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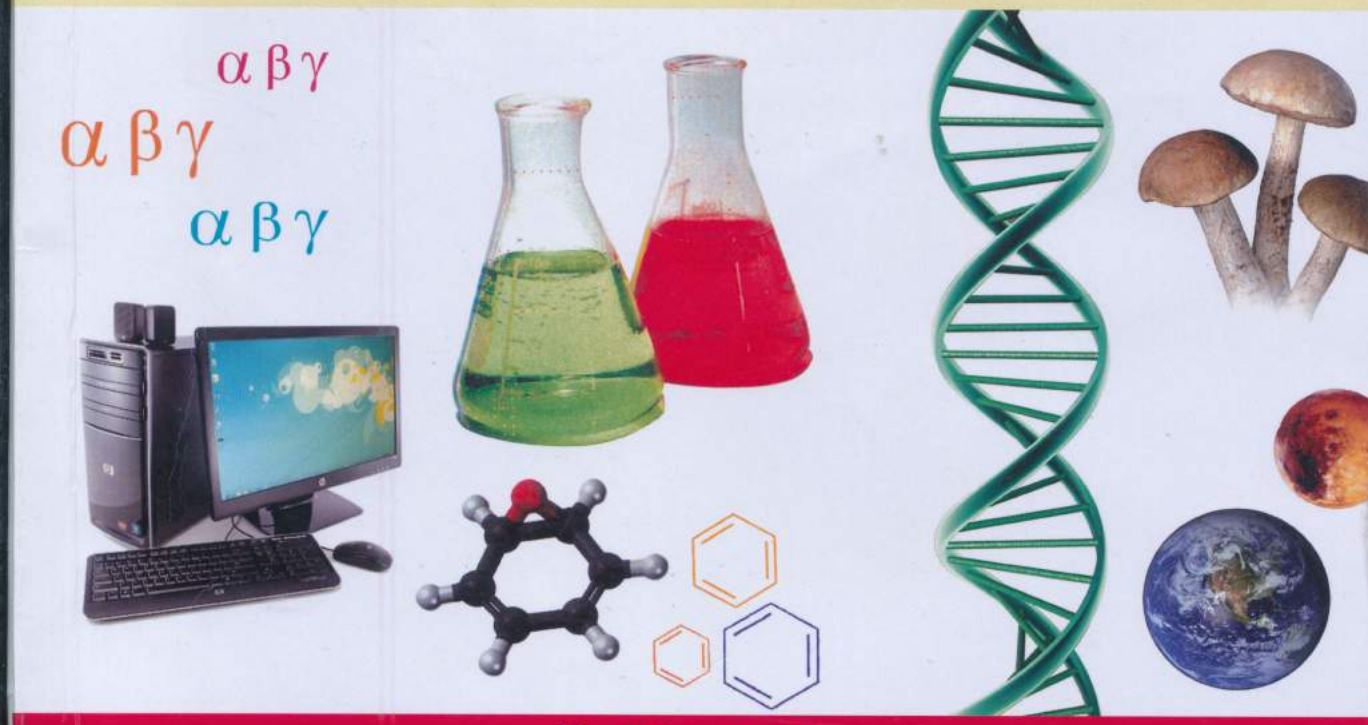

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FOREIGN CAPITAL INFLOWS AND ITS IMPACT ON FOREIGN EXCHANGE MANAGEMENT

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Abstract:

With the emerging trend of globalization, India witnessing a huge inflow of Foreign Direct Investment (FDI) during last two decades.Developing countries like India has to depend to a large extent on foreign capital investments for economic development of the country. The present paper attempts to examine the various aspects of economic growth and inflow of foreign capital through different multinational companies.

Keywords: FDI inflow, economic growth, foreign exchange management

Introduction:

Foreign capital inflow has been an engine of growth in many countries during the last two decades. It is necessary to supplement the domestic capital resource base of a country. The phenomenon appeared in a predominant way for the developing countries since 1990s. India is not an exception to that. Under the structural reform programme the process of integrating Indian Economy with global economy along with convergence of capital flows has been gradually liberalized. As a result, the country allowed foreign entities to come in with their investment. However the entry of foreign capital was not unrestricted. We have established our national priorities and earmarked certain sectors in which foreign capital inflow was desirable in order to foster the pace of economic growth in a sustainable manner in the long run. The policy makers and planners have therefore chalked out a road map supplemented by some regulatory framework to ensure the meaningful utilization of the foreign capital to serve the best interest of our national economy. The regulatory norms in the hands of the regulatory agencies like RBI, SEBI, and Foreign Investment Promotion Board (FIPB) have been strengthened in order to check the possible adversities that might occur on account of inflow of foreign

capital. In opening our door to the foreign capital inflow the economic policy and agenda have strictly adhered to the constitutional obligation of the political administration that comes to governance in the national capital. We as a nation are committed to conform to attaining economic growth with social justice, supplement the national resources with foreign capital but not as a substitution, attaining balanced regional growth and national dispersal of foreign capital mixed as a dose of joint venture, collaborative venture and working in tandem under the tenet of public-private partnership (PPP).

Objectives of the Study:

Taking clue from the foregoing discussion we have decided to conduct a research based study on the foreign capital inflow and its impact on foreign exchange management. The following are the broad objectives of the present study.

1. To ascertain the company wise inflow of foreign capital in selected companies.
2. To analyse the impact of foreign capital on our attaining economic growth and its impact on foreign exchange management.

Company wise Inflow of FDI:

The govt. on May 9, 2008 cleared an FDI proposal worth Rs. 8,000 crore of the Essar group and Rs. 1,000 crore proposal of Chennai based Rakindo Developers.

