength and Conditioning Research.

Cronin, J. and Sleivert, G. (2005) Challenges in understanding the influence of maximal power training on improving athletic performance. Sports Medicine.

Newton, R.U., Kraemer, W.J., and Hakkinen, K. (1999) Effects of ballistic training on preseason preparation of elite volleyball players. Medicine & Science in Sports & Exercise, 31(2), 323-330.

Simenz, C.J., Dugan, C.A., and Ebben, W.P. (2005) Strength and conditioning practices of national basketball association strength and conditioning coaches. Journal of Strength and Conditioning Research, 19(3), 495-504.

Tricoli, V., Lamas, L., Carnevale, R., and Ugrinowitsch, C. (2005) Short-term effects on lower body functional power development: weightlifting vs. vertical jump training programs. Journal of Strength and Conditioning Research, 19(2), 433-437.

Verhoshanski, T. and Tatyan (1983) Speed-strength preparation of future Ademola , A. (2009). Comparative Effect of Three Modes of Polymeric training on Leg Muscle Strength of University Students. European journal of Scientific Research ISSn 145-216 Vol.31 No. 4 (2009).

Adipor, N.(2001). Effect of plyometric exercise and weight training on anaerobic power vertical jump physiological parameter on female basketball players. Master thesis, azad Islamic university unit Tehran markaz.

Aswal , A.F.(1989). Plyometric for soccer's. new studies in athletic quarterly magazine for coaching information. Technical research bibliographic documentation.

Best ,W.J., & Kahn,J.V., (2006). Research in education. (5 th ed). New Delhi: Pearson prentice Hall by Pearson Education.

Bompa, T.(1991). Periodization training for sports human kinetics USA.

Brown,(1986).Effect of plyometric training vertical, performance on basketball players.http//pdfs.Journal.

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Estimation of Emtricitabine and Tenofovir by HPTLC Method

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Abstract:

The HPTLC procedure was optimized for simultaneous determination of Emtricitabine and Tenofovir. The mobile phase Methanol: Toluene: Ethyl acetate: Ammonia (1.5:5.5:1.5:0.1 v/v/v/v) resulted in good resolution, and sharp and symmetrical peaks were obtained. It was observed that prewashing of HPTLC plates with methanol (followed by drying and activation) and pre saturation of HPTLC chamber with mobile phase for 20 min (optimum chamber saturation time) ensured good reproducibility and peak shape of three drugs.

Key Words: *mobile phase, environment-friendly solvents.*

INTRODUCTION:

High Performance Thin Layer Chromatography (HPTLC) is a powerful method equally suitable for qualitative and quantitative analytical tasks.HPTLC has been reported to provide excellent separation, qualitative and quantitative analysis of a wide range of compounds, such as herbal and botanical dietary supplements, nutraceuticals, traditional western medicines, traditional Chinese medicines and Ayurvedic (Indian) medicines and determination of radiolabeled substances in chemical, biochemical, biological, pharmaceutical, and medicinal samples.It includes the ability to analyze crude samples containing multi-components, application of large number of sample and a series of standards using the spray-on technique, choice of solvents for the HPTLC development is wide as the mobile phases are fully evaporated before the detection step, processing of standards and samples identically on the same plate leading to better accuracy and precision of quantification, different and universal selective detection methods, and in situ spectra recording in sequence to obtain positive identification of fractions, storage of total sample on layer without time constrains[1-3].

HPTLC is the most advanced form of modern TLC. It uses HPTLC plates featuring small particles with a narrow size distribution which results in homogenous layers with a smooth surface to be obtained. HPTLC uses smaller plates (10 × 10 or 10 × 20 cm). HPTLC plates provide improved resolution, higher detection sensitivity, and improved *in-situ* quantification and are used for industrial pharmaceutical densitometry quantitative analysis. Normal phase adsorption TLC on silica gel with a less polar mobile phase, such as chloroform– methanol, has been used for more than 90% of reported analysis of pharmaceuticals and drugs[4].Simple and precise HPTLC methods were developed for the simultaneous estimation of two anti-inflammatory drugs (curcuminand galangin). The method was tailored to analyze both drugs in their commercial dosage form (capsules) with no interference fromingredients. Chromatographic separation was performed over precoated TLC plates (60 F254, 20 cm× 10 cm, 250µm thickness,Merck, Darmstadt, Germany) via a linear ascending technique using n-hexane, ethyl acetate, acetic acid, and methanol as the mobilephase. Detection and quantification was achieved at 404 nm through spectrodensitometricanalysis[5].

The selection of mobile phase is based on adsorbent material used as stationary phase and physical and chemical properties of analyte. The mobile-phase systems are used based on their diverse selectivity properties are diethyl ether, methylene chloride, and chloroform combined individually or together with hexane as the strength adjusting solvent for normal-phase TLC and methanol, acetonitrile, and tetrahydrofuran mixed with water for strength adjustment in reversed-phase TLC. Separations byion pairing on C-18 layers are done with a mobile phase such as methanol–0.1 M acetate buffer (pH 3.5) containing 25 mM sodium pentanesulfonate (15.5:4.5).

A new high-performance thin-layer chromatographic (HPTLC) method has been established for determination of minocycline in human plasma. Chromatography was performed on aluminium plates coated with silica gel 60F254; the mobile phase was methanol: acetonitrile:isopropanol: water 5:4:0.5:0.5 (v/v)[6].

RESULT AND DISCUSSION-

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Emtricitabine is 4-amino-5-fluoro-1-[(2R,5S)-2-(hydroxymethyl)-1,3-oxathiolan-5-yl]-2-(1*H*)-pyrimidon (Figure I)[7-8]. Emtricitabine is a nucleoside reverse transcriptase inhibitor (NRTI) for the treatment of HIV infection in adults. Emtricitabine is structurally related with Lamivudine. The drug works by inhibiting reverse transcriptase, the enzyme that copies HIV RNA into new viral DNA. Tenofovir is [{(1R)-2-(6-amino-9H-purin-9-yl) -1-methylethoxy}methyl] phosphonic acid (Figure II)[9]. Tenofovirbelongs to a class of antiretroviral drugs known as nucleotide analogue reverse transcriptase inhibitors (nRTIs), which block reversetranscriptase, an enzyme crucial to viral production in HIV-infected people. Literature review revealed that UV[10-14],HPLC[15-23]and HPTLC[19-22]methods have been reported for analysis of Emtricitabine and Tenofovir as a single form and in combination with other drugs. To date there have been no published reports on simultaneous quantitation of Emtricitabine and Tenofovir by HPTLC in bulk drug and in tablet dosage form. This present study reports for the first time the simultaneous quantitation of Emtricitabine and Tenofovir by HPTLC in bulk drug and in tablet dosage form. The proposed method is validated as per ICH Guidelines[23].

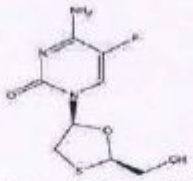

Figure I: Structure of Emtricitabine

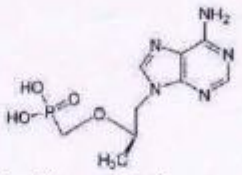

Figure II: Structure of Tenofovir

EXPERIMENTAL SECTION-

METHOD DEVELOPMENT:

The HPTLC procedure was optimized for simultaneous determination of Emtricitabine and Tenofovir. The mobile phase Methanol: Toluene: Ethyl acetate: Ammonia (1.5:5.5:1.5:0.1 v/v/v/v) resulted in good resolution, and sharp and symmetrical peaks were obtained at Rf 0.29 ± 0.02, 0.41 ± 0.02 for Emtricitabine and Tenofovir respectively. It was observed that prewashing of HPTLC plates with methanol (followed by drying and activation) and pre saturation of HPTLC chamber with mobile phase for 20 min (optimum chamber saturation time) ensured good reproducibility and peak shape of these drugs.

VALIDATION OF THE METHOD:-

LINEARITY-

Linear regression data for the calibration plots revealed good linear relationships between response and concentration over the ranges 320-1120 ng per spot Emtricitabine and 480-1680 ng per spot Tenofovir. Each concentration was applied in triplicate on the HPTLC plate (Table I).

Parameter	Emtricitabine	Tenofovir
Linearity range	320-1120 ng/spot	480-1680 ng/spot
correlation coefficient (r^2)	0.998	0.999
Slope	8.02	2.52
Intercept	178.8	50.14

Table I: Linear regression data for drugs

LOD AND LOQ: -

The LOD & LOQ were determined from slope of the lowest part of the calibration plot.LOD and LOQ of respected drug shown in table (II).

Parameter	Emtricitabine	Tenofovir
LOD	30.24	51.90
LOQ	91.64	157.29

Table II: LOD &LOQ for drugs

PRECISION:

The precision of the method was expressed as relative standard deviation (RSD, %). The results listed in Table (III)reveal the high precision of the method.

Drug	Conc.(ng/band)	Intra day			Inter day		
		*%mean	*SD	*%RSD	*%mean	*SD	*%RSD
Emtricitabine	800	99.90	0.73	0.73	99.96	0.90	0.90
Tenofovir	1200	99.98	0.72	0.72	99.73	0.82	0.82

Table III: Statistical evaluation of precision of developed method (n=3)

*Mean of three determinations, SD: Standard Deviation, R.S.D: Relative Standard Deviation

RECOVERY STUDIES:

When the method was used for extraction and subsequent analysis of these drugs from the pharmaceutical dosage forms and the extract was over applied with 100 and 120% of additional drug. As shown in the Table (IV) good recoveries of the Emtricitabine and Tenofovir in the range from 98.00 to 102.00 % were obtained at various added concentrations. The average recoveries of three levels (nine determinations) were 99.16±0.40 and 99.71±0.20 % for Emtricitabine and Tenofovir respectively.

Drug	Level of % recovery	%mean	*S.D.	*%R.S.D.
Emtricitabine	80%	99.59	0.13	0.13
	100%	99.23	0.32	0.32
	120%	98.68	0.65	0.65
Tenofovir	80%	98.59	0.60	0.60
	100%	99.93	0.24	0.24
	120%	100.63	1.64	1.64

Table IV: Recovery study Data

*Mean of three determinations, SD: Standard Deviation, R.S.D: Relative Standard Deviation

ROBUSTNESS:

The standard deviations of peak areas were calculated for the aforementioned four parameters (variation in composition of the mobile phase, amount of mobile phase, Time from spotting to chromatography, Time from chromatography to scanning) and coefficients of variation were found to be less than 2% in all cases as shown in Table (V).

Parameters	**% RSD for Emtricitabine***	**% RSD for Tenofovir***
Mobile phase composition (± 0.1 ml)	99.05	98.95
Amount of mobile phase (± 1.0 %)	99.08	98.55
Time from spotting to chromatography (5 min)	98.86	99.14
Time from chromatography to scanning(10 min)	98.94	98.90

Table V: Results of Robustness

*Mean of three determinations, R.S.D: Relative Standard Deviation

FORCED DEGRADATION STUDIES:

HPTLC studies of the samples obtained during the stress testing of Emtricitabine and Tenofovir under different conditions. Different degradations peak as shown in figures 2-10.The mass balance is a process of adding together the assay value and the levels of degradation products to see how closely these add up to 100% of initial value with due consideration of the margin of analytical error. The amount of drug recovered after degradation studies and the Rf of the degradation products are given in table (VI).

a) ACID INDUCED DEGRADATION: The drugs were degraded in the acidic condition and shows different degradation products at Rf 0.15, 0.24 for Emtricitabine and 0.14, 0.29, 0.79 for Tenofovir as shows in the fig. III-IV.

b) BASE INDUCED DEGRADATION: The drugs were degraded in the alkaline condition and shows different degradation products at Rf 0.25 for Emtricitabine and 0.02 for Tenofovir as shows in the fig. V-VI.

c) HYDROGEN PEROXIDE INDUCED DEGRADATION: The drugs were degraded in hydrogen peroxide (3%) at room temperature shows different degradation products at Rf 0.57, 0.37 for Emtricitabine and 0.58 for Tenofovir as shows in the fig.VII-VIII.

Stress condition	Drug	Mass balance (%assay of recovered + %impurities + % degradents)	Rf values of degradation Products
Acid hydrolysis (0.1N HCl)	Emtricitabine	99.99	0.15,0.24
	Tenofovir	99.12	0.14,0.29,0.79
Alkali hydrolysis (0.1N NaOH)	Emtricitabine	100.10	0.25
	Tenofovir	98.96	0.02
Oxidation ($3\%H_2O_2$)	Emtricitabine	99.96	0.57
	Tenofovir	100.02	0.37,0.58

Table VI: Results of Forced Degradation studies

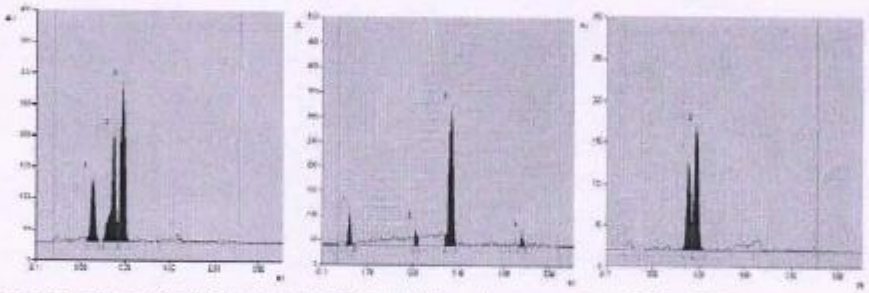

Fig. III: Densitogram of acid hydrolysisFig. IV: Densitogram of acid Fig. V: Densitogram of alkali
Of Emtricitabine hydrolysis of Tenofovirhydrolysis ofEmtricitabine

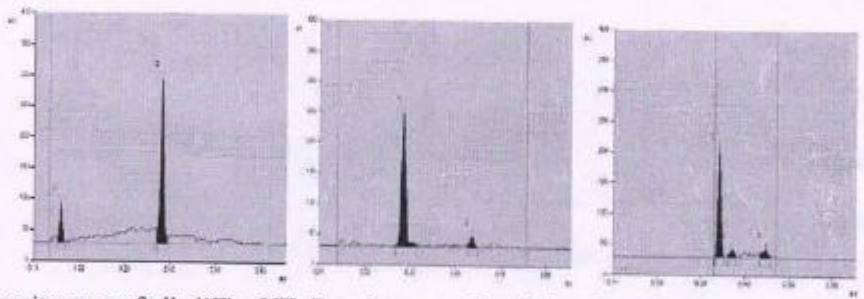

Fig. VI: Densitogram of alkaliFig. VII: Densitogram of oxidative Fig. VIII: Densitogram of oxidative
HydrolysisofTenofovirdegradation of Emtricitabinedegradation of Tenofovir

CONCLUSION:-

The proposed method based on the HPTLC was developed and validated as per ICH guidelines. The standard deviation and % RSD calculated for the proposed method is low, indicating high degree of precision of the method. The results of the recovery studies performed show the high degree of accuracy for the proposed method. Hence, it can be concluded that the developed chromatographic method is accurate, precise and selective and can be employed successfully for the estimation of Emtricitabine and Tenofovir in bulk and formulation.