1. Rakindo: Rakindo will infuse FDI into a holding company for making investment in real estate development and construction activities. Rakindo Developers plan to set up a wholly owned subsidiary with Rs. 1,000 crore FDI from Dubai based Rakeen Development. The Rakindo has planned to build a Rs. 6,000 crore integrated township in Coimbatore Rakindo will be a holding company that will build and operate townships through special purpose vehicles (SPV). It is a joint venture company formed by Rakeen, a company promoted by the Ral al Khaimah group, UAE and Chennai based mineral group 'Trimex' owned by Koreru Prasad. The special purpose vehicles will be engaged in infrastructure construction development projects, which include integrated township, IT parks, hostels, resorts, hospitals, housing, retail, office and commercial premises, educational institutions and Special Economic Zones (SEZ) across the country.
2. **Essar Power Ltd.:** It will bring in Rs. 8,000 crore through Mauritius base Essar Power Holdings for investments in power related activities. With this approval Essar Power Ltd. Can invest in downstream activities including power and cold mining for captive consumption by power projects. After the infusion of Rs. 8,000 crore, Essar Power Holdings Ltd. Will hold 100% in Essar Power Ltd. Essar Global Ltd, a company incorporated in Cayman Islands is the holding company of Essar Power Ltd. Has lined up plains to invest over Rs. 20,000 crore in the

next couple of years. It plans to increase its installed capacity to 6,000MW by 2012 which include power plains of 1200MW each in Madhya Pradesh, Gujrat and Jharkhand.

3. The Foreign investment Promotion Board (FIPB) and the Cabinet also gave its ex-post-facto (retroactive) approval for a proposal of NBCC Ltd. It involves the redemption of 7% non-cumulative preference shares by the company that was due in 2006-07. The shares would now be regularized in the previous fiscal instead of 2006-07.

companies, while they have, in general, reduced their holdings inother segments. FIT holdings inselected companies inpercentage has been indicated below:

Other companies in which FIIS had invested in varying proportion from time to time are:

ONGC, Reliance Industries, Larsen and Turbo, BHEL and ACC, Gujarat, Ambuja Cement.

FDI Inflows during the last three years have been more broad based. From our analysis it appears that some of thesectors have attracted FDI which has helped attaining industrial growth which was recorded at

Companies	March,2007 % holdings in SENSEX	March, 2008% holdings in SENSEX
IT -Infosys	32.5	33.66
Satyam	47.22	48.22
TCS	7.06	10.79
Wipro	5.14	5.24
Pharma-Cipla	16.82	NA
Ranbaxy	16.35	17.95
FMCG- Hindustan	12.28	15.15
Unilever	12.79	14.02
ITC		
Bank- HDFC	32.27	25.89
ICICI	45.02	40.32
SBI	11.9	12.82

Source: The Telegraph, dated May 12, 2008

The FDI proposal of the Essar Group and of Rakindo has been cleared by FIPB but required cabinet approval as they involved investment of more than Rs. 6,000 crore.

FDI Investment in Indian Companies:

The FIIs have increased their stakes in IT Companies, FMCG (first moving consumer goods) and pharmaceutical

8.7% in April to Feb.,2007-08. The FDI inflows for the year 2006-07 was 9.5 billion dollar and that for 2005-06 it was 5.5 billion dollar. In Feb.,2008, the country received actual FDI of around 5 billion dollar. Now FDI inflows are evenly spread covering a broad spectrum of manufacturing industry such as automobiles, chemical and engineering goods. We may thus infer that India has now gained

global recognition as a place for competitive manufacturing.

Long Term Foreign Investment:

Long term foreign investment has jumped to 8.4 billion dollar in Feb.,2008, the largest FDI inflow in a single Month till date. FDI inflow has shot up to 25.45 billion dollar during April,2007 to Feb.,2008. As in the past, tax haven Mauritius continued to be the most preferred route to bring FDI into India. In terms of fundamentals, India is very strong from a medium to long term growth perspective. This is what determines the future outlook of an economy and is factored in by strategic foreign investors in India.

Indian laws allow 51% FDI for single brand retail, while 100% FDI is for the cash and carry business. Global giants such as Walmart and Metro cash and carry have entered through the 100% FDI route, while Carrefour is planning a foray.

Company Analysis for FDI:

Ashok Piramal Group Promoted Penisula Realty Fund (PRF). This fund is also bringing FDI into thesector. Infact, PRF had in 2006 got a Cabinet Committee on Economic Affairs (CCEA) which gave permission for raising 350 million US dollar FDI to invest in real estate and infrastructure projects in the country. According to a study byJones Lang La Salle, FDI in Indian real estate sector is already in excess of 3 billion US dollar.

While rally big firms such as Tricona, K. Raheja Group and SurendraHiranandani Group have already raised around 3 billion US dollar at the Alternate Investment Market (AIM) in London Stock Exchange *LES, others like Unitech, Ansal API, Omaxe and the NirendraHiranandani Group are in talks for raising another 2 to 2.5 billion US dollar.

Unitech has in 2006 announced plans to raise around 700 million US dollar from the London Market. The AIM market, a stock exchange started in 1995, requires no minimum requirement for initial equity, minimum public float, market capitalization, trading history and profitability for companies to list.

Sectors	Fill Holding
Finance	10.41
FMCE	10.58
Infrastructure	4.36
IT	10.94
Manufacturing	5.73
Media & Entertainment	11.06

Petrochemicals	2.91
Pharmaceuticals	7.86
Services	5.57
Telecommunication	8.69
Misc.	2.62
Other Companies	7.06

Source: Indian Securities Market: An overview, 2004, Economic & Political Weekly, June VI, 2005, p. 2397.

Impact Measurement of FDI:

The impact of FDI can be measured with the help of the following parameters.

a) The depth of value addition as a result of FDI enabling production: This will be done to access the ratio of value added to output (sales). This is an indicator of the extent to which the firm is vertically integrated. It is believed that a firm with high value addition is likely to provide higher employment opportunities as compared with the one in which the addition is low.

b) The extent of jobs generated byFDI: Employment intensive sectors like textiles, food-processing, leather products and rubber goods attract relatively lower FDI compared with capital intensive areas like telecommunications.

c) The FDI inflows in sectors which are export-oriented as well as the ones which seek the domestic market need to be examined.

d) The repatriation of profits done by the foreign direct investors. Now we shall proceed to discuss the impact of FDI on foreign exchange management which is elaborated hereunder.

Some Steps Adopted:

1. After the opening of the banking sector to foreign players in 2009, the pressure on national players to consolidate is likely to increase further. Considering the massive asset base of banks, even the smallest merger in the sector that may not affect consumer interest will have to go through Competition Commission of India (CCI) review which might take up to 210 days.
2. The government on 27 March,2008has authorized RBI to sign a currency swap agreement with bank of Japan to exchange 3 billion dollar against rupee or yen for mitigating short term balance of payment (BOP) problem. It is an additional arrangement outside IMF to meet short term liquidity in dollars during a BOP crisis. A bilateral agreement on currency swap will add to a regional network of such accords designed to

provide emergency financial liquidity to either or both parties in times of currency market turbulence.

3. The RBI adopted the Market Stabilization Scheme (MSS) to mop up excessive liquidity which resulted in a sharp decline in daily Liquidity Adjustment Facility (LAF) reverse repo subscriptions in September,2007. The main benefits of capital account liberalization for emerging markets appear to be indirect, because it relates more to building other institutions than to the increased financing provided by capital inflows. From a close scrutiny of foreign capital flows the present authors feel that we should have a controlled capital account liberalization. In the regime the central bank securities forex reserves by channeling household flows through institutions such as close ended mutual funds that issue shares denominated in the domestic currency. These mutual funds use the proceeds to purchase foreign exchange from the central bank and invest in abroad in a wide array of foreign assets.

4. Until recently, the only options available for an Indian corporate to raise overseas debt were either by way of foreign currency convertible bonds (FCCB). Under this there was no mechanism for the promoters of Indian companies to unlock value intheir group companies to raise funds abroad. In view of the situation and to contain the adverse impact of capital flows into the country, on 15 February, 2008, the finance ministry notified the issue of Foreign Currency Exchangeable Bonds (FCEB) Scheme allowing Indian Companies of FCEBs.

5. Capital inflows vis-à-vis Inflation: Three-pronged strategy of fiscal; supply side; and monetary measure were undertaken in April,2008 by RBI to check inflation. Expected good monsoon, coupled with a strong performance from the service sector would stimulate growth. With global uncertainties increasing, growth slowing down and inflationary pressure being high, there is a dilemma for policy makers in advanced economics whether to go in for short-term financial stability at the cost of medium term inflation. Domestic performance can moderate inflation; with normal monsoon, a 3 pc agriculture growth can be achieved. With strong economic fundamentals' high productivity, and healthy savings and investment ratio, there was no reason for growth momentum to be impeded.

6. The US Federal reserve has reduced interest rate, the federal fund's rate by 75 basis points in January 2008. The quarterly monetary policy of RBI in January 2008, the repo (and reverse repo) rate and the cash reserve ratio remain unchanged. New capital inflows, mainly on account of FDI (3.9 billion dollar in April-September,2007-08 compared to 4.5 billion dollar in the corresponding period of 2006-07); foreign portfolio investment (18.3 billion dollar in April-September,2007-08 versus 1.6 billion dollar in 2006-07); and external commercial borrowings (ECB) plus short-term credit

(16.3 billion dollar verses 9.6 billion dollar) for exceeded the requirements for financing the current account deficit leading to an accretion of reserves (excluding valuation) by 40.4 billion dollar in the first half of 2007-08. Indeed, net inflows by foreign institutional investors have amounted to 26.8 billion dollar in the current financial year upto January 11, 2008. Even as the figures of capital inflows have been a cause for celebration among the 'India Shining' elite, the situation of net capitalflows well in excess of the current account deficit has made it very difficult for the RBI to manage the money supplyand conduct monetary policy. As in February,2008, with the US Federal Reserve resorting to big cuts in its key interest rate and the RBI deciding to hold rates for the present, the widening interest rate differential (adjusted for the expected rate of change in the value of the rupee) is expected to further boost capital inflows, leading to greater appreciation of the Indian rupee and compounding the difficulties in monetary macroeconomic management. Yet the concern for the New Delhi administration is the continuation of unprecedented inflow of foreign portfolio finance.

Epilogue:

The process of greater economic interdependence amongst countries has resulted in larger flows of cross border movement of goods and services, and in international capital flows. The US Federal Reserve Bank's decision of the largest ever one-time out in interest rates in February,2008, the sub-prime crisis in the USA in January,2008, apprehension about a recession in the US economy in February 2008, have resulted in shrinking of share price across the world, caused upturn in gold price in world market- all these have influenced international capital flight.

The fears of 'contagion' have thrown orthodox economic theory into disarray. The old prescriptions such as 'free trade is the best medicine' or 'remove all controls on international capital flows' may not absolutely hold good in the complex regime or inter-dependence. Hence there is a case for regulated FDI only to that extent in those sectors where it is truly necessary.

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TITLE OF THE PAPER: AUTONOMOUS CAR— AN IMMINENT REALITY OF THE NEAR FUTURE

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Abstract:

An autonomous car is a vehicle capable of sensing its environment and operating without human involvement. A human passenger is not required to take control of the vehicle at any time, nor is a human passenger required to be present in the vehicle at all. An autonomous car can go anywhere a traditional car goes and do everything that an experienced human driver does. In the past five years, autonomous driving has gone from "may be possible" to "definitely possible" to "inevitable" to "how did anyone ever think this wasn't inevitable?" to "now commercially available." In December 2018, Waymo, the company that emerged from Google's self-driving-car project, officially started its commercial self-driving-car service in the suburbs of Phoenix. The details of the program—it's available only to a few hundred vetted riders, and human safety operators will remain behind the wheel. People are now paying for robot rides. Waymo will expand the service's capability and availability over time. Also smaller startups like May Mobility and Drive.ai are running small-scale but revenue-generating shuttle services. Every significant automaker is pursuing the tech, eager to rebrand and rebuild itself as a "mobility provider". Ride-hailing companies like Lyft and Uber are hustling to dismiss the profit-gobbling human drivers who now shuttle their users about. Tech giants like Apple, IBM, and Intel are looking to carve off their slice of the pie. Countless startups have materialized to fill niches in a burgeoning ecosystem, focusing on laser sensors, compressing mapping data, setting up service centers, and more.

The Society of Automotive Engineers (SAE) currently defines 6 levels of driving automation ranging from Level 0 (fully manual) to Level 5 (fully autonomous). These levels have been adopted by the U.S. Department of Transportation.