REFERENCES:

1. CAMAG,(2010-2011). Basic equipment for modern thin layer chromatography. Switzerland: Camag. Available from:camag.com/downloads/free/brochures/CAMAG-basic-equipment-08.pdf .
2. CAMAG, (2010-2011). Instrumental thin layer chromatography. Switzerland: Camag. Available from:camag.com/downloads/free/brochures/CAMAG_TLC10-11_E.pdf

3. Patel, R.B. and Patel, M.R. and Patel, B.G. (2011) Experimental Aspects and Implementation of HPTLC. In: Shrivastava, M.M. HPTLC. New York: Springer, pp. 41- 54.
4. Shrivastava, M.M. (2011) An Overview of HPTLC: A Modern Analytical Technique with Excellent Potential for Automation, Optimization, Hyphenation, and Multidimensional Applications. In: Shrivastava, M.M. HPTLC. New York: Springer, pp. 3- 24.
5. Kharat. S, Namde. A, Mehta. P., (2016), Journal of Taibah University for Science xxx xxx–xxx, 1-7.
6. Jain, G. K., Jain, N., Iqbal, Z., Talegaonkar, S., Ahmad, F. J., and Khar, R. K., (2007), Development and validation of an HPTLC method for determination of Minocycline in Human Plasma.ActaChromatographica.,(19), 197-205
7. www.drugbank.ca/drugs/DB08864
8. www.rxlist.com/edurant-drug.htm
9. Indian pharmacopoeia, (2007), Govt. of India, Ministry of Health and Family Welfare, The Indian Pharmacopoeia Commission, Ghaziabad, (vol- I) 1075-1076.
10. Mithiles. G. S., Jena. S, Dr.Banji. D., Roy S., (2012), Method Development and Validation of Rilpivirine in bulk and Pharmaceutical Tablet Dosage Form by using UV – Visible Spectrophotometric Method. Asian Journal of Research in Chemistry, 5 (12).
11. .Nagaraju P.T, Channabasavaraj. K. P., Shantha Kumar P. T.(2011), Development Validation Spectrophotometric Method for Estimation of Emtricitabine in Tablet Dosage Form. International Journal of ChemTech Research, 3(01):23-28.
12. Madeesh Sk, Ismail Y .and Gunasekaran A. V., Narendra A, Deepikab. D. And Mathrusri A. M., (2013), Determination Of Emtricitabine By Derivative Spectrophotometric Method In Pharmaceutical Dosage Forms, Chemical Science Transactions.
13. Soumya. B., Thimmaraju. M.. (2012), Simultaneous Determination of Tenofovir disoproxil fumarate and Lamivudine by UV Spectrophotometric Method, International Journal of Pharmacy and Pharmaceutical Science Research,]2(01):9-15.
14. Anandakumar. K., Kannan. K. and Vetrichelvan. T. (2010), Development and Validation of First-Derivative Spectrophotometric Method for the Simultaneous Estimation of Lamivudine and Tenofovir Disoproxil fumerate in Pure and in Tablet Formulation, Der Pharmacia Lettre, 2(5): 221-228.
15. Kavitha K Y, Geetha G, Hariprasad R, Venkatnarayana R, (2013), Subramanian G. Development and Validation of RP-HPLC Analytical Method for Simultaneous Estimation of Emtricitabine, Rilpivirine, Tenofovir Disoproxil Fumarate and Its Pharmaceutical Dosage Forms.International Journal of Comprehensive Pharmacy 01 (07).
16. Venkata C. R., Devi. P. R., Mukkanti. K., (2012), Effective Estimation Of Rilpivirine by Hplc Method In Tablet Dosage Forms And Its In vitro Dissolution Assessment, International Journal Of Pharmacy And Pharmaceutical Sciences, 4(3): 595-599.
17. Murali P., Mamade. D. A., Jos H., Ann V. S., (2010), Erwin Adams. Characterization of Emtricitabine related substances by liquid chromatography coupled to an ion trap mass spectrometer, Science Direct Talanta, 125-128.
18. Syed S. H., Premnath S., Udupa, Krishna. M., (2013), Development & Validation Of Stability Indicating Rp-Hplc Method For Tenofovir Nanoparticle Formulation, International Journal Of Pharmacy And Pharmaceutical Sciences, 5(2):245-248.
19. Havele. S. and Dhaneshwar. S. R., (2012), Development and validation of a stability indicating lc method for the determination of tenofovir disoproxil fumarate in pharmaceutical formulation, Songklanakarin Journal of Science and Technology, 34(6):612-622.
20. Sentenac, S., Fernandez, C., Thuillier. A., Lechat. P., Aymard. G., (2003), Sensitive determination of tenofovir in human plasma samples using reversed-phase liquid chromatography, Journal of Chromatography B, (793):317–324.
21. Mirna El B., Marie-Claude G., Jerome G., (2007), Relevance of a combined UV and single mass spectrometry detection for the determination of tenofovir in human plasma by HPLC in therapeutic drug monitoring, Journal of Chromatography B, (854) :192–197.
22. CH Venkat R., Devi. P. R., Mukkanti. K., Srinivasu. P., (2012), Development And Validation Of Stability Indicating HPLC Method For Combination Tablet Dosage Form Of Efavirenz, Lamivudine And Tenofovir In Tablet, International Journal Of Pharmaceutical And Phytopharmacological Research, 2(1): 40-45.
23. Rathore. A. S., Sathiyanarayanan. L, and Mahadik. K. R., (2012), Stability Indicating High-Performance Thin-Layer Chromatographic Method for Quantitative Estimation of Emtricitabine in Bulk Drug and Pharmaceutical Dosage Form, International Scholarly Research NetworkISRN Chromatography.

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NAYANTARA SAHGAL: A GREAT INDIAN NOVELIST

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ABSTRACT

The first generation of important women writers began publishing their works in the 1950s. Ruth Prawer Jhabvala, Kamala Markandaya, Santha Rama Rau, Nayantara Sahgal were all active on the literary scene. During this period, Nayantara Sahgal emerged as one of the most significant voices in the realm of Indian English fiction. Fiction by women writers constitutes a major segment of the contemporary Indian writing in English. Indian women novelists hitherto have been projecting the Indian traditional image of women. Later on, the thrust was on their sense of frustration and alienation. It was because of conflicting forces acting on them in the society exposed to the West. The plight of the working women was still worse, aggravated by her problems of marital adjustment and quest for identity. But the later women novelists like Anita Desai, Shashi Deshpande and Nayantara Sahgal delved deep into the roots of women's problems. They gave fuller treatment to it. They concentrated on the plight and problems of urban educated women. Sahgal's concern for women, however, is that of a humanist more than it is of a feminist. Woman suffers not only by man's act of physical violence, but she is often emotionally hurt and crippled through his arrogance, cynicism and indifference. Loneliness, suffering and frustration in marriage sometimes cause disintegration and make women rebellious. It is not physical loneliness that Sahgal talks of, but deeper emotional and spiritual voids created by egoism.

The first generation of important women writers began publishing their works in the 1950s. Ruth Prawer Jhabvala, Kamala Markandaya, Santha Rama Rau, Nayantara Sahgal were all active on the literary scene. During this period, Nayantara Sahgal emerged as one of the most significant voices in the realm of Indian English fiction. Fiction by women writers constitutes a major segment of the contemporary Indian writing in English. Indian women novelists hitherto have been projecting the Indian traditional image of women. Later on, the thrust was on their sense of frustration and alienation. It was because of conflicting forces acting on them in the society exposed to the West. The plight of the working women was still worse, aggravated by her problems of marital adjustment and quest for identity. But the later women novelists like Anita Desai, Shashi Deshpande and Nayantara Sahgal delved deep into the roots of women's problems. They gave fuller treatment to it. They concentrated on the plight and problems of urban educated women.

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Nayantara Sahgal occupies a prominent place in the history of Indian-English novel as a novelist with more than three decades of literary career. Sahgal as a committed writer takes special care to keep track of the stream of national consciousness. With insight and understanding, women writers in English present the dilemma which modern women are facing in recent times. Women who are conscious of their emotional needs and strive for self-fulfillment rejecting the existing traditions and social set-up and long for a more liberal and unconventional way of life finds their place in the novels of Nayantara Sahgal. Her novels portray women trampled and oppressed because of their dependence upon men and the harrowing experience they have to face in their struggle to come out of the bondage and stand on their own feet. The hardship and suffering involved in fighting against an established order, the shattering experience of divorce and the resultant alienation between parents and children from the thematic concern of Sahgal's novels.

Nayantara Sahgal, (born May 10, 1927, Allahabad (now Prayagraj), India) is an Indian journalist and novelist whose fiction presents the personal crises of India's elite amid settings of political upheaval. Sahgal was educated in the United States at Wellesley College (B.A. 1947). Well-acquainted with Indian aristocracy – her uncle was Jawaharlal Nehru, her cousin Indira Gandhi, and her mother an ambassador to the United States—Sahgal first wrote *Prison and Chocolate Cake* (1954), an autobiographical memoir about her youth amid the Nehru family. She then turned to fiction, often setting her stories of personal conflict amid Indian political crises. In her fourth novel, *The Day in Shadow* (1971), for example, the heroine is an educated divorcée struggling in India's male-dominated society.

Sahgal's corpus of work so far consists of nine novels: *A Time to be Happy* (1958), *This Time of Morning* (1965), *Storm in Chandigarh* (1969), *The Day in Shadow* (1971), *A Situation in New Delhi* (1977), *Rich Like Us* (1983), *Plans for Departure* (1986), *Mistaken Identity* (1988), *Lesser Breeds* (2003), and three autobiographies *Prison and Chocolate Cake* (1954), *From Fear Set Free* (1963), *Relationship*, four books of politics, including public addresses and essays, *Indira Gandhi: Her Road to Power, A Voice for Freedom* (1977), *Point of View* (1997) *Indira Gandhi's Emergency and Style* (1978) and one book of history, *The Freedom Movement in India* (1970).

She is one of the first Indian writers in English to make a mark on an international readership. Her talent has been seen in full bloom in *Rich Like Us* for which she has received in prestigious British honour the Sinclair Prize for Fiction in 1985 and the Sahitya Akademi Award in 1986. For her *Plaits for Departure*, she has been awarded the Commonwealth Writer's Prize for Eurasia region in 1986. She has been Vice President of the People's Union for Civil Liberties. She was nominated a member of the executive committee of the Authors' Guild of India as well as the Sahitya Akademi's Advisory Board for English till she resigned during the Emergency as a measure of protest against the disinclination of the Board to pass a resolution condemning press censorship and imprisonment without trial.

Nayantara Sahgal became a Fellow of the Woodrow Wilson International center for Scholars the National Humanities Center and the Bunting Institute, U.S.A. She has served on the jury of the Commonwealth Writer's Prize in 1990 and 1991. In 1990, she was elected Fellow of the American Academy of Arts and Sciences. In 1997, she was awarded an Honorary

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Doctorate for Literature by the University of Leeds. In all her works, there is a juxtaposition of two worlds: the personal world of man-woman relationship and the impersonal worlds of politics. She has established herself both as a creative writer and a political columnist.

The contrast between the idealism at the beginning of India's independence and the moral decline of post-Nehru India that is particularly evident in *A Situation in New Delhi* (1977) recurs in such Sahgal novels as *Rich like Us* (1985). It confronts civil disorder, corruption, and oppression while detailing the internal conflicts in a businessman's family. Three of Sahgal's later novels—*Plans for Departure* (1985), *Mistaken Identity* (1988), and *Lesser Breeds* (2003) – are set in colonial India. *When the Moon Shines by Day* (2017) is a dystopian satire. In *The Fate of Butterflies* (2019), Sahgal focused on several people living under a repressive regime. She also wrote *Day of Reckoning: Stories* (2015). Sahgal's works of nonfiction included *Relationship, Extracts from a Correspondence* (1994) and *Point of View: A Personal Response to Life, Literature, and Politics* (1997) as well as several works on Jawaharlal Nehru and Indira Gandhi. In her novels, she takes to task even ministers, businessmen, industrialists and academicians, engrossed in their activities.

Sahgal's first five novels, *A Time To Be Happy* (1956), *This Time of Morning* (1965), *Storm in Chandigarh* (1969), *The Day in Shadow* (1971) and *A Situation in New Delhi* (1977), are situational, while the latter three, *Rich Like Us* (1985), *Plans for Departure* (1987) and *Mistaken Identity* (1988), are mainly character-oriented. These characters present the emancipated woman, one who musters adequate courage to walk out of her suffocating and inhuman circumstances. She is the liberated woman who is virtuous, morally upright, and self-respecting, though she appears to deviate from age-old tradition.

Nayantara

struggle of freedom of India. She has seen the trouble and turmoil before and after the independence in 1947. In her novels, on the one hand, she highlights the sacrifices of the patriots for their nation. On the other hand, she exposes the power-hungry politicians and their thirst for power.

In novel after novel, she explores the nature and scope of the trauma of women folk. Suffering and loneliness have mellowed Sahgal and she has been able to transform these into understanding and compassion. She believes that the potentialities in women are not exploited to the full. Sahgal's female characters are individuals who can remain independent within the framework of society into which they were born. She is able to go deep into the psyche of her female characters and study them with sympathy and understanding. Sahgal has portrayed women's sufferings without sentimentality.

Sahgal tries to portray the sensibility of woman: how a woman looks out at herself and her problems. She feels that woman should try to understand and realize herself as a human being and not just as an appendage to some male life. In her novels women represent different kinds of virtues. They do not suffer but maintain their position. Sahgal represents new morality, according to which woman is not to be taken as a mere toy, an object of lust and momentary pleasure, but man's equal and honored partner. All the novels of Sahgal talk about women who are oppressed by marriage, by political circumstances, by accidents of history. Most of her female characters have extra-marital relationship with one or more than one person. Her women are victims of a conventional society which does not permit women to assert their

rights pertaining to their individual freedom and considers the very issue of identity-crisis as preposterous apropos women.

After 1947, there came two turning points in her life which she describes in her article, "This time of Fulfilment". The first was her marriage to Gautam Sahgal, an ambitious Youngman working in a British Company. She was so attracted towards him that she overlooked studying his temperament and mental make-up. She unfortunately took a hasty decision and married him in 1949 and had three children.

Nayantara found herself totally misfit in the world of Gautam. For her it was a shift of values and a change from "the atmosphere of a political crusade to one of commerce", simply getting money and spending it. She, irrespective of all agony and tension, tried her best for adjustment. She wrote her second autobiographical piece, *From Fear Set Free* (1962) and dedicated it to Gautam, still trying to make her love marriage successful. But it failed ultimately and she divorced Gautam in 1967. This unfortunate marriage affected Nayantara so deeply that marital disharmony becomes one of the major themes in her novels.

In her first novel, *A Time to be Happy* (1958), Kusum's unhappiness reflects her own and the coming together of Sand and Kusum is perhaps a wishful projection of her own desires. In her second novel, *This Time of Morning* (1965), Rashmi feels Suffocated and not at ease in her marriage to a businessman Dalip, and ultimately they are separated. The third and fourth novels – *Storm in Chandigarh* (1969) and *The Day in Shadow* (1971) are emotional autobiographies taking into account tremendous differences in married life. In *The Day in Shadow*, she purposely chooses Simrit, a sensitive writer and a freelance journalist, who is ill-treated by her domineering and insensitive husband Som who always runs after money, power and pelf, and even goes to the extent of (mis) using her as a convenience for tax purposes even after he has divorced her. The 'brutal divorce' settlement in the novel has got autobiographical touches. Sahgal herself acknowledges: "In this book, I tried to figure out something that has happened to me—the shattering experience of divorce".

The second turning point in her life was her decision to live with a man without marriage. It was, in her own words, "not an affair but a revolution, a self-discovery that life had to be lived more fully in order to be meaningful". In 1979, she married E.N. Mangat Rai, an I.C.S. Officer, after many years of living together. Talking about her second marriage, Mrs. Sahgal writes: "Neither of us were at all interested in getting married. But in 1979, the Janata government appointed me ambassador to Italy and that forced me to marry . . . Fundamentally, there is not much difference between living together and being married. If you are loyal to each other, it does not matter. If there is loyalty and trust, one does not need marriage."

Mrs. Sahgal belongs to one of the aristocratic and elite families of India. She is a born artist. Writing is an inborn propensity, a passion for her. She began her writing career by recording the experiences of her childhood in an autobiography, *Prison and Chocolate Cake*, which she published at the age of twenty seven. Her two autobiographies— *Prison and Chocolate Cake* (1954) and *From Fear Set Free* (1968)—provide a memorable account of childhood impressions on her sensitive mind. Since her childhood she has been devoted to writing

which was enriched with the first-hand knowledge of India's politics, and the intense personal experiences of divorce and re-marriage, strengthening the creative artist in her.