- **Level 0:** All major systems are controlled by humans

* *Corresponding Author*

- **Level 1:** Certain systems, such as cruise control or automatic braking, may be controlled by the car, one at a time
- **Level 2:** The car offers at least two simultaneous automated functions, like acceleration and steering, but requires humans for safe operation
- **Level 3:** The car can manage all safety-critical functions under certain conditions, but the driver is expected to take over when alerted
- **Level 4:** The car is fully-autonomous in some driving scenarios, though not all
- **Level 5:** The car is completely capable of self-driving in every situation

Autonomous vs. Automated vs. Self-Driving:

The SAE uses the term automated instead of autonomous. One reason is that the word autonomy has implications beyond the electromechanical. A fully autonomous car would be self-aware and capable of making its own choices. For example if we say "drive me to work" but the car decides to take us to the market instead. A fully automated car, however, would follow orders and then drive itself.

The term self-driving is often used interchangeably with autonomous. However, it's slightly different. A self-driving car can drive itself in some or even all situations, but a human passenger must always be present and ready to take control. Self-driving cars would fall under Level 3 (conditional driving automation) or Level 4 (high driving automation). They are subject to geofencing, unlike a fully autonomous Level 5 car that could go anywhere.

The driverless technology will add $7 trillion to the global economy and save hundreds of thousands of lives in the next few decades. Simultaneously, it could devastate the auto industry and its associated gas stations, drive-thrus, taxi drivers, and truckers.

How do Autonomous Cars Work?

Autonomous cars rely on sensors, actuators, complex algorithms, machine learning systems, and powerful processors to execute software. These cars create and maintain a map of their surroundings based on a variety of sensors situated in different parts of the vehicle. Radar sensors monitor the position of nearby vehicles. Video cameras detect traffic lights, read road signs, track other vehicles, and look for pedestrians. Lidar (light detection and ranging) sensors bounce pulses of light off the car's surroundings to measure distances, detect road edges, and identify lane markings. Ultrasonic sensors in the wheels detect curbs and other vehicles when parking.

Sophisticated software then processes all this sensory input, plots a path, and sends instructions to the car's actuators, which control acceleration, braking, and steering.

Hard-coded rules, obstacle avoidance algorithms, predictive modeling, and object recognition help the software follow traffic rules and navigate obstacles.

Challenges with Autonomous Cars Fully autonomous (Level 5) cars are undergoing testing in several pockets of the world, but none are yet available to the general public. We're still years away from that. The challenges range from the technological and legislative to the environmental and philosophical. Here are just some of the unknowns.

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- **Lidar and Radar:** Lidar is expensive and is still trying to strike the right balance between range and resolution. If multiple autonomous cars were to drive on the same road, would their lidar signals interfere with one another? And if multiple radio frequencies are available, will the frequency range be enough to support mass production of autonomous cars?
- **Weather Conditions:** What happens when an autonomous car drives in heavy precipitation? If there's a layer of snow on the road, lane dividers disappear. How will the cameras and sensors track lane markings if the markings are obscured by water, oil, ice, or debris?
- **Traffic Conditions and Laws:** Will autonomous cars have trouble in tunnels or on bridges? How will they do in bumper-to-bumper traffic? Will autonomous cars be relegated to a specific lane? Will they be granted carpool lane access? And what about the fleet of legacy cars still sharing the roadways for the next 20 or 30 years?
- **Accident Liability:** Who is liable for accidents caused by an autonomous car? The manufacturer? The human passenger? The latest blueprints suggest that a fully autonomous Level 5 car will not have a dashboard or a steering wheel, so a human passenger would not even have the option to take control of the vehicle in an emergency.
- **Artificial vs. Emotional Intelligence:** Human drivers rely on subtle cues and non-verbal communication—like making eye contact with pedestrians or reading the facial expressions and body language of other drivers—to make split-second judgement calls and predict behaviors. Will autonomous cars be able to replicate this connection? Will they have the same life-saving instincts as human drivers?

Benefits of Autonomous Cars: The scenarios for convenience and quality-of-life improvements are limitless. The elderly and the physically disabled would have independence. If kids were at summer camp and forgot their bathing suits and toothbrushes, the car could bring them the missing items. One could even send his dog to a veterinary appointment. But the real promise of autonomous cars is the potential for dramatically lowering CO_2 emissions. In a recent study, experts identified three trends that, if adopted concurrently, would unleash the full potential of autonomous cars: vehicle automation, vehicle electrification, and ridesharing. By 2050, these "three revolutions in urban transportation" could:

- Reduce traffic congestion (30% fewer vehicles on the road)
- Cut transportation costs by 40% (in terms of vehicles, fuel, and infrastructure)
- Improve walkability and livability
- Free up parking lots for other uses (schools, parks, community centers)
- Reduce urban CO_2 emissions by 80% worldwide Conclusion: Autonomous cars are a reality of the present times. They will be playing an important role and even have the potential to change the face of transportation as we know it.

Conclusion: Autonomous cars are a reality of the present times. They will be playing an important role and even have the potential to change the face of transportation as we know it. ❑❑

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ENTOMOPHAGY – A STEP FORWARD FOR FUTURE FOOD SECURITY

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Introduction:

Thomas Robert Malthus, an English cleric, and scholar, published his Theory on Population Growth in his 1798 writings, where he mentioned that population will grow in geometric progression and food supply will grow in arithmetic progression. Now, after about two centuries, population outburst seems to lead towards Malthusian catastrophe. Man has bred himself into starvation by consuming arithmetically increased food sources. It is widely accepted that by 2050 the world will host 9 billion people. To accommodate this number, current food production will need to almost double. Land is scarce and expanding the area devoted to farming is rarely a viable or sustainable option. To meet the food and nutrition challenges of today – there are nearly 1 billion chronically hungry people worldwide – and tomorrow, what we eat and how we produce it needs to be re-evaluated. Inefficiencies need to be rectified and food waste reduced. We need to find new ways of growing food. Entomophagy, the consumption of insects by humans, may be an alternative source of future food. It is practiced in many countries around the world, predominantly in Asia, Africa, and Latin America. Insects as food and feed emerge as an especially relevant issue in the twenty-first century due to the rising cost of animal protein, food and feed insecurity, environmental pressures, population growth and increasing demand for protein among the middle classes. Thus, alternative solutions to conventional livestock and feed sources urgently need to be found. The consumption of insects, or entomophagy, therefore contributes positively to the environment and to health and livelihoods (Anon., 2013).

The edible insects, its type, the scope of its cultivation, preservation, and commercialization; and use of insects in different countries in general and North East India in particular is reviewed briefly in this article.

The role of insect:

It is estimated that insects form part of the traditional diets of at least 2 billion people. More than 1900 species have reportedly been used as food. Insects deliver a host of ecological services that are fundamental to the survival of humankind. They also play an important role as pollinators in plant reproduction, in improving soil fertility through waste bioconversion, and in natural biocontrol for harmful pest species, and they provide a variety of valuable products for humans such as honey and silk and medical applications such as maggot therapy. In addition, insects have assumed their place in human cultures as collection items and ornaments and in movies, visual arts and literature. Globally, the most commonly consumed insects are beetles (Coleoptera) (31 percent), caterpillars (Lepidoptera) (18 percent) and bees, wasps and ants (Hymenoptera) (14 percent). Following these are grasshoppers, locusts and crickets (Orthoptera) (13 percent), cicadas, leafhoppers, planthoppers, scale insects and true bugs (Hemiptera) (10 percent), termites (Isoptera) (3 percent), dragonflies (Odonata) (3 percent), flies (Diptera) (2 percent) and other orders (5 percent) (Anon., 2013).

Culture:

Entomophagy is heavily influenced by cultural and religious practices, and insects are commonly consumed as a food source in many regions of the world. In most Western countries, however, people view entomophagy with disgust and associate eating insects with primitive behaviour. This attitude has resulted in the neglect of insects in agricultural research. Despite historical references to the use of insects for food, the topic of entomophagy has only very recently started to capture public attention worldwide.

Insect as a natural source:

Edible insects inhabit a large variety of habitats, from aquatic ecosystems and farmed land to forests. Until recently, insects were a seemingly inexhaustible resource obtainable by harvesting from nature. However, some edible insect species are now in peril. A number of anthropogenic factors, such as overharvesting, pollution, wildfire and habitat degradation, have contributed to a decline in many edible insect populations. Climate change will likely affect the distribution and availability of edible insects in ways that are still relatively unknown. This publication includes case studies from several regions on the conservation strategies and semi-cultivation practices of rural people to protect insect species and their host plants. Such efforts contribute to improved habitat conservation.

Environmental opportunity:

The environmental benefits of rearing insects for food and feed are founded on the high feed conversion efficiency of insects. Crickets, for example, require only 2 kilograms of feed for every 1 kilogram of bodyweight gain. In addition, insects can be reared on organic side-streams (including human and animal waste) and can help reduce environmental contamination. Insects are reported to emit fewer greenhouse gases and less ammonia than cattle or pigs, and they require significantly less land and water than cattle rearing. Compared with mammals and birds, insects may also pose less risk of transmitting zoonotic infections to humans, livestock and wildlife, although this topic requires further research.

Insect as food:

Insects are often considered a nuisance to human beings and mere pests for crops and animals. Yet this is far from the truth. Insects provide food at low environmental cost, contribute positively to livelihoods, and play a fundamental role in nature. However, these benefits are largely unknown to the public. Contrary to popular belief, insects are not merely "famine foods" eaten in times of food scarcity or when purchasing and harvesting "conventional foods" becomes difficult; many people around the world eat insects out of choice, largely because of the palatability of the insects and their established place in local food cultures. Insect rearing for food and feed remains a sector in its infancy, and key future challenges will likely emerge as the field evolves (Anon., 2013).

Many animals, such as spiders, lizards and birds, are entomophagous, as are many insects. People throughout the world have been eating insects as a regular part of their diets for millennia. Although this practice should be specified as human entomophagy, throughout this book entomophagy refers to human entomophagy. The earliest citing of entomophagy can be found in biblical literature; nevertheless, eating insects was, and still is, taboo in many westernized societies. The unconventional nature of entomophagy has meant that farming insects for food and feed has largely been absent from the great agricultural innovations in livestock farming that emerged in past centuries – with a few exceptions, such as bees, silkworms and scale insects (from which a red colorant is derived). Insects have also failed to feature on the agendas of agricultural research and development agencies worldwide, including at FAO. Until recently, references to insects for food and feed have been largely anecdotal. It is therefore unsurprising that insects are still lacking from the diets of many rich nations and that their sale for human consumption remains part of a niche food sector of novelty snacks. Nevertheless, insect consumption is not a new concept in many parts of the world. From ants to beetle larvae – eaten by tribes in Africa and Australia as part of their subsistence diets – to the popular, crispy-fried locusts and beetles enjoyed in Thailand, it is estimated that insect-eating is practised regularly by at least 2 billion people worldwide. More than 1900 insect species have been documented in literature as edible, most of them in tropical countries. The most commonly eaten insect groups are beetles, caterpillars, bees, wasps, ants, grasshoppers, locusts, crickets, cicadas, leaf and planthoppers, scale insects and true bugs, termites, dragonflies and flies (Anon., 2013).

The research aimed at assessing the perceptions and willingness of poultry farmers, feed traders and processors to use insects as a source of protein ingredient in poultry feed. The research used a cross-sectional design and a structured questionnaire to collect quantitative data from 287 poultry farmers and 71 feed traders from 3 culturally diverse regions in Uganda. The study findings revealed that majority of the farmers mixed their own poultry feed. Willingness to use insects in poultry feeds was expressed by over 70% of the farmers, feed traders and processors, indicating a strong potential demand for insect-based feeds. However, some poultry farmers doubted the possibility of acquiring insects (rearing/ harvesting) in large enough quantities and the

consumers' acceptance of poultry products from birds raised on insect-based feed. Nonetheless, there is a high potential for adoption of insects for use as poultry feed if they can be produced in sustainable quantities that ensure the viability of poultry farming and the feed processing businesses (Sebatta *et al.*, 2018).

Insect as food in North East India:

The Northeast India is one of the major biodiversity hotspots, where a large percentage of its flora and fauna remains unexplored. The Northeast India is home to many traditionally living indigenous tribes and communities who are in constant touch with nature. The Moridhal Panchayat in Dhemaji district of Assam, Northeast India, houses four main indigenous Assamese communities – Mising, Lalong, Koch and Ahom apart from others. These communities are reservoir of traditional ethno-zoological knowledge and ethno-zoological practices. During the survey it was found that these communities use 16 species of insects belonging to 6 orders of class Insecta as food as well as for the treatment of over 6 kinds of diseases including whooping cough and asthma. These traditional practices needs to be further investigated which may eventually lead to the discovery of new and more effective drugs (Dutta *et al.*, 2016).