All the novels of Sahgal from *A Time to be Happy* to *Mistaken Identity* show her deep concern with the parlous state of women in the parochial society. Though Sahgal has carved a niche for herself chiefly as a political novelist, her feminist concern is quite obvious and her fighter spirit quite vocal in her fiction. Sahgal's concern for women, however, is that of a humanist more than it is of a feminist. Woman suffers not only by man's act of physical violence, but she is often emotionally hurt and crippled through his arrogance, cynicism and indifference. Loneliness, suffering and frustration in marriage sometimes cause disintegration and make women rebellious. It is not physical loneliness that Sahgal talks of, but deeper emotional and spiritual voids created by egoism.

REFERENCES

1. Aswathi, Kamal N. ed., (1993) *Contemporary Indian English Fiction: An Anthology of Essays*. ABS Publications, Jalandar, India.
2. Singh RA (1984) *The Novels of Nayantara Sahgal*. Prakash Book Depot, Bareilly, Uttar Pradesh, India.
3. Bhat, Sajid Ahamad (2017) *Feminism in Nayantara Sahgal's Novels*. New Man International Journal of Multidisciplinary Studies 4(3): 13- 16.
4. G Sankar, L Kamaraj, A Mohamed Ansath Raja (2018) *Social Realism and Psychological Transformation of Women Protagonist in Nayantara Sahgal's Storm in Chandigarh and a Situation in New Delhi - A Study*. Glob J Arch & Anthropol 3(1): 555601.
5. Rao, Krishn, AV (1976) *Nayantara Sahgal: A Study of Her Fiction and Non-Fiction*. M. Seshachalam, Madras, India.

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Exercise Effects on Mental Health

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Abstract

Mental disorders are common, and they are a significant contributor to disability in the community. There is growing interest in the effectiveness of exercise interventions for improving mental and physical health in individuals with mental disorders. This paper reviews the evidence for the benefits of exercise for mental health problems and also shown that physical fitness apparently protects the memory centers of the brain. Regular physical exercise helps lower our risk for high blood pressure, high cholesterol, diabetes, and host of other problems. In this paper we are discus the effect of physical fitness as a factor influenced by sport and other bodily activities on the mental health of non-patients.

Keywords: Physical Fitness, Mental Health, Sports, Exercise.

Introduction

There is a substantial body of evidence that shows a positive relationship between physical activity and mental health and illness [6, 25, 26, 28, and 29].People who are engaged in sports activities have a better feeling about their body image and physical health [4]. Cross-sectional studies show that regular physical activity is associated with better mental health and emotional well-being [11] and lower rates of mental disorders [12]. Physical fitness exercises help cure panic, reduce depression symptoms, increase emotional responses in depressed people [8-15], decrease anxiety [16,17], cure psychosomatic disorders, obsession and psychosis [18-20], increase life expectancy [13] and improve the quality of life [21]. Because of today's lifestyle and eating habits, relaxed work environment rich as well as poor people also are struggling with various vaious mental and physical disorders / sickness, like high blood pressure, diabetise, canser, hart desises,

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hypertension, etc. For betterment and maintaining standard of life every human being has to mentain his/ her mental health sound. Physical Fitness and its components are related with mental health. Self-image and life satisfaction are truely responsible for good mental health. It helps to improve positive approch towards self and others. And it is been prooved that physical activity helps an individual in mentaining his/ her mental state.[4]

Research has prooved that Mental health is improved by regular low, medium level physical activity. People exercising for regular succession find improvement in there self actualisation, self image and their physical fitness[24-25].In todays generation, lack of exercise has become very serious health issues associated with mental and Physical health.Through participation in sports and other physical activity self image can be improved [3,5] and personality becomes dynamic. Also self confidence, high social cooperation and coordination can be achieved. By exercising physical activity enxiety can be reduced. and increases emotional response of people suffering from anziety. It helps in making an individual free from physical and mental fitness related disordors [7,8] Also it helps to improve Quality life span.

Therefore, the aim of this research is to study the effect of physical fitness as a factor influenced by sport and other bodily activities on the mental health of non-patients.

Effect of Exercise on Various Componants of Mental Health :

1. Emotions:

A we start with regular exercise of any physical activity then it becoms our habit with regular exercising any kind of physical activity. It helps to achive good living standard and good habits. Regular exercising fill our life with positive attitude and strengthens our emotional attitude.[1]

Physical exercise are related to continuous positive emotional state of an individual's mind . Research work carried out in this field proved that physical activity and mental health are closely associated with each other. 'META' discribes that aerobic exercise provides boost to the mental and physical energy level. Which required to perform day today work.[3] In our daily routine sometime we come accross intensive fatigue, partially or complete failure, anxiety, dipression etc. Throu exercising regular physical activity we can lower the intensity of such eliments. Experimental test promotes possitive effect of medium intensity level exercise in maintaining good mental health. [6]

2. Quality of life :

Physical activity is closely associated with overall physical, mental, spiritual, health and our quality of life depend upon all this aspects. There are total 8 components on which quality of life is chararactarized. Vitality, Social work, mental health, emotional health pain, physical work, health limitations. Research has proved that physical activity is benifitted for the people suffering

from mental disorder [9] High level physical activity helps adoloscents to balance their mental health related state positively [27]

3. Self Image:

As per experts self assessment is the best index of an individual's mental health. It has been proved from 399 non clinical tests, possitive impact of regular exercise can be seen as self image, self concept can be positively improved and level of anxiety (depression) can be redused. Study shows that regular exercise is benificial for self awareness and self image. Also to change negative self image in to possitive. And also it has been proved that in less time clusture of aerobic exercise and resistance training method helps to improve self-image.[5]
It is been studied in supervisory training programme implemented/ executed for obese adolescents, they found their improvement in their self image and also approach of others towards them was positively improved.[22]

4. Sleep:

Research shows that out of adult population 30 percent people are suffering from sleep disorder. And also found that exercising physical fitness activity done in adequate presence of light it helps in sound sleep. Also in personal study it is been observed that through exercise quality and depth of sleep is improved[13]. Therefore people who are suffering from sleeping disorder by exercising any physical activity regularly they can improve their quality of sleep.

5. Stress and Tension :

Study shows that regular physical activity can minimize or control the anxiety level of stress or tension. To avoid / reduce mental or physical stress people generally found smoking or drinking but it won't help. And its bad reaction can be observed [2]. Exercise is the only healthy way of overcoming any sort of stress and anxiety. By exercising regular physical activity we will be able to maintain our health sound and can improve positive response to mental stress and control it.

6. Sadness:

Medical field has proved that mental challenge and stress are the two mild levels of mental disorders and through exercise one can overcome from it. Research shows that exercise is a perfect way of mental stress healing. Therefore physical activity is a n easier way to keep away sadness rather than smoking, Alcohol consumption, taking medical and or any psychiatric treatment. Also study shows that people who are actively doing Physical activity from last two or more years are physically and mentally fit [21].

Importance of Physical Exercise to Maintain the Mental Fitness.

Various research being carried out regarding curing various serious physical or mental disorder, minimum three time per week 30 minutes workout is suggested by the medical Practitioners. 'DOSE' study suggests that 30 Minutes Exercise for 5 or more days in a week, it helps in lowering the desperation / mental stress [23]. Aerobic and anaerobic physical training beneficial for overall health.

Conclusion:

In this paper relation between physical activity and mental health is studied. It is also observed that Physiology and Psychology this two different subjects are closely related with each other. Also for curing mental health physical activity are being suggested. And high level physical fitness enables an individual to improve and or maintain his / her mental health and to pursue a good standard of living. Physical fitness can be enhanced by regular sporting and other physical moderate activities. Once physical fitness, as a factor influenced by sport, is improved, society's mental health can be expected to be attained. Since sport, as a tool in managing tension, can reduce the effects of tenseness, increase positive emotions and since it can enhance people's physical and mental health and, as a result, their happiness in life. As mental disorders increase the risk of chronic physical conditions, and tend to recur across the lifespan, exercise can be useful for both mental and physical health, and may maintain well-being and prevent recurrences of poor mental health

Reference:

[1] Neeser,K.J. Aging Studies. School of Sport Science, Chulalonkorn Univ, 2005, Bangkok,Thailand.
[2] Powers, S.K. Exercise Physiology: Theory & Application to Fitness & Performance.2001, McGraw-Hill Inc.
[3] Harris, D.V. Sports Psychology: Mental Skills for Physical People. 1987.
[4] Straub, O.S., Health Psychology. 2002, New York: Worth Publisher
[5] Esfahani, N., The impact of sport on physical, anxiety, sleep disorder, social function and depression components of mental
health in Azzahra University students. *Harakat*, 2002(12): p. 75-86.
[6] Biddle, S.J.H, K.R. Fox, and S.H. Boutcher, Physical activity and psychological well-being. 2000, London: Routledge.
[7] Vliet, P.V.D., The effect of fitness training on clinically depressed patients: an intra-individual approach. *Psychology of*
sport and exercise, 2004(5): p. 153-16.
[8] Asci, F.H., The effects of physical fitness training on trait anxiety and physical self-concept of female university students.
Psychology of sport and Exercise, 2003(4): p. 255-264.

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Diversity of zooplankton and seasonal variation of density in Sukhana Dam, Garkheda Dist Aurangabad (M.S.) India

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Abstract

The present study was to understand the diversity of zooplankton during July 2008 to June 2009 in the Sukhana dam, Garkheda Dist. Aurangabad India. During the present study total 29 species of Zooplankton belonging to four groups i.e. Cladocera (10 species), Copepoda (05species), Rotifera (12 species) and Ostracoda (02 species). Total number of 15,058 zooplanktons was noticed in Sukhana dam, consisting of 23.83% of Rotifera; 28.52% of Cladocera; 44.48% of Copepoda and 3.17% of Ostracoda during present study period.
It was noticed that Zooplankton population density of Sukhana dam was maximum in summer and minimum in rainy season.

Keywords: Zooplankton, Seasonal variation, Sukhana dam and Garkheda.

Introduction

The world plankton refers to the floating organism that lives on surface water. These organisms can be plant or animals. The plant forms are phytoplanktons and animal forms are zooplankton. Zooplanktons are the heterotrophic type of planktons. These are organisms drifting in the water column of oceans and fresh water bodies. The name of zooplanktons is derived from the Greek zoon, meaning "animal" and planktos, meaning "wanderer" or "drifter". Many zooplanktons are too small to be seen individually with the naked eye. Zooplanktons are small animals that float freely in the water column of Lakes and oceans and whose distribution is primarily determined by water currents and mixing.

Zooplanktons play a role of converting phytoplanktons in to food, suitable for fish and aquatic animals and acquired importance in fishery research. The zooplanktons can also play an important role, indicating the presence or absence of certain species of fishes or in determining the population densities. Freshwater zooplanktons are an important component in aquatic ecosystems, whose main function is to act as a primary and secondary links in the food chain (Hutchinson, 1967).

Zooplankton are one of the most important biotic components influencing all the functional aspects of an aquatic ecosystem, such as food chains, food webs, energy flow and cycling of matter (Murugan *et al.*, 1998; Dadhick and Sexena, 1999; Sinha and Islam,

2002; Park and Shin, 2007). The distribution of zooplankton community depends on a complex of factors such as, change of climatic conditions, physical and chemical parameters and vegetation cover (Rocha *et al.,* 1999; Neves *et al.,* 2003). According to Murugan *et al.* (1998) and Dadhick and Sexena (1999) the zooplankton plays an integral role and serves bio-indicators and it is a well-suited tool for understanding water pollution status (Contreras *et al.,* 2009). A number of studies have been carried out on ecological condition of freshwater bodies in various parts of India (Gulati and Schultz, 1980; Rana, 1991; Sinha and Islam, 2002). The higher abundance of zooplanktonsic fauna recorded during summer, while lower value during rainy season. This fluctuation of zooplanktons is mainly due to environmental changes (Sunkad and Patil, 2004; Sheeba and Ramanujan, 2005).

Keeping this view in mind present study has been undertaken to assess monthly variation, group wise seasonal variation, group wise total percentage, species diversity and species evenness in Sukhana dam.

Materials and Methods

Study area:

Sukhana dam is situated near the village Garkheda in Aurangabad tahsil. It is build over Sukhana river which passed through the Chikalthana the suburb, known for Breweries and Pharmaceuticals' industrial hub. It is 22 K.M. away from the East side of Aurangabad city. The dam was constructed in the year 1968 as medium irrigation dam. Soil has been used as bunding materials, the bund height is 16.92 meters and the catchments area is about 21.34 Sq.km. The Top width of bund is about three meters. The initial purpose of dam was irrigation but latter the water was used for industrial activities as chikalthana industrial area grown up during 1974 to 1990.

Sampling Methods and Analysis:

During the present study zooplankton sample were collected monthly for the period of one year i.e July 2008 to June 2009. At two sampling station (Station A & B) from Sukhana dam Plankton hand net made of nylon bolting cloth (mesh size 25µm) was used for sampling purpose. After collection concentrated plankton sample were fixed and preserved as early as possible in 4% formalin. Plankton sample were examined under compound binocular microscope and identified up to genus and species level with the help of standard literature. (Edmonson, 1963; Battish, 1992; IAAB, 1998).

Results and Discussion

Diversity of Zooplanktons:

Total number of 15,058 zooplanktons was noticed in Sukhana dam, consisting of 23.83% of Rotifera; 28.52% of Cladocera; 44.48% of Copepoda and 3.17% of Ostracoda during the year of 2008-09 (has shown in fig. no. 1). The population density of zooplankton of all recorded four groups was maximum in the summer season and that was minimum in the rainy season. (Table no. 2). The monthly zooplankton population density has given in table no. 1.

There were twenty nine species of zooplankton belonging to four classes viz. Cladocera, Rotifera, Copepodaa and Ostracoda were recorded from the Sukhana dam. The species observed were as *Brachionus caudatus, Brachionus rubens, Brachinous forficula, Asplanchana priodonata, Keratella cochlearis, Trichocera sylindrica, Branchinous calyciflorus, Filinia opoliensis, Filinila longiseta, Trichocera similis, Asplanchana brightwelli* and *Brachionus diversicomis* among the group of **Rotifera** (12 species). *Ceriodaphni cornuta, Alona pulchella, llll.Moina macrocopa, Monia micrura, Chydrous reticulatus, Chydrous sphaericus, Daphnia carinata, Diaphnanosoma sarsi, Macrothrix goeldi* and *Biapertura karua,* among the group of **Cladocera** (10 species). *Heliodiaptomus viduus, Tropocyclops parasinus, Mesocyclops leuckarti, Rhinediaptomus indicus* and *Copepod larvae* among the grpup **Copepoda** (5 species). *Llyocypris gibba* and *Darwinula* sp among the group **Ostracoda** (2 species). Monthly fluctuation of Zooplankton population density of Sukhana Dam (org/L) (has given in table no.1.)

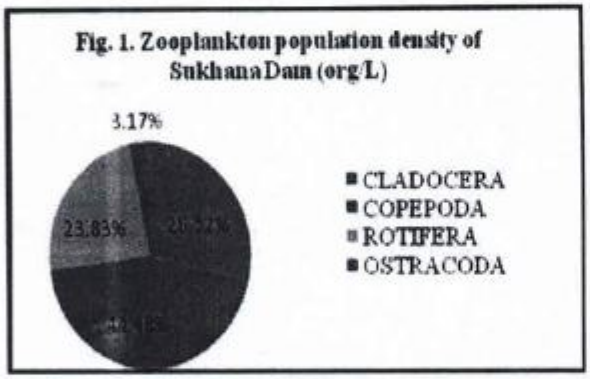
Similarly, Dahiwale, (2008) has described 4 genera of Rotifers, 13 genera of Cladocera, 8 genera of Copepoda and 1 genus of Ostracoda from Hussain Sagar Lake at Hyderabad and Sukhana dam at Marathwada respectively. (Smith *et al.,* 2009) has described 6 genera of Protozoa, 36 genera of Rotifers, 5 genera of Cladocera, 8 genera of Copepoda, 3 genus of Ostracoda, 2 genus of larvae, 2 genus of Brachiopod, 2 genus of Oligochaeta and 2 genus of Nematoda in Panchganga River, Kolhapur. (Rajagopal *et al.,* 2010) has described 24 genera of Rotifers, 8 genera of Cladocera, 9 genera of Copepoda and 4 genus of Ostracoda in Perennial Ponds of Virudhunagar Dist. Tamilnadu.