Edible insects are good source of supplement food item that could meet the people present and future need. In some parts of the world insect are used for human food, while being a taboo in other places and cultural groups. Edible insects are natural renewable resource that provides food and economical safety to many ethnic groups in Eastern Himalayas. The present study deals with the different edible insects consumed by the different ethnic communities and tribes inhabited in Eastern Himalayan. Red ants are one of the food items in Assamese festival like Bohag Bihu especially by the Mishing Tribe and Ahom Community. The adult termites are eaten fried by the tribal communities of Manipur, Assam and Nagaland which is rich source of protein, fat and essential amino acids. Most of the tribal communities in North Eastern India prefer pre pupal stage of Eri pupa for consumption. Manipuri's preferred special recipe of snail which is made in combination with dry fish, locally called Tharoi thongba whereas, Manipur tribal consumed the giant water bug by pushing the dry rice inside the body and boiled it. Honey bees are mostly eaten in Assam and Manipur by making chutney, fry and bakery product. Grasshopper, field cricket are simply fried with salt, chilly spices and mustard oil and consumed directly. Hence, the edible insect can be comparable with other conventional food products by integrating scientific cultivation and validation to the traditional wisdom for livelihood development of the tribal's (Chowdhury *et al.*, 2015).

Insects are quality food items that can provide substantial amount of nutrients essential for maintenance of health and protection from age related diseases. The ethnic people of India consume different insects as food. Practice of entomophagy is quite common among the ethnic individuals of North East India especially among the tribes of Nagaland, Manipur, Arunachl Pradesh and Assam and to a lesser degree by the tribes of Mizoram and Meghalaya. The tiwa are an ethnic community of Assam. Certain species of edible insects are found abundantly in Tiwa villages. The present study was conducted to record the status of entomophagy

in tiwa community of Morigaon district, enlist the diversity of edible insects and determine their nutritional value. It was found that 15 species of insects belonging to 6 orders such as Hemiptera, Coleoptera, Orthoptera, Hymenoptera, Odonata and Isoptera of class insecta are consumed by the Tiwa people. People use these insects as their regular diet or during special occasions.

Nutritional value of the insects consumed was also determined and it was found that they were rich in nutrients especially in proteins, suggesting their use as good nutritional supplements of balanced diet (Rahman *et al.*, 2018).

In a study it is revealed that a total of 25 species of insects, belonging to eight orders and fourteen families are consumed as food by the Bodos. Out of them ten species belong to order Orthoptera, five to the Hymenoptera, three to Coleoptera, two each to Odonata and Hemiptera and one each to Araneae, Lepidoptera and Isoptera. The ethnozoological knowledge of this tribe ranges from edible to medicinal use. This study aims to make a comprehensive list of edible insects consumed by the Bodos of Assam (Narzari and Sarmah, 2015).

Edible insects are a natural renewable resource that provides food to many ethnic groups abroad and North East India too. Some of these species are overexploited because of increased consumption, caused by the huge human population growth in the area. The rural people hunt or collect different kinds of resources, in order to have more means to satiate their hunger, but the quantity or quality of foods found is unequal depending on the place, season and people seeking these foods. Insects are a healthy, nutritious and a savoury meal. Species of insects are collected according to their seasonal presence and abundance. Most people in developed countries dislike or hesitate to consume them – probably because they are repulsed by the appearance of insects, not their taste. Tribal people especially Rabha people of Assam have chosen to take entomophagy as a sustainable source of food as it has been using since ancient times, a knowledge which has been passed down from generation to generation through word of mouth. The Rabhas are a tribe belonging to the great Bodo family and scattered in parts of lower Assam, Kamrup district, Goalpara district, parts of West Bengal and Meghalaya. Some edible insects consumed by Rabha people in lower Assam in India are cricket, grasshoppers, water giant bug (Bellostoma) termites, red ants, beetle larvae, pupa of insects, water skater (Gerridaec) etc. Edible insects, among the Rabhas, are not used as emergency during food shortages, but are included as a planned part of the diet throughout the year or when seasonally available. Insects can be accepted favourably in the future by processing and mixing them with other foodstuffs (Rabha, 2016).

Insects are an important component in the diets of the different communities of Assam. Consumption of the insects which are usually pest on different agri-horticultural crops benefits us by decreasing their numbers and also reduces the need to make use of pesticides. Insects also form an important source of animal protein so more research should be conducted to rear them artificially for the purpose of making them an essential component in our diet. Many people use insects as a source of income for their livelihood either by selling their by-

products like honey, silk, etc. or by directly collecting and selling different insects as food. Thus, insects play an important role in the socioeconomic lives of the different communities of Assam. Thus, further research on edible insects should include key factors like ecology, management and conservation implications, industrialization and marketing. It would also be helpful to document entomophagy and techniques of artificial rearing so that edible insects can be used as food and they can also be used as a medicine in a sustainable manner for the benefit of mankind (Hazarika, 2018).

Insects as feed:

The cost of compound feed is a constraint in intensive fish and poultry farming, contributing 60-80% of the total production costs, 70% of which is due to fish and soy meal used as protein source. There is limited information on the practice as well as technical and economic feasibility of the use of insects as alternative protein ingredients in compound feed. Excluding South Africa, rearing, processing and use of insects is still at experimentation level at laboratory scale. Insects (grasshoppers, house fly maggots, Westwood larvae, termites and garden snail) meal replaced conventional protein sources by 10-100% without affecting the growth performance of fish and poultry. In some cases, insect based feed performed better than conventional feed. Published research confirms the potential of insects for use in poultry and fish production systems and mass production and processing of target insects is the next necessary step. Based on available and ongoing research, piloting and up-scaling the use of insects as alternative protein sources in animal feed in partnership with private sector is necessary. This will confirm and enhance the technical and economic feasibility of using of insects as an alternative protein source on a commercial scale (Ssepuuya *et al.*, 2017).