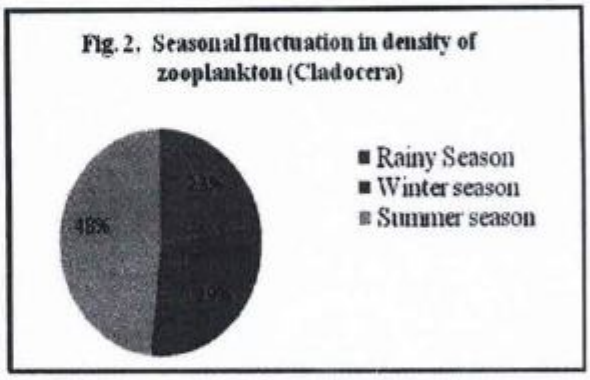
Table No. 1. Zooplankton population density of Sukhana Dam (org/L) during 2008- 09.

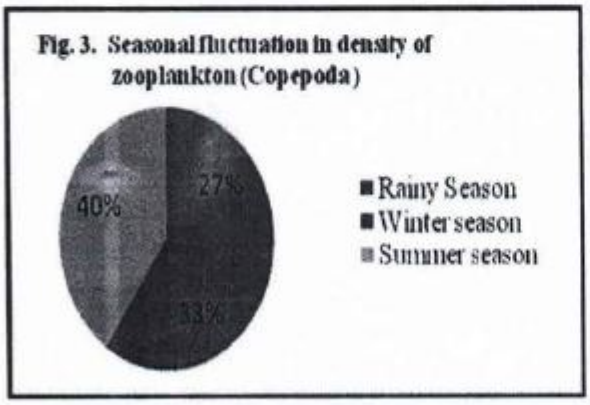
Sr. no.	Species	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
	Cladocera												
1.	*Ceriodaphni cornuta*	40	120	120	90	80	80	110	120	160	110	120	20
2.	*Alona pulchella*	30	40	-	50	60	-	60	30	50	40	50	20
3.	*Moina macrocopa*	40	60	-	50	70	-	80	80	100	70	80	-
4.	*Monia micrura*	-	30	20	-	20	-	20	-	50	-	30	-
5.	*Chydrous reticulatus*	50	-	60	30	50	50	30	60	50	70	70	-
6.	*Chydrous sphaericus*	-	-	60	30	30	10	30	-	70	40	-	-
7.	*Daphnia carinata*		-	20	10	-	-	-	-	30	-	40	-
8.	*Diaphnanosoma sarsi*	-	-	-	-	-	-	-	-	30	50	-	-
9.	*Macrothrix goeldi*	-	-	-	30	-	-	-	40	50	40	50	-
10.	*Biapertura karua*	60	60	70	50	80	-	10	-	60	90	70	10
	Copepoda												
1.	*Heliodiaptomus viduus*	130	110	198	150	160	50	170	150	200	90	140	60
2.	*Tropocyclops parasinus*	-	70	80	110	110	70	120	70	120	90	110	40
3.	*Mesocyclops leuckarti*	80	50	80	100	90	30	70	90	110	80	60	80
4.	*Rhinediaptomus indicus*	-	-	-	30	10	-	50	40	120	30	60	-
5.	*Copepod larvae*	200	250	320	230	220	210	290	280	330	270	380	160
	Rotifera												
1.	*Brachionus caudatus*	20	110	80	110	90	40	140	100	130	170	70	40
2.	*Brachionus rubens*	-	-	70	20	30	-	-	-	70	60	-	-
3.	*Brachinous forficula*	-	-	-	20	-	20	-	50	30	40	50	-
4.	*Asplanchana priodonata*	-	-	-	-	-	-	-	30	-	-	10	-
5.	*Keratella cochlearis*	-	60	20	-	-	20	-	40	50	30	40	-
6.	*Trichocera sylindrica*	-	-	-	-	-	-	30	-	-	-	20	-
7.	*Branchinous calyciflorus*	30	50	30	60	50	40	70	-	60	130	100	50
8.	*Filinia opoliensis*	-	-	-	30	20	-	20	-	10	-	-	-
9.	*Filinila longiseta*	-	-	40	20	60	-	70	-	-	50	90	-
10.	*Trichocera similis*	-	20	-	10	-	-	-	10	20	20	30	-
11.	*Asplanchana brightwelli*	-	-	-	30	-	-	-	-	40	30	40	-
12.	*Brachionus diversicomis*	-	40	20	-	-	-	50	-	40	40	20	10
	Ostracoda												
1.	*Llyocypris gibba*	-	20	20	10	10	-	40	30	20	30	-	-
2.	*Darwinula sp*	10	20	30	20	30	20	30	30	30	40	20	-

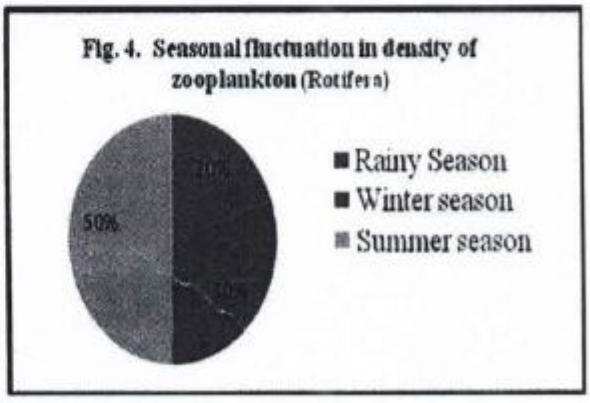
Table No. 2. Average value of seasonal density of observed Zooplankton of Sukhana Dam (org/L) during 2008-09.

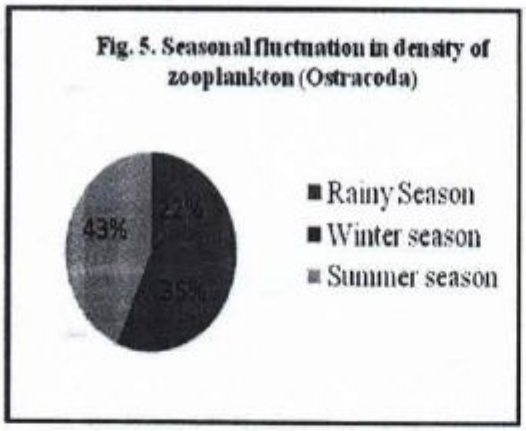
Month /Seasons		Cladocera	Copepoda	Rotifera	Ostracoda
Rainy Season	Jun	50	340	100	0
	Jul	220	410	50	10
	Aug	310	480	280	40
	Sep	350	678	260	50
Total		**930**	**1908**	**690**	**100**
Winter season	Oct	340	620	300	30
	Nov	390	590	250	40
	Dec	140	360	120	20
	Jan	340	700	380	70
Total		**1210**	**2270**	**1050**	**160**
Summer season	Feb	330	630	230	60
	Mar	650	880	450	50
	Apr	510	560	570	70
	May	510	750	470	20
Total		**2000**	**2820**	**1720**	**200**
Grand Total		**4140**	**6998**	**3460**	**460**
Percentage (%) Contribution		**28.52%**	**44.48%**	**23.83%**	**3.17%**

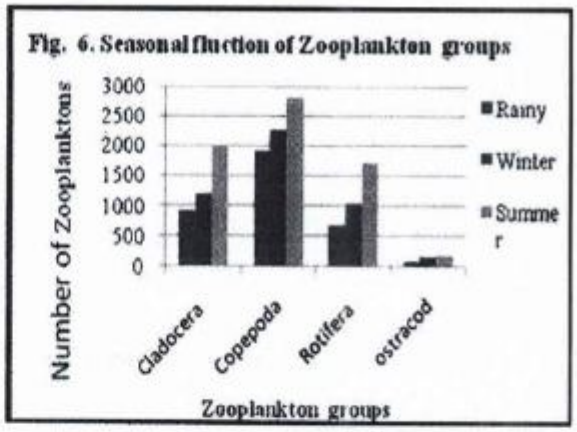












In the present study period i.e July 2008 to June 2009 total 4140 Cladocera were recorded in Sukhana dam, consisting of 48% in summer season, 29% in winter and 23% in Rainy season.. The mean value of density of Cladocera was varied from 50 org./L to 650 org./L. the maximum density of Cladocera was observed in summer season and minimum in rainy season. Seasonal variation in the density of Cladocerans has given in figure No. 2.

Total No. of 6998 Copepods were recorded in Sukhana dam, consisting of 40% in summer season, 33% in winter and 27% in rainy season. The mean value of density of Copepods was varied from 340 org./L to 880 org./L. the maximum density of Copepods was observed in summer season and minimum in rainy season. Seasonal variation in the density of Copepods has given in figure No. 3

Total No. of 3460 Rotifera were recorded in Sukhana dam, consisting of 50% in summer season, 30% in winter and 20% in rainy season. The mean value of density of Rotifera was varied from 50 org./L to 570 org./L. the maximum density of Rotifera was observed in summer season and minimum in rainy season. Seasonal variation in the density of Rotifera has given in figure No. 4

Total No. of 460 Ostracoda were recorded in Sukhana dam, consisting of 43% in summer season, 35% in winter and 22% in rainy season. The mean value of density of Ostracoda was varied from 10 org./L to 70 org./L. The maximum density of Ostracoda was observed in summer season and minimum in rainy season. Seasonal variation in the density of Ostracoda has given in figure No. 5.

It was noticed that Zooplankton population density of Sukhana dam was maximum in summer because the increasing temperature enhances the rate of decomposition due to which the water becomes nutrient rich similarly due to concentration followed by evaporation in summer season the nutrient concentration increases and abundant food present in form of phytoplankton and micro-organism to zooplanktons and minimum in rainy season because low density during the monsoon season is attributed to heavy flood and fresh water inflow.

Similar, results have been reported by (Rajagopal *et al.*, 2010) (Pandit *et al.*, 2007) When the observed Zooplankton population density arranged in an increasing order during the three seasons are:

Summer: Ostracoda < Rotifera < Cladocera < Copepods

Winter: Ostracoda < Rotifera < Cladocera < Copepods

Rainy: Ostracoda < Rotifera < Cladocera < Copepods

Seasonal variation in the density of four principal zooplankton components graphically presented in Fig. No. 6.

Conclusion

- It can be concluded that Rotifera were the dominant zooplankton group in the study period.
- It can be concluded that Zooplankton population density of Sukhana dam was maximum in summer and minimum in monsoon.
- The presence of species will depend on its environmental tolerance. If competition or predation is reduced or the food supply or suitable habitat increased, the species will become more abundant.

References

1. **Battish, S. K. (1992):** Freshwater zooplanktons of India, Oxford and IBH Publishing Co. 1- 233.
2. **Contrearas,J.J., S.S.S. Sharma, M. Merino-Ibarra and S. Nandini (2009):** Seasonal changes in the rotifer (Rotifera) diversity from a tropical high altitude reservoir (Valle de Bravo, Mexico). *J. Environ. Biol.*, 30,191-195.
3. **Dadhick, N. and M.M. Sexena (1999):** Zooplankton as indicators of trophical status of some desert waters near Bikaner. *J. Environ. Pollut.*, 6,251-254.
4. **Dahiwale, B. J. (2008):** Diversity of benthic macro invertebrates with respect to hydro-biological characteristics of Sukhna Dam near Aurangabad, Ph. D. Thesis of Dr. B.A.M. University; Aurangabad, 213-216.
5. **Edmondson, W. T. (1963):** Fresh Water Biology. 2nd Edn., John Wiley and Sons. INC, New York.
6. **Gualti, R.D. and G.W. Schultz (1980):** Remarks on the resent status of limnology in India based on Mainly on Indian publications in hydrobiologia and suggestion for future approach. *Hydrobiologia*, 72,211-222.
7. **Hutchinson, G. E. (1967):** A treatise on Limnology II, Introduction to Lake Biology and the Limnoplankton, 11-15.
8. **IAAB (1998):** Methodology for Water Analysis.
9. **Murugan,N.,P. and Murugavel and M.S. Koderkar (1998):** Freshwater cladocera; *Indian Association. Of Aqua. Biologists (IAAB). Hydrobiologia.* **PP**.1-47.
10. **Neves, I.F. O Rocha K.F. roche and A. A. Pinto (2003):** Zooplankton community structure of Two marginal lakes of the River Cuiaba (Mato Grasso, Brazil) with analysis of Rotifers and Cladocera diversity Braz. *J. Biol.* **63**(3): 329-343.
11. **Pandit, S. V., Vaidya, V. V. and Joshi, P. P. (2007):** Studies on zooplanktons diversity of Pravara River, near Sangamner, Dist. Ahmednagar, (MS), J. of Aqua. Biol. Vol. 22 (1): 33-37.
12. **Park, K.S. and H.W. Shin. (2007):** Studies on phyto and-zooplankton composition and its relation to fish productivity in a west coast fish pond ecosystem. *J. Environ. Biol.*, 28, 415-422.
13. **Rajagopal, T., Thangamani, A., Sevarkodiyone, S.P., Sekar, M. and Archunan, G. (2010):** Zooplanktons diversity and physico-chemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu. Journal of Environmental Biology 31: 265-272.
14. **Rana, K.S. (1991):** Impact of solar radiation and the aquatic ecosystem. A case study of Soor Sarowar, Agra.*Nat.Environ.*,**8**,43-49.
15. **Rocha, O., T. Matsumura-Tundisi, E.L.G. Espindola, K.f. Roche and A.C. Rietzler (1999):** Ecological theory applied to reservoir zooplankton, pp.457-476. In: Theoretical reservoir ecology and its application (*Eds.:J.G.Tundisi and M. Straskraba*). *Internet. Inst. Ecol., Sao Carlos.*
16. **Sheeba, S. and Ramanujan, N. (2005):** Qualitative and quantitative study of zooplanktons in Ithikkara River, Kerala; Pollut. Res., 24, 119-122.
17. **Sinha, B. and M.R. Islam (2002):** Seasonal variation in zooplankton population of two lentic bodies and Assam State Zoo cum Botanical garden, Guwahati, Assam. *Eco.Environ.Cons.*, **8**, 273-278.

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18. **Smita Kabir Mulani., Mule, M. B. and Patil, S. U. (2009):** Studies on water quality and zooplanktons community of the Panchganga River in Kolhapur city. Journal of Environmental Biology, 30(3) 455-459.
19. **Sunkad, B. N. and Patil, H. S. (2004):** Water quality assessment of fort Lake of Belgaum (Karnataka): with special reference to zooplanktons. J.Environ. Biol. Vol. 25(1), 99-102.

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as yet being made by government offices and industry around the world. As portrayed right now, Internet of things gives a thought of the conceivable outcomes offered by various existing and future advancements which, together, could change the method of working of our social orders inside and out. It is an advancement of our data and correspondence frameworks that will bring about the web of things however the acknowledgment of IoT by the organization will be firmly connected to regard for security and the assurance of individual information we trust that this review will be valuable for scientists and specialists in the field, helping them to comprehend the immense capability of IoT and what are the fundamental fields of utilization of the web of items that are fit for changing the IoT to a dream of research really.

REFERENCES

[1] Yinong Chen, Hualiang Hu, "Internet of intelligent things and robot as a service", Simulation Modelling Practice and Theory, vol. 34.

[2] H. Yang and S. Ynag "RFID sensor network architectures to integrate RFID, sensor and WSN" Measurement and Control.

[3] Gluhak S. Krco, M. Nati D. Pfisterer, N. Mitton and T. Razafindralambo, "A survey on facilities for experimental internet of things research," Communications Magazine, IEEE, vol. 49.

[4] https://blog.resellerclub.com/what-is-the-role-of-cloud-computing-in-iot/

[5] https://www.digiteum.com/rfid-technology-internet-of-things

[6] D. Singh, G. Tripathi, Antonio J. Jara, «A survey of Internetof-Things: Future Vision, Architecture, Challenges and Services», IEEE World Forum on Internet of Things (WFIoT), 2014.

[7] M. Aazam, I. Khan, A. A. Alsaffar, E.-N. Huh,"Cloud of internet integrating Internet of things and cloud computing and the issues involved", 11th International Conference on Applied Sciences and Technology (IBCAST), 2014.

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FOREIGN DIRECT INVESTMENT AND FOREIGN INSTITUTIONAL.WITH IMPACT ON FARMER IN GLOBAL ARENA

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Abstract

The Indian consumers have undergone a remarkable transformation. Just a decade or two ago, the Indian consumers saved most of their income, purchased the bare necessities and rarely indulged themselves. In India the vast middle class and its most untapped retail Industry are the key attractive force for global retail. Today armed with a higher income, credit cards, exposure to the shopping culture of the west and a desire to improve their standard of living, the Indian consumers are spending like never before. The Government of India was initially very apprehensive of the Introduction of FDI later it encourages by the outcome of economic policy of 1991 in India. Retail Industry of India is divided into two sectors. The Government of India was forced to hold FDI in Multi- Brand Retail by several political parties. People those who oppose to the FDI in Multi-Brand Retail, feel that FDI will pose some threats before the unorganized retail sector and will adversely impact the small retailers, farmers and consumers. Organized retail with its variety of products and multitude of malls and supermarkets or big bazaar is fueling their

addiction. Their new mentality, in turn, is fueling the growth of organized retail in India. This paper firstly speaks about global giant's entry to India and their realities. Status of organized food retailing in India with SWOT analysis and highlights on farmers issues towards FDI in multi brand retailing market to India. The last part reveals the recommendations before allowing FDI in Multi brand Retailing.etc. At present India does not allow FDI in multi-brand retail but permits up to 51% in single brand retail and 100% in cash and carry wholesale trading? .The paper gathers evidence through a panel exercise the actual FDI to India during the year 2010-11. Since 1995, Indian agriculture has grown at roughly 2.5 per cent a year, whereas the overall economic growth rate in this period has been close to 7 per cent per annum..

Key Words: FDI, Brand Retailing, Impact on Farmer in Global Arena

Introduction:-

India is the second fastest growing economy in the world. It is third largest economy in the world in terms of GDP and forth largest economy in terms of purchasing power parity. India is the "Promised Land" for global brand and Indian retailer A "Vibrant Economy" India tops in the list of emerging market for global retailers and Indian retail sector is expending and modernizing rapidly in line with India's economic growth hundreds of thousands of weekly hats and bazaars are located across the length and breadth of our country. Foreign Direct Investment (FDI) is investment directly into production in country by a company in the target country or by expanding operations of an existing business in that country. Foreign direct investment is done for many reasons including to take advantage of cheaper wages in the country special investment privileges such as tax exemption offered by the country as an incentive to gain tariff free access to the markets of the country or the region. Foreign direct investment is in contrast to portfolio investment which is a passive investment in the securities of another country such as stocks and bonds. As a part of the national accounts of a country, FDI refers to the net inflows of investment to acquire a lasting management interest in an enterprise operation in an economy other than that of the investor. Currently Indian farmers face the problem of middlemen commission agents charge 10% from farmers for the auctioning of produce and also deduct 10% on the pretext of quality deficiency. Farmers spend around more to take the produce to markets.

Foreign Direct Investment in India:-

Retailing in India is one of the pillars of its economy and accounts 15 to 17 percent of its GDP. The Indian retail market is estimated to be US$ 500 billion and one of the top five retail markets in the world by economic value. India is one of the fastest growing retail markets in the world, with 1.5 billion People. Indian's retailing industry is essentially owner manned small shops in 2010 larger format convenience stores and super markets accounted for about 5 percent of the industry, and these were present only in large urban centers, India's retail and logistics industry employs about 40 million Indians. (3.3% of Indian population) Till 2011, Indian central government denied foreign direct investment in multi-brand retail, forbidding foreign groups from any ownership in supermarkets, convenience stores of any retail outlets. Even single-brand retail was limited to 51 percent ownership and a bureaucratic process. Single brand implies that foreign companies would be allowed to sell goods sold internationally under a 'single brand', viz., Reebok, Nokia and Adidas FDI in Multi Brand retail implies that a retail store with a foreign investment can sell multiple brands under one roof. Opening up FDI in multi-brand retail will mean that global retailers including Wal-Mart, Carrefour and Tesco can open stores offering a range of household items and grocery directly to consumers in the same way as the ubiquitous

kirana store. In January 2012, Indian approved reforms for single-brand stores welcoming anyone in the world to innovate Indian retail market with 100 percent ownership, but imposed the requirement that the single brand retailer source 30 percent of its goods from India, Indian Government continues the hold on retail reforms for multi-brand stores.IKEA announced it has applied for permission to invest $ 1.9 billion in India and set up 30 retail stores. And believes that the 30 percent requirement is likely to significantly delay if not prevent most single brand majors from Europe, USA and Japan from opening stores and creating associated jobs in India. Indian retail reforms of till 2011, Indian central government denied foreign direct investment in multi-brand Indian retail, forbidding foreign groups from any ownership in super markets, convenience stores or any retail outlets to sell multiple products from different brands directly to Indian consumers.FDI no threat to small retailers, says Montek Singh Ahuluwallia Modern retail is an expanding segment and will more than double in a short time.Allaying fears that opening up of the retail sector for Foreign Direct Investment will hurt kirana shops, that modern retail was an expanding segment and it would more than double in very short time."I don't think FDI in retail is a threat to small retailers modern retail is the expanding segment those who say that the small sector would be hurt, I think they are wrong programmed devil's advocate. Addressing the National council on BJP party president NitinGadkari said, It is being said BJP is not spelling out its stand clearly on FDI in retail, We want to say FDI in retail will hurt the livelihood of the small trader.We will not allow FDI in multi-brand retail to come to India.

Objective of the study:

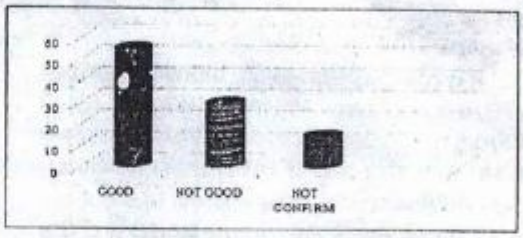
To Study the benefits of FDI in Multi-Brand Retail in India

To know the impact of FDI in Multi brand retailing on Farmer

Research Methodology:

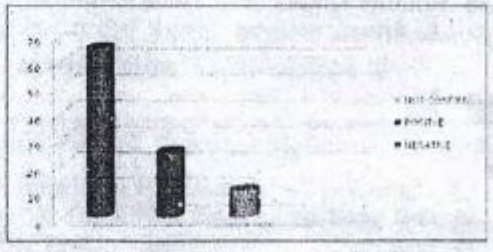
The descriptive methodology has been used to collect the data. To analyze the overall position of the entry of the FDI in Multi-Brand Retail in India, In concern with Research study the data will be collect through the made which is one viz Primary dada and secondary data. Random sampling method will be used for collection of primary data. The sample size will be 100. Further sum Statistical tools will be used for analysis of collected data. The area of present study is Aurangabad, which is one of the historical backward regions town of Maharashtra State.

Data Analysis & Findings:



Graph no.1 showing the FDI in Multi-Brand Retail Sector Impact on Farmers

The above graph one shows that the 55% of the people on Aurangabad District view that the Indian farmers will be benefitted by the FDI in retail. This means that they are of the view that Indian farmers will get good income for their produces, without the middlemen in between the two parties. There will be good storage techniques and transportation techniques. The rest 30% of the people of Aurangabad District were of the view that the Indian farmers will not be benefitted by the FDI in retail because they were of the view that Indian farmers will not get the benefitted. There will be some irregularities. The left over 15% were not having the detail information about the recent issue.



Graph no 2 showing the Multi-Brand Retailing will reduce the purchase from local Farmers

This graph shows that the 65% of the Farmer in this district say that Multi Brand retailing will not reduce the purchase from local

farmer. They are of the view that multi brand retailer will have their own market while local farmer will continue with their available market without much change in it. The rest 25% of the farmer of the view that multi brand retailer will reduce the purchase from local farmer because the multi brand retailers will make a switch over to commission agent. The left over 10% were not having the detail information about the recent issue.

Conclusion:

It is obvious that India, being a member in WTO, it has allowed FDI in Multi-brand retail also. From the above discussion, it can be drawn that though the small retailer are not so apprehensive about the big stores. In India we have 11 shops per 1000 people and 1.2 crore shops, which gives employment to about 5 crore people. Allowing this major FDI will bring new technology to India and it will bring proper refrigeration technology so that wastage of food or grains can be stopped. Why we are not passing 'Food Security Bill' which is still in the parliament. It is concluded that the decision taken by the Government to allow 51% FDI in Multi-brand Retail of India is a boon to its economy. but required the things for achieve FDI in multi brand retail sector India as on Increased sourcing of farm produces by local farmers, product sources from same state, any Tax, service charge on farm production is not dedication.

References:-

1. Ahluwalia M.S. "FDI in multi-brand retail is good, benefits famers" The Times of Indian, http:// timesofindia.indiatimes.com

2. World Bank (2010), 'Investing Across Borders - A Survey of 87 Economies'.

3. World Bank (2010), 'Doing Business' Various Issues

4. FDI in key sectors are detrimental of economy –The Hindu news paper

5. Farming community in support of FDI in retail- Times of India

6. http://www.wspacking.com

7. Google search engine

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गांधी विचारातील नैतिकता : आजचे वास्तव

प्राचार्य डॉ. किरण सावे

सोनोपंत दांडेकर कला, व्ही. एस. आपटे वाणिज्य आणि एम. एच. मेहता विज्ञान महाविद्यालय पालघर

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प्रस्तावना :

आज घडीला भारताच्या स्वातंत्र्याला बराच काळ लोटला आहे. आधुनिक भारत सर्वच क्षेत्रात पुढे पुढे जात आहे. मानवी उत्क्रांती व विज्ञानवाद, धर्मवाद, समाजवाद, सत्य, अहिंसा, समता, बंधुता, न्याय, व सार्वजनिक जीवनातील नैतिकता यासंबंधी जेंव्हा जेंव्हा चर्चा होते, तेंव्हा गांधीजींची शिकवण व त्यांच्या तत्वज्ञानाची ही सर्वांगांनी समिक्षा होते त्याची उपयोगिता व प्रासंगिकता तपासली जाते.

भारत हे धर्मनिष्ठ राज्य नसले तरी भारताने धर्म नाकारला नाही. लोकशाही परंपरेत एका विशिष्ठ अर्थाने धर्मवादाला काहीच स्थान नाही म्हणून धर्माला भारतीयांच्या जीवनात काहीच स्थान नाही असे नव्हे किंबहुना धर्म, देव व देश यांसी भारतीय समाज जीवन पुर्णपणे मिश्रित झाले आहे. गांधीजी धर्मनिष्ठ होतेच पण धर्मवादी नव्हते. त्यांची देशभक्ती व धर्मनिष्ठा एकच होत्या.

गांधीजी धर्माच्या संकल्पनेत मानवता हा सर्वात महत्वाचा आधार होता व जिथे मानवता (Humanity) असत नाही तिथे धर्म व त्या धर्माची शिकवण अर्थहीन आहेत. एखाद्या धर्माचो तत्वे व ग्रंथ प्रमाण्य फक्त त्या ग्रंथामध्येच त्या पुरतेच मर्यादीत असेल तर त्या ग्रंथ व नैतिकतेचे अधिष्ठान प्राप्तच होणार नाही. धार्मिक तत्वे ही मानवतेच्या आचरण पातळीवर स्विकारली जाऊन तपासली गेली पाहीजेत असे करतांना धर्म, राष्ट्र व जाति यामध्ये नितिमत्तेच्या स्ववर्तनाद्वारे जगाला अत्यंत

Solution of Second order linear differential equation using Mathematical software

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Abstract — In this paper, mathematical programming approach is used to solve second order linear differential equation, solution of second order DE are obtained by general solution as well Laplace Transform in the form of programming using MATLAB software.

Keywords— Second order differential Equation, Mathematical Programming (MATLAB).

Introduction

As we know differential equation has vital role in mathematical modelling. Differential equation is used in various fields like Economics, Electrical, Civil, computer, Mechanical engineering and sciences. We know theoretically it is solved by general solution method (complementary solution + Particular integral = Total solution) as well mathematical tool i.e. Integral Transform (Laplace Transform), following are the real life examples of linear (or nonlinear) differential equations.

1. Linear Models with Initial Value Problems – spring/ mass system with free undamped motion, free damped motion and driven motion, LRC – series electrical circuit etc.
2. Linear Models with Boundary Value Problems – deflection of a beam, rotating string, temperature in sphere etc.
3. Non-linear Models- nonlinear springs, nonlinear pendulum, rocket motion, ballistic pendulum etc.

Atsa'am, D. D. et. Al. [1] has developed object oriented software to solve second order linear ordinary differential equations with constant coefficients. **Ra'ft Abdelrahim and Zurni Omar [2]** has proposed a new hybrid block method of order five for solving second-order ordinary differential equations directly, this method is developed using interpolation and collocation techniques.

Araceli Queiruga Dios et. al. [3] have proposed the students a term project that summarizes some of the knowledge and competences acquired during the lessons, also described study of the software and specific applications. **E.S. Cheb-Terrab et. al. [4]** has presented an update of the ODE tools Maple package, for the analytical solving of 1st and 2nd order ODEs using Lie group symmetry methods.

In this paper solution of second order linear differential equation model has been studied and solve using programming approach in MATLAB/ maple software.

Mathematical form of Second order linear Differential equation

general form of a second order linear differential equation as

$$ay'' + by' + cy = f(t)$$

where $a \neq 0, b \text{ and } c$ are constants, with initial value condition $y(0) = y_0, y'(0) = y_1$.

To solve this IVP, general solution is obtained (i.e. complementary function as well particular integral) as well with the help of Laplace transform solution can be found.

Application

To solve second order Differential Equations, we can use general solution method i.e. by finding C.F and P.I. as well Laplace Transforms, to solve following second order D.E. problem MATLAB software R2013a is used.

Ex. Solve differential equation $\frac{d^2x}{dt^2} + 7\frac{dx}{dt} + 10x = 20$, with $x(0) = 5, \frac{dx}{dt}(0) = 3$

To solve this problem in MATLAB following terms are used.

- syms – this command is used for to create symbolic variables and functions.
- subs – this command is used for symbolic substitution.
- laplace – this is inbuilt function used to solve Laplace transform
- ilaplace – this is inbuilt function used to solve inverse Laplace transform
- dsolve – this command is used for to solve ordinary differential equation

MATLAB Programming with the help of Laplace Transform

```
>> syms x t s X F
>>
F=laplace('diff(x(t),t,t)+7*diff(x(t),t)+10*x(t)=20',s)

F =

7*s*laplace(x(t), t, s) - D(x)(0) - 7*x(0) - s*x(0) + s^2*laplace(x(t), t, s) + 10*laplace(x(t), t, s) == 20/s

>> F=subs(F,{'laplace(x(t),t,s)'},{X})

F =

10*X - 7*x(0) - D(x)(0) + 7*X*s - s*x(0) + X*s^2 == 20/s
>> F=subs(F,{'x(0)','D(x)(0)'},{5,3})

F =

10*X - 5*s + 7*X*s + X*s^2 - 38 == 20/s

>> X=solve(F,'X')

X =

(5*s + 20/s + 38)/(s^2 + 7*s + 10)
```

```
>> x=ilaplace(X)

x =

6*exp(-2*t) - 3*exp(-5*t) + 2
```

MATLAB Program with dsolve command

```
>>
x=dsolve('D2x+7*Dx+10*x=20','x(0)=5','Dx
(0)=3')

x =

6*exp(-2*t) - 3*exp(-5*t) + 2

>>
```

Conclusion

To solve second order differential equation MATLAB programming approach is used by using Laplace Transform method as well general method, with the help programming various critical problem can be solved.