Conclusion:

Though certain anti-nutrients like hydrocyanide, oxalates, pytates, tannins etc. are reported in edible insects, it is also reported that these materials are present in a negligible amount are below mammalian toxicity level. There is enough potential to improve the nutritional quality of human food, fortified with insect nutrients. Hence, an information hub of edible insects may be developed covering as many tribes as possible before the existing traditional information is lost and attempts may be made to ensure food security. Traditional food is nutritious, economic, ecofriendly an also sustainable as a cottage industry, especially in rural areas of the country. To manage human food security, edible insects also can play its role through development of ecologically suitable collection and artificial rearing techniques. Year round availability of these insects may be possible by developing improved conservation techniques and modern insectary. High reproductive capacity of insects is an added advantage towards this venture and needs attention from both government organizations. Rewards in terms of long-term food security, income potential, pesticide reduction, and insect conservation are conceivable, and thus entomophagy has the potential of becoming an important factor in sustainable development. Although the

majority of edible insects are gathered from forest habitats, innovation in mass-rearing systems has begun in many countries. Insects offer a significant opportunity to merge traditional knowledge and modern science in both developed and developing countries.

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SOLID STATE NUCLEAR TRACK DETECTOR (SSNTD) AND ITS APPLICATION

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Abstract:

Alpha particle tracks can be studied by measuring the diameter of alpha particle tracks using solid state nuclear track detector (SSNTD).SSNTD is a track forming material and it can store tracks .For the formation of track, a track forming material should have some characteristics such as low free carrier density, low carrier mobility, high resistivity etc. The sensitivity of different track forming material is different. From the study,it is found that the diameter alpha particle track is in the range of 1-10 micrometer. SSNTD can be used for the study of radon concentration, identification of elements, blood purification and many more. SSNTD are used in most of the branches of the science. So it becomes an important tool for science.In my study the diameter of alpha particle track found to be 7.24 micrometer by using LR-115.

1. Introduction:

The science of solid-state nuclear track detector was first introduced by D A Young [2] in 1958 when working at the Atomic Energy Research Establishment (AERE) at Harwell, England. Young observed that when Lithium Fluoride crystal placed 1mm away from Uranium Oxide film were irradiated by thermal neutrons, the surface of the crystal shows number of shallows etch pits after treatment with the chemical reagent ($HF+CH_3COOH$) and saturated iron trifluoride. The number of pits had one to one correspondence with the fission fragments recoiling into the crystals from the uranium foil. Thus, a particle detector was born, but its potential was not realized until three more years. Young had recognized the existence of tracks and demonstrated that tracks could be etched and made optically visible and explained the track formation as a resultant trail of damage left behind by the passage of fission fragments.In 1959, E C H Silk and R S Barnes [3] of AERE Harwell directly observed the damage region produced by fission fragments in thin sheet of mica under transmission electron microscope. The work

published by Young was not known to them. The credit for development of particle detector from the observation of tracks due to damage by fission fragments goes to R L Fleischer, P B Price and R M Walker in 1961 [4]. After that, field has grown to such an extent that currently in most of the field of science and technology it finds its application. In this work LR-115 is used for our study.

2.Experimental Details:

Charged particles transferred their energy to matter through Coulomb interaction with the atomic electrons, thus inducing excitation or ionization of the atoms. The form in which the converted energy appears depends on the detector and its design. The gases detectors for example, are design to directly collect the ionization electrons to form an electric current signal, while in scintillators, the excitation and successive de-excitation contribute to inducing electron transitions which result in the emission of light. Similarly, in photographic emulsion, solid state nuclear track detector (SSNTD), the ionization induces chemical reactions which allow a track image to be formed and so on. [1]. The damage part or trails have greater chemical activity than that of bulk materials. This is due to the disorder structure which contains large free energy. In this method the material with damage trails are immersed in a suitable chemical solution. The reagent reacts with the damage trails more than with the undamaged portion or bulk material. The decomposition of deposited damage parts and precipitated in the solution and visible tracks. The process of enlarging the track dimension by chemical action is called chemical etching. For formation of track chemical etching the rate of etching along the track (V_T) should be greater than rate of etching of the bulk material.

3. Results andDiscussions: Diameter of alpha particle track:

In this measurement, four set of observations have been taken and their mean diameters and standard deviations are calculated by the equation 1 and 2 respectively:

$$d_{mean} = \Sigma f_i d_i / \Sigma f_i \quad \ldots\ldots\ldots\ldots \quad (1)$$

$$\sigma_{mean} = \sqrt{[(\Sigma di - d_{mean})^2/(n-1)]} \quad (2)$$

The figure1 shows the alpha LR-115 with alpha tracks. The frequency distribution of the mean diameter for all tracks are plotted in figure: 2 for LR-115. The probability density function of a distribution function is given by:

$$P(x)=1/\sqrt{(2\pi x_{mean})}\exp(-xi-x_{mean})^2/2x_{mean} \ldots (3)$$

From the estimated values of the mean diameter, the probability density functions are drawn and plotted in Figure:2

Figure. 1: LR-115 with alpha particle tracks

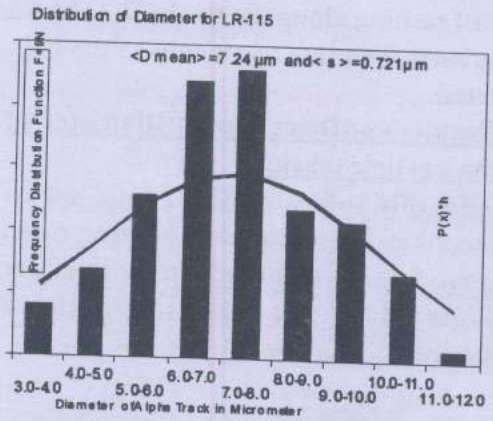

Figure. 2: Distribution of Diameter of alpha particle tracks

4. Summary and conclusion:

In this work, an attempt has been made to study the response characteristics of alpha particles tracks in LR-115 detector. The track diameters of the alpha particles after passing through the detector are studied. The measured value of the diameter of the alpha particles from the experiment is found to follow approximately a Gaussian distribution for the studied detector. The mean value of diameter of the tracks in LR-115 is found to be 7.24 µm. Diameter of alpha particle track is in the range 1-10 µm hence, the LR-115 detector is better for track counting in radon estimation.