References

[1] Atsa'am, D. D. and Odeh, A. Pius, Design and Implementation of Object-Oriented Computer Software to Solve Second Order Ordinary Differential Equations with Constant Coefficients, International journal of scientific research in information systems and engineering (IJSRISE), Vol. 1, No.1, 2015, pp. 17 – 28.

[2] Ra'ft Abdelrahim and Zurni Omar, Direct Solution of Second-Order Ordinary Differential Equation Using a Single-Step Hybrid Block Method of Order Five, Math. Comput. Appl. 2016, 21, 12, pp. 1-7.

[3] Araceli Queiruga Dios et. al., How Engineers deal with Mathematics solving Differential Equation, Procedia Computer Science Volume 51, 2015, pp. 1977–1985.

[4] E.S. Cheb-Terrab et. al. , Computer Algebra Solving of Second Order ODEs Using Symmetry Methods, Symbolic Computation Group, Departamento de Física Teórica, IF-UERJ., http://dft.if.uerj.br/preprint/e7-1.tex, pp. 1 – 22.

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Application of Laplace Decomposition Method to Solve Boundary Value Problems

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Abstract

In this paper, Laplace Decomposition Method (LDM) is applied to nonlinear partial differential equations with boundary conditions. Numerical results obtained by using LDM compared with the results obtained by using Adomian decomposition Method (ADM) and Variational iteration method (VIM).

Key words: Laplace decomposition method, Boundary value problems.

Introduction

Liu [3] and He [4] have worked on Boundary value problems, they have concluded that ADM could not always satisfy all its boundary conditions, leading to an error at its boundary conditions. ADM does not yield correct approximation. But A. M. Wazwaz [2] (2000) shows that this conclusion is not correct. A. M. Wazwaz solve the BVP which solved by Liu [3] and He [4] with the help of Taylor expansion and concluded that the by proper investment of ADM, the exact solution can be easily obtained for BVP of closed form solution. However, if exact solution does not exist, then a rapid convergent series solution is always attainable by this method as proved by [1]. But again Bongsoo Jang [5] (2008) by solving two Boundary value problems concluded that ADM is not appropriate method to find the exact or accurate approximate solution for the complex Dirchlet boundary value problem. Liu [3], He [4] and Bongsoo Jang [5] in their papers promoted VIM and said that VIM is easy to implement without producing complex term, Adomian polynomials.

In this paper we have employed Laplace decomposition method to solve the BVP's. Illustrative examples show that the proposed method gave the exact solution which is same as solution obtained by VIM in [3, 4, 5]. In the next section we have present the framework in a general way so that it may be used in BVP of same type.

LDM for BVP's

In this paper we shall consider the most general BVP

$$\nabla^2 u + Nu + Ru = h(x,y) \quad (1)$$

Subject to the boundary conditions

$$u(0,y) = \alpha_1(y), \quad u_x(0,y) = \alpha_2(y), \quad u(1,y) = \alpha_3(y) \quad (2)$$

$$u(x,0) = \beta_1(y), \quad u_y(x,0) = \beta_2(y), \quad u(x,1) = \beta_3(x) \quad (3)$$

Where

$\alpha_1(y), \alpha_2(y), \alpha_3(y), \beta_1(x), \beta_2(x), \beta_3(x)$ and $h(x,y)$ are assumed real and as many times differentiable as required for $x, y \in [0,1]$. Also $\nabla^2 = \frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2}$, Nu is a nonlinear term and Ru is a remaining linear term. Let us write the equation (1) in the

following form,

$$\frac{\partial^2 u(x,y)}{\partial x^2} = h(x,y) - Nu(x,y) - Ru(x,y) - \frac{\partial^2 u(x,y)}{\partial y^2} \quad (4)$$

Here we are going to find the solution of given BVP in x- direction by taking Laplace transform of equations (4) with respect to x, we get

$$s^2u(s,y) - su(0,y) - u_x(0,y) = L_x[h(x,y) - Nu(x,y) - Ru(x,y) - u_{yy}(x,y)]$$

$$u(s,y) = \frac{1}{s}\alpha_1(y) + \frac{1}{s^2}\alpha_2(y) + \frac{1}{s^2}L_x[h(x,y) - Nu(x,y) - Ru(x,y) - u_{yy}(x,y)]$$

Taking inverse laplace transform of above equation, we get

$$u(x,y) = \alpha_1(y) + x\alpha_2(y) + L_x^{-1}\left[\frac{1}{s}L_x[h(x,y) - Nu(x,y) - Ru(x,y) - u_{yy}(x,y)]\right] \quad (5)$$

We know that LDM decompose the solution u(x, y) by an infinite series of components

$$u(x,y) = \sum_{n=0}^{\infty} u_n(x,y) \quad (6)$$

and decompose the nonlinear term $Nu(x,y)$ by an infinite series of polynomials

$$Nu(x,y) = \sum_{n=0}^{\infty} A_n \quad (7)$$

Where A_n are Adomian polynomials [1] depending on the components $u_0, u_1, u_2, u_3, \ldots\ldots u_n$. Adomian polynomials are defined by

$$A_n(u_0, u_1, u_2, u_3, \ldots\ldots u_n) = \frac{1}{n!}\frac{d^n}{d\lambda^n}\left[N\left(\sum_{n=0}^{\infty}\lambda^i\, u_i\right)\right]_{\lambda=0}$$

Substituting the decomposition series (6) and (7) into the both side of (5) gives

$$\sum_{n=0}^{\infty} u_n(x,y) = \alpha_1(y) + x\alpha_2(y) + \left[L_x^{-1}\frac{1}{s^2}L_x[h(x,y) - \sum_{n=0}^{\infty}A_n - R(\sum_{n=0}^{\infty}u_n(x,y)) - \sum_{n=0}^{\infty}u_{nyy}(x,y)]\right]$$

Comparing the both sides of above equation, we get the following recurrence relation

$$u_0(x,y) = \alpha_1(y) + x\alpha_2(y) + L_x^{-1}\left[\frac{1}{s^2}L_x[h(x,y)]\right] \quad (8)$$

$$u_{n+1}(x,y) = -L_x^{-1}\left[\frac{1}{s^2}L_x[A_n + Ru_n(x,y) + u_{nyy}(x,y)]\right], n \geq 0 \quad (9)$$

Once the components $u_n(x,t)$ are determined by the above recursion, the exact or approximate solution $u(x,t)$ in a series form is immediately obtained.

Numerical illustrations

Example 1.

Consider the BVP

$$\nabla^2 u + \left(\frac{\partial u}{\partial y}\right)^2 = 2y + x^4, 0 < x, y < 1 \quad (1.1)$$

Subject to the boundary conditions

$$u(0,y) = 0, \quad u_x(0,y) = a, \quad u(1,y) = y + a \quad (1.2)$$

$$u(x,0) = ax, \quad u_y(x,0) = x^2, \quad u(x,1) = x(x+a) \quad (1.3)$$

Where a is constant , by comparing the above problem with the most general BVP (1). We get $Nu = \left(\frac{\partial u}{\partial y}\right)^2$, is a nonlinear

term and $h(x,y) = 2y + x^4$, is a source term and the linear term int this problem is zero.

By the LDM for BVP explained in Section 2, we get the following recurrence relation

$$u_0(x,y) = ax + yx^2 + \tfrac{1}{30}x^6 \quad (1.4)$$

$$u_{n+1}(x,y) = -L_x^{-1}\left[\tfrac{1}{s^2}L_x[A_n + u_{nyy}(x,y)]\right], n \geq 0 \quad (1.5)$$

The first few Adomain polynomials A_n that represent the nonlinear term $\left(\frac{\partial u}{\partial x}\right)$ are defined by

$$A_0 = u_{0y}^2,$$
$$A_1 = 2u_{0y}u_{1y},$$
$$A_2 = 2u_{0y}u_{2y} + u_{1y}^2$$

From the recurrence (1.4) and (1.5) we get,

$$u_0(x,y) = ax + yx^2 + \frac{1}{30}x^6$$

$$u_1(x,y) = -L_x^{-1}\left[\frac{1}{s^2}L_x[A_0 + u_{0yy}(x,y)]\right],$$
$$= -L_x^{-1}\left[\frac{1}{s^2}L_x[u_{0y}^2 + u_{0yy}(x,y)]\right]$$
$$= -\frac{1}{30}x^6$$

$$u_2(x,y) = -L_x^{-1}\left[\frac{1}{s^2}L_x[A_1 + u_{1yy}(x,y)]\right],$$
$$= -L_x^{-1}\left[\frac{1}{s^2}L_x[2u_{0y}u_{1y} + u_{1yy}(x,y)]\right]$$
$$= -L_x^{-1}\left[\frac{1}{s^2}L_x[(x^2)(0) + 0]\right] = 0$$

Similarly, $u_3 = 0, u_4 = 0 \ldots$ and so on. Substitute the values of $u_0, u_1, u_2, u_3, \ldots\ldots u_n$ in (6), we get the exact solution of nonlinear BVP (1.1), which satisfies all boundary conditions (1.2) and (1.3).

$$u(x,y) = ax + yx^2 + \frac{1}{30}x^6 - \frac{1}{30}x^6$$
$$= axyx^2 = x(yx + a) \quad (1.6)$$

Example 2.

Consider the BVP

$$\nabla^2 u - u = 2e^{-y}, in\ (0,1)^2 \quad (2.1)$$

Subject to the boundary conditions

$$u(0,y) = 0, \quad u_x(0,y) = a, \quad u(1,y) = e^{-y} \quad (2.2)$$

$$u(x,0) = x^2, \quad u_y(x,0) = -x^2, \quad u(x,1) = \frac{x^2}{e} \quad (2.3)$$

In the given BVP Nonlinear term Nu is zero general linear $Ru = -u$, and source term $h(x,y) = 2e^{-y}$.

From the LDM for BVP's explained in Section 2, we get the following recurrence relation with help of equations (8) and (9).

$$u_0(x,y) = L_x^{-1}\left[\tfrac{1}{s^2}L_x[2e^{-y}]\right] = \tfrac{x^2}{2}(2e^{-y}) = e^{-y}x^2 \quad (2.4)$$

$$u_{n+1}(x,y) = -L_x^{-1}\left[\tfrac{1}{s^2}L_x[u_n - u_{nyy}]\right], n \geq 0 \quad (2.5)$$

Calculating each component of the decomposition series (6) yield

$$u_0(x,y) = e^{-y}x^2$$

$$u_1(x,y) = -L_x^{-1}\left[\frac{1}{s^2}L_x[u_0 - u_{0yy}]\right],$$

$$= - L_x^{-1}\left[\frac{1}{s^2} L_x[e^{-y}x^2 - e^{-y}x^2]\right]$$

$$= 0$$

From the recurrence relation (2.5) , we can easily see that , $u_2 = 0, u_3 = 0 \ldots$ and by putting these values in (6), we get

$$u(x,y) = x^2 e^{-y} \qquad (2.6)$$

Which is the exact solution satisfied all given boundary conditions (2.2), (2,3). It is worth nothing that only in one iteration yield the exact solution.

Conclusion

This article, Laplace decomposition method(LDM) is applied to solve nonlinear partial differential equations with boundary conditions in x direction by taking Laplace transform with respect to x.

The results of two examples are compared with VIM [2, 3, 5]. The results of these two examples tell us that both methods LDM and VIM can be used alternatively for the solution of higher order boundary value problems.

References

[1] G. Adomian,A Review of the Decomposition Method in Applied Mathematics, Journal of Mathematical Analysis and Applications, Vol. 135, No. 2, 501-544, 1988.

[2] A. M .Wazawaz, " A note on using Adomian decomposition method for solving boundary value problems, Foundations of physics Letters, 13(5) 493-498, 2000.

[3] G. L. Liu, " Weighted residual decomposition method in nonlinear applied mathematics," Preceedings, 6 congress of Modern Mathematics and Mechanics (MM M-VI), 643-648, 1995.

[4] J. H. He, "A new approach to nonlinear partial differntial equations, Commum. Nonlinear Sci. Numer. Simulation," 2(4), 230 - 240, 1997.

[5] Bongsoo Jang, "Exact solution to the boundary value problems by VIM", Journal of Korean, Vol. 19, No. 4, 1371 - 1377, 2008.

[6] S. S. Handibag and B. D. Karande, Existence the Solutions of Some Fifth-Order Kdv Equation by Laplace Decomposition Method, American Journal of Computational Mathematics, 2013, 3, 80-85 http://dx.doi.org/10.4236/ajcm.2013.31013 Published Online March 2013.

[7] S. S. Handibag and B. D. Karande, Application of Laplace Decomposition Method to Solve Linear and Nonlinear Heat Equation, International Journal of Applied Physics and Mathematics, Vol. 2, No. 5, September 2012.

[8] A. M. Wazwaz, The Hirotas bilinear method and the tanh-coth method for multiple soliton solutions of the Sawada-Kotera Kadomtsev-Petviashvili equation,App. Math. and Comp., 200 (1): 160-166, 2008.

[9] Borhanifar, A. and M.M. Kabir, New periodic and soliton solutions by application of Exp-function method for nonlinear evolution equations, J. Comp. Applied Math., 229 (1): 158-167, 2009.

[10] Engui Fan and Y.C. Hon, Applications of extended tanh method to special

types of nonlinear equations, Applied Math. and Comp., 141 (2-3): 351-358, 2003.

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संत जनाबाईंच्या अभंगातील विठ्ठलभक्ती: एक अभ्यास

प्रा. डॉ. प्रशांत भंडे

मराठी विभाग प्रमुख,

कै. रसिका महाविद्यालय देवणी, जि. लातूर

संत जनाबाई यांचा जन्म गंगाखेड जि. परभणी येथे झाला. वारकरी संप्रदायातील एक संतकवयित्री. वयाच्या सहाव्या -सातव्या वर्षी ती संत नामदेवाच्या घरात आली. विठ्ठल रुखमाईलाच आपले आई वडील मानून विठ्ठलभक्ताच्या परिवारात वाढली नामदेवाच्या कुटुंबातील एक आम म्हणून जनाबाई पंढरपूरात राहिल्या. जनाबाईने विपुल काव्यरचना केली, परंतू आज त्यांच्या नावावर फक्त ३५० अभंग आढळतात. कृष्णजन्म, प्रल्हादचरित्र, द्रोपदीस्वयंवर, हरिश्चंद्राख्यान ही आख्याने जनाबाईनी रचली. 'संत वाटिकेतील जाईची वेल', 'नामयाची दासी जनी' या उपाधीने जनाबाईस ओळखले जाते.

नामयाची दासी म्हणून ओळखल्या जाणाऱ्या संत जनाबाईच्या अभंगातून विठ्ठलाच्या भेटीची ओढ आणि आपले जीवन विठ्ठलमय झाल्याची प्रचिती येते. श्री विठ्ठलाचा कनाळूपणा, भक्तावरील प्रेम, संकटाप्रसंगी धावून येणारा, कामामध्ये मदत करणारा, सर्व संतांना लेकराप्रमाणे वागवणारा, दीन दुबळयांचा कैवारी, अनाथचा नाथ अशा विविध रुपांचे दर्शन जनाबाईच्या अभंगातून घडते. जनाबाचे विठ्ठलाशी अतुट नाते होते म्हणूनच देव खाते देव पिते असा भाव तिच्या काही अभंगातून व्यक्त होतो. धरिला पंढरीचा चोर अशा अधिकारवाणीने ती विठ्ठलाची भक्ती करते. डोईचा पदर आला खांद्यावरी या अभंगातून जनमाणसाच्या टिंगलटवाळीची पर्वा न करता समर्पण भावनेतून ती विठ्ठलाच्या भेटीसाठी पंढरपूरास जाते. संत जनाबाईंनी पुढील लोकप्रिय अभंगाचे लेखन केले.

१) विठू माझा लेकुरवाळा
२) ये गं ये गं विठाबाई
३) झाडलोट करी जनी केर भरी चक्रपाणी
४) देव खाते देव पिते । देवावरी मी निजते.
५) धरिला पंढरिचा चोर

'डोईचा पदर आला खांद्यावरी' या अभंगातून वारकरी संप्रदयाचे दैवत श्री विठ्ठल यांच्या भेटीसाठी आतूर झालेली जनाबाई जनमाणसाच्या टिंगलटवाळीची भिती न बाळगता खांद्यावरी वीणा, [illegible] टाळ घेऊन आणि मुखाने हरिनामाचा गजर करीत विठ्ठलाचे गुणगान गात पंढरपूर[illegible] दर्शन घेण्यासाठी आली आहे.

डोईचा पदर आला खांद्यावरी ।
भरल्या बाजारी जाईन मी ।।

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हाती घेईन टाळ खांद्यावरी वीणा ।
आतां मज मना कोण करी ।।

जनाबाईचे संपूर्ण जीवन विठ्ठलमय झाले आहे.

"झाडलोट करी जनी । केर भरी चक्रपाणी ।।
साळी सडायास काढी । पुढे होऊन ऊखळ झाडी ।।
सांडुनिया थोरपण । करी दळण कांडण ।।
राणा जाये शेणासाठी ।वेचू लागे विठोबा पाठी ।।
जनी जाई पाणियासी । मागे धावे श्रषीकेशी ।। "

जनाबाईच्या प्रत्येक कामात विठ्ठल मदत करतो. ती जेव्हा झाडून काढते तेव्हा विठ्ठल तिने झाड केर भरतो. जनाबाई जेव्हा साळी सडण्यास बसते त्याचपुर्वी विठ्ठल उखळ साफ करुन ठेवतो. श्री विठ्ठल खूप महान आहे. आनाथांचा नाथ आहे. दीनदुबळयांचा कैवारी आहे. तो आपले मोठेपण सोडून भक्तासाठी धावून येतो आणि मदत करतो तो जनाबाईंना दळण कांडन करुन देतो.. जनाबाई रानात शेणाच्या गोवऱ्या वेचण्यासाठी जाते तेंव्हा विठ्ठल ही गोवऱ्या वेचू लागतो. जनाबाई पाणी भरण्यासाठी जाते तेंव्हा विठ्ठल ही धावून जातो आणि मदत करतो. असा एकात्मभाव तिच्या अभंगातून जाणवतो. विठ्ठल जनाबाईच्या जीवनाचा अविभाज्य अंग आहे. विठू माझा लेकुरवाळा संगे लेकुरांचा मेळा । असा विठ्ठल लडीवाळ आहे. तो आपल्या भक्तांचे लाड पुरवितो त्यांच्या अडचणी दूर करतो. याचा आत्मविश्वास जनाबाईस आहे म्हणून ती विठ्ठलास म्हणते,

"आंघळयाची काठी । आडकली कवणे बेटी ।।
माझिये हरिणी । गुंतलीस कवणे राणी ।।"

असे जनाबाईचे संपूर्ण जीवनच विठ्ठलमय बनले आहे. म्हणून समाजाचे सर्व संकेत नियम तोडून अजन्म ती विठ्ठलाचा धावा करते. तिच्या भक्तीचा उपहास काही लोक करायचे. जनाबाईच्या व्यक्तीत्वावर संशय घेणाऱ्या बडव्या लोकांचा ती उपहास करते. ज्यांना माझी भक्ती रुचत नाही त्यांनी खुशाल मनगटावर तेल घालून बोंबा माराव्यात असे ती म्हणते. जगाचा आरोप सहन करीत ती विठ्ठलाशी एकरुप होण्यासाठी भक्तीमार्गाचा पुरस्कार करते.

"डोईचा पदर आला खांद्यावर । भरल्या बाजारी जाईन
हाती घेईन टाळ खांद्यावरी वीणा । आता मज मना कोण करी ।।
पंढरिच्या पेठे मांडियेले पाल । मनगटावर तेल घाला तुम्ही ।।
जनी म्हणे देवा मी जाले वेसवा । रिघाले केशवा घर तुझे।।"

स्त्रीजीवनाचे काही रुढ संकेत आहेत. उदा. स्त्रीने डोक्यावर पदर घेतला पाहिजे, सार्वजनिक जीवनात तिने यावरु नये इत्यादी . हा रुढ संकेत बाजूला सारुन जनाबाई लोकनिंदेची पर्वा न करता तनमनाचा बिसर होऊन विठ्ठलाच्या भेटीमाठी पंढरीस आली आहे. विठ्ठल हेच आपले जीवन. पंढरपूर हेच माझे माहेर असा भक्तीचा संसार मांडला आहे. तिच्या भक्तीला काही लोक विरोध करीत आहेत.

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स्त्रीमर्यादाचे जनाबाई उल्लंघन करीत आहेत असा आरोप सुडबुध्दीने केला जात आहे. जनाबाई याची पर्वा करीत नाही. उलट ढोंगी अहंकारी, पुरुषांनी मनगटावर तेल घालून बोंबा माराव्यात असा टोला ती लगावते. जनाबाई म्हणते, विठ्ठलाच्या भक्तीपोटी मी संसाराचा, घरादाराचा त्याग केला. निंदक लोकांनी तिच्या वर्तनावर अनैतिकतेचे आरोप केले ते मी सहन केले. हे विठ्ठला माझ्या भक्तीची तू दखल घे आणि तुझ्या मला सामावून घे, तुझ्या घरी मला आश्रय दे.

"आंधळयाची काठी । आडकळी कवणे बेटी ।।
माझिये हरिणी । चुकले भावे पाहे वास ।।
मुके मी पाडस । चुकले भावे पाहे वास ।।
आता जीव जाऊ पाहे । धाव घाली माझे आये ।।
माझी भेटवा जननी । संता विनवी दासीजनी ।। "

प्रतिकाच्या माध्यमातून विठ्ठलाच्या भेटीची उत्कटता, तीव्रता या अभंगातून व्यक्त झाली आहे. विठ्ठल आमच्या जगण्याचा आधार, काठी आहे. या विठ्ठलाचे माझ्याकडे दुर्लक्ष आहे. तो भेटत नसल्यामुळे एखाद्या जंगलात वाट चुकलेल्या पाडसाप्रमाणे माझी अवस्था झाली आहे. म्हणून हे माझे आई तू मला लवकर दर्शन देऊन माझे समाधान करावे अशी विठ्ठलभेटीची तळमळ या अभंगातून व्यक्त झाली आहे.

संत जनाबाई आपल्या संतांना विनवणी करते आहे. की विठू आई हेच माझ्या जगण्याचे अंतीम उदिष्ट आहे. आणि या आईची भेट न झाल्यामुळे मला जगणे अशक्य झाले आहे. म्हणून विठ्ठलाचा धावा करताना जनाबाई म्हणते, माझिये हरिणी गुंतलीस कवणे रानी ।। हे माझे आई मी तुझ्याविण वाट चुकलेल्या पाडसाप्रमाणे भरकटत आहे. तुझ्याशिवाय मला जगण्याची इच्छा नाही म्हणून तू लवकरच माझ्या भेटीसाठी ये असा आर्त धावा जनाबाई करते. माय-लेकरु आणि हरिण - पाडसाच्या प्रतिक योजनेतून भक्तीची उत्कटता या अभंगातून प्रकट झाली आहे. या अभंगातून संत जनाबाईच्या मनात श्री विठ्ठलाविषयी असणारा आदरभाव आणि विठ्ठलाच्या भेटीची आर्त व्याकुळता व्यक्त होते. विठ्ठलाला ती आपली आई मानते. आई ज्याप्रमाणे आपल्या लेकरांवर माया करते. कशाचीही कमतरता भासू देत नाही त्याप्रमाणे विठाआई जनाबाईवर माया करते. तिला अंगाखांद्यावर खेळवते, जेवताना घास भरवते, दैनंदिन कामकाजात मदत करते.

"ये ग ये ग विठाबाई माझे पंढरीचे आई ।।
भीमा आणि चंद्रभागा तुझ्या चरणीच्या गंगा ||
इतुक्यासहित त्वा बा यावे माझ्या रंगणी नाचावे ||
माझा रंग तुझिया गुणी म्हणे नामयाची जनी ।।"

संत जनाबाई श्री विठ्ठलाला आपल्या आईच्या रुपात पाहते. विठाई आपल्या सर्व लेकरांवर प्रेम करते. त्यांचे लाड पुरविते म्हणून सर्व संत गोपाळांना ती आपली आई वाटते. ही आई भीमा आणि चंद्रभागेच्या पावन तीर्थाने पवित्र झालेली आहे. तिचे दर्शन अगदी पुण्यमय आहे. तिला

पाहिल्याशिवाय जनाबाईना चैन पडत नाही म्हणून ती भक्तीमय अंतःकरणाने आपल्या विठ्ठलाला हाक मारते. कारण "विठू माझा लेकुरवाळा संगे लेकुरांचा मेळा" अशी तीची श्रध्दा आहे. म्हणून ती असे म्हणते की हे विठ्ठला तू त्वरीत यावे आणि माझी भेटीची तहान भगवावी माझ्या अस्तित्वामध्ये तू मिसळावे. मला तुझ्यामध्ये एकरूप व्हायचे आहे. देहभान विसरुन तुझ्यामध्ये मिसळायचे आहे.

अशा प्रकारे देव आणि भक्त यांच्यातील भेटीची ओढ आणि एकरुपतेचे दर्शन प्रस्तुत अभंगातून घडते.संत जनाबाईच्या उत्कट भक्तीने श्रीविठ्ठल प्रसन्न होतो तिला प्रत्येक कामात मदत करतात. आणि जनाबाईचे जीवन विठ्ठलमय करतात. म्हणून ती एका अभंगात म्हणते देव खाते, देव पीते देवावरी झोपते. अशा विठ्ठलमय जीवनाची प्रचिती आणि विठ्ठलाने जनाबाईला प्रत्येक कामात केलेली मदत याचे भक्तीरसयुक्त वर्णन या अभंगातून केले आहे.

निष्कर्ष :

१) विठ्ठलाच्या भेटीची तळमळ, आर्तता, व्याकुळता, समर्पण शीलता या अभंगातून व्यक्त झाली आहे.
२) भावपूर्ण व सरस अभंग
४) उपमा, दृष्टांत, प्रतिकांचा वापर
३) अकृत्रिम भावना व सरळ आविष्कार यांचा संगम.
५) स्त्रीमनाचा हळूवारपणा आणि भक्तीची उत्कटता यांचे चित्रण

संदर्भ ग्रंथ :

१) प्राचीन मराठी वाङ्मयाचे स्वरुप ह. श्री. शेणोलीकर
२) संत वाङ्मयाची सामाजिक फलश्रुती गं. बा. सरदार
३) प्राचीन मराठी वाङ्मयाचा इतिहास ल. रा. नसिराबादकर
४) संक्षीप्त मराठी वाङ्मयकोश संपा. जया दडकर, प्रभा गणोरकर, वसंत आबाजी डहाके, सदानंद भटकळ
५) श्री नामदेवांची गाथा - संपादक व प्रकाशक : गीताप्रेस गोरखपूर
६) प्राचीन मराठी वाङ्मयाचा इतिहास खंड ४ अ. ना. देशपांडे

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SWOT Analysis and Academic Libraries: Current perspective

Mrs. Raykar Durga Dr. Sontakke Shivaji

Abstract

In this paper SWOT Analysis and its relation to academic libraries are discussed. This study is a qualitative and descriptive study on SWOT. SWOT Analysis will be examined from a historical, theoretical, and time frame perspective as an efficient situation analysis tool that is used in marketing, public relations, advertising, and any other area that requires strategic planning. SWOT Analysis is a method of analyzing the 'strengths,' 'weaknesses,' 'opportunities,' and 'threats' that are present in an entity, a strategy, a project, an individual, or a business operation. Here the attempt is to describe What is SWOT Analysis, how to do SWOT Analysis, Its limitations and alternatives, and finally its relation with academic libraries with the help of related literature, etc.

Keywords: *SWOT Analysis, Academic Libraries, Strategic Planning*

Introduction

The majority of all sectors today participate in strategic planning. Strategic planning is a method of assisting all sectors. By assisting throughout the distribution of resources to accomplish goals, an institution may become more efficient. It's a component for successful management. It is, in other words, a component of strategic management. Strategic planning is, in reality, necessary for effective strategic management.

The research, decisions, and behaviour that an institution makes in order to build and maintain competitive advantages are referred to as strategic management. The strategic management method consists of a series of evaluations and decisions that can help an institution to select a "right plan," or one that creates competitive advantages.

Vision is the starting point. A vision of the future is a depiction of what might happen in the future. It is a description of an institution wants to achieve future position. Task will be the next step in the strategic management process. The long-term purpose of an institution is its mission. Mission statements define what an institution aspires to be in the long run as well as what it wants to avoid in the short term. The third step in the strategic management process is to set goals.

The external and internal review phases of the strategic management process, also known as SWOT. An Institution can identify the critical challenges and opportunities in its own environment by performing an external review. It also considers how competition is likely to evolve in this setting, as well as the consequences of that evolution for the challenges and opportunities that an organisation faces. Internal analysis helps an institution to determine its organisational strengths and weaknesses, while external analysis focuses on the environmental challenges and opportunities that an institution faces. It also aids an institution in determining which of its resources and capabilities are most valuable.

Objectives

1. To introduce SWOT Analysis
2. To review the status of Academic libraries
3. To identify SWOT of different Academic libraries

What is SWOT Analysis?

SWOT Stands for Strengths, Weaknesses, Opportunities and Threats. SWOT Analysis used to get best advantage and to reduce the chances of failure by understanding what are lacking and eliminating hazards.

This strategy is based on a business environmental study, which compares the company's strengths and weaknesses to opportunities and challenges in the market environment (external or market analysis) (internal or company analysis). It's achieved with the support of a SWOT matrix, which can aid in the development of strategies for maximizing current opportunities and identifying and containing potential threats in real time.

How to do SWOT Analysis?

SWOT Analysis can be done through its following matrix.

1.1. Strengths:
What do you do well?
What unique resources you can draw on?
What do others see as your Strengths?

1.2. Weaknesses:
What could you improve?
What do you have fever resources than others?
What are others likely to see as Weakness?

1.3. Opportunities:
What opportunities are open to you?
What trends could you take advantages of?
How can you turn your strengths into your opportunities?

1.4. Threats:
What threats could harm you?
What is your competition doing?

What threats do your weaknesses expose to you?

Limitations and Alternatives of SWOT Analysis:

When conducting a SWOT analysis, keep in mind that it is just one step in the overall business planning process. To make decisions regarding complex issues, you'll usually need to conduct more in-depth analysis and research.

Remember that a SWOT analysis only considers issues that can be classified as a strength, weakness, opportunity, or threat. As a result, using a SWOT analysis to address uncertain or two-sided variables, such as factors which can be either a strength or a weakness or both, is difficult.

Limitations: It's possible that a SWOT analysis is limited because it:

a. Things aren't prioritized
b. Does not have alternatives or alternate options
c. Can generate a lot of ideas but not help you choose the right one
d. Can generate a large amount of data, but not all of it is useful.

2 Alternatives:

a. SCORE Analysis (Strengths, Opportunities, Aspirations, Results)
b. NOISE Analysis (Needs, Opportunities, Improvements, Strengths, Exceptions)
c. Improvement Venn Diagram
d. Feedback from users
e. Quarterly meetings to discussed progress

The SWOT review, on the other hand, has flaws. First and foremost, it necessitates extensive study because you would need a great deal of knowledge about your business and its market climate. Furthermore, both the selection of the evaluated categories as well as the subsequent assessment and weighting are subjective, which may lead to findings that are skewed. Keep in mind that the SWOT review outlines the current situation and allows you to derive future changes and interventions, but it does not constitute strategic planning in and of itself.

SWOT Analysis in Academic Libraries:

Jagtar Singh & Trishanjit Kaur (2009) discussed in their paper that academic libraries future is in our hand. Author discussed knowledge paradigm, present and future scenario, strategic response etc. In knowledge paradigm author wrote about NKC (National Knowledge Commission). NKC focused on access to knowledge, knowledge-concepts, knowledge-creation, knowledge application and development of better services means expansion, excellence and inclusion but it expect support from library. In present scenario regulatory bodies like UGC, AICTE, DTE formed for capacity building but without libraries it is not possible. Lack of good infrastructure is the weakest point in capacity building. ICT is the opportunity and challenge for libraries means paradigm shift from traditional to digital or virtual. Shared subscription, library consortia, institutional repositories, and open access archives are the outcome of our strategic response therefore SWOT Analysis and Gap Analysis are important factors. Generation, acquisition, processing, storage, dissemination, and use of knowledge and information are stages of information life cycle. Collection management, knowledge organization, digital preservation, online searching, content management, knowledge management, and promotion of library are the challenges. Finally author conclude knowledge base, pertinent skills and proactive positive mind set are essential factors for future academic libraries.

P.K. Suresh Kumar (2012) examined in their paper marketing of information products and services is an integral part of administrate. In knowledge paradigm author wrote about NKC (National Knowledge Commission). Access to knowledge, knowledge-concepts, knowledge-creation, knowledge application and development of better services are important factors in knowledge paradigm. Expansion, excellence and inclusion focused by NKC but need support of libraries. In present scenario library infrastructure is the weakness of libraries so libraries should build up their capacity. ICT is opportunity and Challenge in front of libraries. Shared subscription, library consortia, institutional repositories, and open access archives are the challenges therefore SWOT Analysis and Gap Analysis of libraries is important. knowledge base, pertinent skills and proactive positive mind set are the essential components of a competent librarian finally author conclude with our future library must be a hybrid library which must be user- centred and expert-assisted.

Kumar, P. K. S. (2012) describe in their paper about objective analysis of SWOT Analysis of four university libraries in Kerala named Kerala University Library (KUL), Mahatma Gandhi University Library (MGUL), Cochin University of Science and Technology Library (CUSATL) and CH Mohammed Koya Library of University of Calicut (CHMKL). Author studied Strengths and weakness in terms of the collection, staff strength, qualification of the staff and infrastructure. Also, author studied Strength and Weakness taken from the Chief of Each Library. Author studied SWOT on the ranking bases and found strengths like Experienced and qualified staff, Geographical position, Collection, Special Collections, Funds, Infrastructure, Membership, IT facilities, Information Products/Services Customer Care, etc. Weakness identified like Shortage of staff, Insufficient Investment, Space problem, Lack of infrastructure, Absence of Librarian, etc. Author discussed separately of each library. Opportunities and threats discussed by author Commonly new academic initiatives,

new sources of funds, Cooperation and Consortium, Technology, etc. Author conclude with all libraries has positive opinion towards marketing but no one library have specific funds for marketing of information products and services.

Miteshkumar Pandya (2012) represent in their paper about cloud computing and its use in library. With the help of SWOT Analysis author discussed advantages and disadvantages. Cloud computing (in context of library) means internet based soft copy of resources and managed by third person. Author describe application, storage and connectivity are main parts of it. Also, author discussed special features of cloud computing like Elasticity and Scalability, Multi-tenancy, Energy consumption, Reliability, Security, Consumption based billing, Data Management, Managing Cloud Activities, Self Service Model, etc. Ex Libris, Polaris Library Systems, Dura Cloud, etc. are Service providers of Cloud computing for libraries. Cost effective, Flexible and innovative, Round the clock access, Simplified Cost and Consumption Model, Enterprise Grade Services and Management, Faster Provisioning of Systems and Applications, Simplicity of Integration, Highly Secured Infrastructure, Compliant Facilities and Processes, Flexible and resilient in disaster recovery, reduces hardware and maintenance cost, etc. are strengths and opportunities of cloud computing-based libraries. Risk or data loss, Failure in compliance, Constant connectivity required, Dependency, Quality problems with cloud service provider, Time and Budget Constraints, etc. are weakness and threats found. Author conclude with in future the use of cloud base libraries may increase.

N.A, Hazidah and N.N, Edzan (2012) put on display the strategies used in marketing and promoting the University of Malaya Library (UML) effectively. The SWOT Analysis is used to generate strategies and actions. Identification of SWOTs is essential because subsequent steps in the process of planning for achieving the selected objective may be derived from SWOTs. Author also gave information on UML (University of Malaya Library) and explained why promotion is crucial by giving other authors' views. Collection, seating capacity, location, New technology such as QR code for mobile access, SMS, qualified staff, etc. Are strengths. Out-dated structures, Limited parking area, etc. Weakness. Different types of training and educating users program, active participation in research, Interlibrary loan and document delivery services, Library publications, outreach program, Introducing different reading areas for different purposes, etc. are opportunities. High subscription, lack of responsibility of borrow material, etc. are threats. Finally, author concluded with existence of resources, facilities and services that exceed users' expectations, it goes to show that the Library has effectively promoted its services.

Dharmaraj K. Veer and Santosh D. Kadam (2014) emphasizes in their paper on different facets of SWOT Analysis in context of libraries. To know the strengths of libraries should list out the positive things. To know weakness libraries should list out harmful things. To know opportunities in front of libraries, libraries should list out helpful things. To know threats in front of libraries, libraries should list out obstacles. Author selected engineering college libraries in this study. Author suggested ways & Means for quality services and facilities for engineering college libraries specially for Marathwada region. Qualified librarians, IT knowledge, training programmes, Separate Reference Section, good collection, proper administration, e-services, etc. are strengths. Lack of uniformity, lack of independent Library Building, Inadequate Technological Facilities, Finance, Not accredited by NBA, etc. are weakness. independent Library building, technological facilities, OPAC, Web-OPAC, e-consortia, Accreditation from, user Education, etc. are opportunities. Inadequate Library Finance, High Subscription rates of e-consortia, Increasing costs of publications, etc. are threats. Finally author conclude with SWOT Analysis lead automatically to useful changes in the structure or functioning of libraries.

V. Kadam (2017) exposed in his study about barcode-based library management systems. It's a case study. In this study, author chooses a library of Dr.BATU, Lonere. Also, the researcher used SWOT analysis for getting the actual picture after implementation of bar code. While studying researcher found Strengths like Mini tag size, Negligible data entry error rate, Low-cost tags, Low operating cost, Speedy check-in and check-out process, No queuing up at check out/check-in counters, Save time of the borrower and the staff, High-speed data entry, Supported by many suppliers, Reduces staff daily routine work , Improves efficiency of the management, proves information availability, Improves the image of the organization, Better for even Small business, Bar-coding facilities stock verification of books and journals, Simple process for stock verification, etc. Weakness like high cost of Scanner, Printer and overhead due to cost tags per volume, Unlike RFID (Radio Frequency Identification), it has no theft detection function, Scanning problems due to physically damaged label, CCD Scanner problems, Selecting the distance between the bar code and the CCD Scanner, Tallying borrower's signature every time at the circulation counter, Compare to successor technology like RFID, defective labels always lead to wrong/no reading of data, Laminated barcode library identity card are required, Less capacity, etc. Opportunities like prospect for development, Extending library opening hours, Implementation of this system in other departments of University e.g. student section, Account section, Starting new small Bookshop in the library, etc. Treats like Loss of employee jobs, Choose RFID or Barcode.

Pengfei Ji, Xiaozhu Zou and Zhi Li (2017) presented in their paper about Patent information service strategies of university libraries with the help of SWOT Analysis. University libraries have a lot of literature, comprehensive professional knowledge, enough funds for equipment, scientific research environment, etc.

which are important for patent information services means strengths. difficult to understand the details of patent technology, lack of market awareness, most, lack of professional training system, etc. are weaknesses. According to the principle of complementarity SO strategy, WO strategy, ST strategy and WT strategy are four countermeasure strategies. Author listed Integration of existing resources, Carry out a variety of promotional activities, Increase the degree of opening to the society under SO strategy. Establishing a patent information management system, Improve the quality and ability of librarians listed under WO Strategy. Establish patent database, Library cooperation with patent agency listed under ST strategy. Improving consciousness, increasing investment, improving rules and regulations, training professionals in libraries, novel and authoritative services listed under WT strategy.

Darandale, A. G. (2017) submitted in their paper National Digital Libraries SWOT. Author gave some examples of Digital Libraries like Nalanda Digital Library, Vidyanidhi Digital Library, ERNET, Indian Institute of Science, Banglore, Kalasampada, Electronic Thesis and Dissertation Digital Library, INFLIBNET, Librarian's Digital Library, Raman research Institute, National Library of India. The aim of this study is to find strengths and opportunities in comparison with other digital repositories. The advantages and disadvantages described by the author in this article are as follows: wider dissemination of information, global visibility, single location content, professional visibility, Open access, global search service, etc. Educational material from primary to post-graduation, more than 60 types of teaching resources, availability in more than 70 languages, Variety of reading material-video lectures, global classical books, journal articles, thesis and audio books, Free of charge and easy to register, Android mobile phone app availability, etc. are strengths. Not produce its own data, Sometimes time consuming, Current issues not available soon, Browsing start with Hindi, English and Bengali language, sometimes printing limitations, full text access sometimes required permissions, etc. are Weakness. Information access with democratic nature, without personal bias, info from worldwide, etc. are opportunities. Electricity, internet, may decreasc the print format reading, etc. are threats.

Xiaofang Qiu (2017) discussed SWOT Analysis of private College libraries and its development strategy. Library works according to changes and requirements of the market, establishing a solid foundation for the development of skills, flexible and efficient management system, determine the features of libraries according to teachers, school funds, cultural and economic development in the place where the school locates, etc. are strengths of libraries. Development unstable, especially the teaching body, lacking mental preparation for the massive investment, the books and reference materials are insufficient. And the space in the library is narrow to develop further, etc. are Weakness. The national policies provide broad space for the development of private higher education, train academic, research-oriented and design talents, etc. are opportunities. Parents misunderstanding about education, faces fierce competition, etc. are a great threat. Author also suggested development Strategies like Expand Financing Channels to Guarantee, A Stable Capital Source Integrity Is Important to Create A Good Reputation of Libraries, The Government and the Society Support the Development.

Anna Kaushik (2018) gave aims to conduct a SWOT analysis of massive open online courses (MOOCs) in library and information science in order to identify and understand different insights and best practices. This paper is a review paper. Author put different opinion of different authors from a different point of view like SWOT Analysis of MOOCs library is useful to know professional needs & their potential, SWOT helps to note lack these tools to develop competencies and skills in library, SWOT analysis of MOOCs in connection to observe it is helpful to improve medical education or not, reputation was one of the main factors to engage in MOOC activities, etc. after study author found MOOCs provide great flexibility and reliable platform to upgrade their knowledge, it is helpful in promoting information literacy, etc, are the strength of MOOC. Drop rates of learners, lack of authority and quality, High development time and cost, Copyright issues, Language and cultural differences, etc. are weaknesses. Building reputation through networking, free access and Building professional development, etc. are opportunities. Fair use, Return on investment, Disruption in online and traditional courses, Sustainability, etc. are threats.

Kadeeja Banu C V and Nusrath N (2018) analysed in their paper Farook College Library on the bases of SWOT and with the help of questionnaire and interviews. This library is one of the best libraries in the state of Kerala. From Questionnaire author realised basic facilities such as circulation counter, space, reading table and chairs, OPAC, drinking water, toilet also textbooks, reference books, newspapers, general periodicals, subject journals, books for competitive exams and question papers needed by users of such library. Also total analysis shows that users need services such as display of new arrivals, issue and return, newspaper clipping services, digital library, personalised information service, reprographic service, translation service and online information service, assistance of staffs, orientation programs. College library building construction, good collection, wide range of electronic resources, DDC classification, Koha software for house-keeping operation, many services, etc. are strengths of Farook College Library.

Roseline Bawack (2019) put forward in their paper about knowledge management in academic libraries with the help of SWOT. Misunderstanding of the concept of KM, lack of knowledge sharing culture, reluctance

of librarians to embrace change, lack of skilled and competent staff, lack of incentives for innovation and knowledge sharing, lack of commitment by management, lack of motivation for collaboration are the main reasons behind this study. Author used surveys, questionnaires, observation, focus groups and interviews with students, library staff and others. Hybrid and robust collection, electronic resources, qualified and competent library staff, presence of adequate state-of-the- art technologies and tools to drive KM processes, fluid communication, knowledge sharing culture, membership in a library consortium, cooperation ties with other university libraries and networking to share resources are strengths found. The weaknesses of a library includes lack of qualified, competent and adequate personnel, lack of digital and electronic resources, lack of digital space, lack of communication with management, inadequate and obsolete technologies and infrastructure. technological developments, changes in the external environment and operational changes may be opportunities or threats. giving formal training programs and demonstration on how to use selected library software to staff, open access movement, digitization of library collections, building and managing institutional repositories, availability of internet and effective usage by staff and students, library website, users' needs etc. opportunities found.

Conclusion:

The lot of studies examining the SWOT approach reveals that relying solely on SWOT in strategic planning is inadequate. According to academic studies on the topic, the efficacy of SWOT can be enhanced by combining qualitative and quantitative techniques. A variety of academics have introduced new analytical approaches to use in conjunction with SWOT analysis, and others have suggested alternative methodologies. Although there has been a huge amount of academic research on SWOT, little attention has been paid to understanding the method's historical emergence, benefits, and limitations. This article aims to reveal a simple understanding of the methodology, as well as recent methodological changes. SWOT studies of academic libraries may help for further progress of the libraries.

References:

1. Bawack, Roseline (2019). "Application of Knowledge Management in Academic Libraries: A SWOT Analysis". Library Philosophy and Practice (e-journal). 3814. https://digitalcommons.unl.edu/libphilprac/3814
2. Darandale, A. G. (2017). SWOT analysis of National Digital Library of India. Galaxy: International Multidisciplinary Research Journal, 8(7), 1–9.
3. Emet GÜREL and Merba TAT (2017). SWOT ANALYSIS: A THEORETICAL REVIEW. The Journal of International Social Research.10(51), retrieved from http://dx.doi.org/10.17719/jisr.2017.1832
4. Hazidah, N., & Edzan, N. (2012). The SWOT Analysis: Marketing and Promotional Strategies Used at the University of Malaya Library. In Conference on Gen Next Libraries 2012. Emerging Technologies: New Direction for Libraries (pp. 1–6).
5. Ji, P., Zou, X., & Li, Z. (2017). SWOT Analysis Of Patent Information Service Strategy Of University Libraries For Enterprises. Atlantis Press. https://doi.org/10.2991/jimec-17.2017.19
6. Kadam, V. (2017). Application of SWOT, Principal Component and Cross-case analysis for Implementing and Recommending an ICT Technology in Library - A Case study. Atlantis Press. https://doi.org/10.2991/iccasp-16.2017.109
7. Kaushik, A. (2018, November 5). SWOT analysis of MOOCs in library and information science domain. Library Hi Tech News. Emerald Group Publishing Ltd. https://doi.org/10.1108/LHTN-08-2018-0048
8. Kumar, P. K. S. (2012). University libraries in Kerala: A SWOT analysis for marketing. Library Philosophy and Practice, 2012(1).
9. Pandya, M. (2012). Cloud computing for libraries: A SWOT analysis. In Building Participatory Library Services in Digital Era. INFLIBNET Centre. Retrieved from http://ir.inflibnet.ac.in/handle/1944/1703
10. Qiu, X. (2017). SWOT Analysis of Private College Library and Its Development Strategy. Atlantis Press. https://doi.org/10.2991/iccese-17.2017.177
11. Singh, J., & Kaur, T. (2009). Future of Academic Libraries in India: Challenges and Opportunities. Ical, 51–54.
12. V, K. B. C. (2018). SWOT analysis of Farook College Library Number of Respondents, 4(4), 1–11.
13. Veer, D. K., & Kadam, S. D. (2018). SWOT Analysis of Engineering College Libraries in Maharashtra : With Special Reference to Marathwada Region SWOT Analysis of Engineering College Libraries in Maharashtra : With Special Reference to Marathwada Region, (May 2014).

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