The standard deviation of tracks in LR-115 is also found to be 0.721µm which shows large variation of diameter of alpha tracks. It helps in the estimation of radon concentration. This detector is very much useful for identification of particles from proton to iron in areas where supply of power is not possible.

5. SSNTD and ITS Application:

Since long back, the search for low cost but efficient radiation detection instrumentation is being continued in the Nuclear Physics and Radiation Laboratories. Even though a number of attempts have been made by several workers, finally in 1961, it was R L Fleischer, P B Price and R M Walker could succeed to develop such a low cost but efficient particle detector what is known as Solid State Nuclear Track Detector, or more popularly known as SSNTD. They showed that poor semiconductors and insulators could be used to detect and characterise various charged particles through the technique of optical visualization of their damaged trails in the medium using chemical etching. Immediately after this discovery, the field of SSNTD has undergone a phenomenal growth and has achieved the status of a separate scientific discipline in its own right.

The Solid-state nuclear track detector (SSNTD) where it has got well established applications include fission and nuclear physics, space physics, study of meteoritic and lunar samples, cosmic rays, particle accelerators and reactors, metallurgy, geology and archaeology, medicine and biology and many others [5-10].

5.1 SSNTD in Geochronolog:

Most of the materials contain some traces natural Uranium. Some Uranium atoms have been decaying by spontaneous fission process. Some latent damage trail in the material is created by fission fragment.Density of latent damage trails is proportional to product of age of the material and the Uranium content. Age of the

solidification can be known by knowing the uranium content of the material. This is fission track dating. This method is used in dating of geological, archaeological, cosmological samples and also in ocean bottom spread and continental drift. It is also used in distribution of Pu, U, Th, B, Pb, Bi. Plastic track detector is also used in measurement of uranium and thorium.

5.2. SSNTD in Seismology:

SSNTD can be used in the prediction of earthquake. Many changes taking places in earth crust, small fractures releases radon gas which are trapped within the ground and the changes takes place in that region prior to major physical jolt of an earthquake. Under favorable conditions radon intensity as a function of time should be co-related. It changes with seismic activity in the area. This kind of information can be used to predict the earthquake.

5.3. Cosmological Application:

SSNTD can be used in the measurement of cosmic rays' fluxes at high altitude and track studies. Apollo and Luna samples gives information concerning their past radiation and thermal histories. The dynamical process on moon-track analysis along with the micro crater studies gives interesting information concerning the composition and fluxes of micrometeoroids in space. In past tracks analysis gives the information about- (i) the erosion and accretion rates on lunar surface, (ii) the original size of meteorites to their loss mass caused by ablation while entering the earth's atmosphere, (iii) the tektites' fall time to the earth and (iv) the existence of fluxes of cosmic rays during different periods of time.

5.4. Application in Material Science:

Various experiences show that when the dimension of the artificial structures approach or becomes small that particular characteristic dimensions such as wavelength mean free path, coherence length and molecular sizes it becomes possible to access material in new and different ways, thus giving a new approximation of nuclear tracks in solid. Such application is possible due to the ability of nuclear tracks to influences the global properties of the materials through structural changes in region. One of the most important examples of such application is in firing magnetic optics iron garnets. Latent tracks as well as etched tracks can be applied for the purpose of changing magnetic materials.

5.5. Biological Application of SSNTD:

Use of producing "through holes" by etching latent damage trails has also helped in making filters. The size, shape, position and number can be controlled through experimental details. In filtering of cancer cells from human blood and cleaning of air from dust particles SSNTD can be used as filters. SSNTD also been made in the radiobiology of plutonium. One of the importance of such studies due to the extensive involvement of scientists in plutonium production and latent danger of its increased intake by the personal working with it. SSNTD's also been used to find location of plutonium concentration in living matter. The method is very simplest one. The detector is placed in contact under study

and a direct autograph is taken of natural alpha decay is obtained, another a rapid mapping is by irradiating the detector tissue assembly by thermo neutron in a reactor. An image resolution of about 10μm or better can be achieved by using SSNTD's. In medical diagnostics it is much important to study the living cells. Conversional flow cytometry uses capillaries with inner between 10μm to 100μm. The economical uses of etched tracks employ one single etched track count, size and measure the electro kinetics mobility of submicron size particles. The size diameter of red blood cells is about 7.5 μm and its thickness is in between 1-2 μm. The dough nut shaped healthy red blood cells are extremely flexible and easy squeeze through the considerably finer capillaries of human body, the diameter is in between 3-5μm. Many diseases of heart and circulatory system have been traced to an insufficient deformability of red blood cells. The drug influences the characteristics of red blood cells. It shows that with passage times these cells through single pores can yield important information about rigidity of these cells. It is found that stiffer the cell longer it takes to pass through the pores of nuclear track micro filter. The single pore membrane is the control unit of a measuring cell, which can be divided into lower and upper compartment. The measuring pore has precisely had diameter about 5μm. Only one human red blood cell at a time can 'squeeze' itselfthrough artificial capillaries. It is important to maintain a constant pressure difference between upper and lower compartments. A number of red blood cells are measured in succession to obtain the passage time spectrum representing various deformability.

2.6. Elements analysis using SSTTD:

SSNTD can be used for measurement and concentration and distribution of a number of elements (uranium, lead, boron, lithium) in a variety of material. The requirement is that some high ionizing reaction products should emanate from samples under study. The incident particles upon hitting the samples form reaction products which produce latent trails in the track detector. The detector is subsequently etched and canned. The spatial resolution of such method is limited primarily by the range of reaction products in etched track detector. The resolution will amount to about 10μm, example in case of uranium in silicate minerals. If isotopes of the element of interest is radioactive and emits alpha particles, it may be possible to carry out elements mapping without any irradiation. SSNTD also found application in bird altimetry and lithography. SSNTD techniques can be used to measure the lead contents and its distribution in teeth and bone and to relate it if possible, with age of person. Radioactive isotopes 206Po and 210Po are produced from 206, 207, 208, Po bombardment with 3He 4He. They have half-life 8.8 and 138 days respectively. Teeth and bone show increase of lead with increase of age giving clear indication that lead enters blood through food and inhalation of car exhausts and industrial pollutions.

5.6. Conclusion:

It is important for the determining the element present in an area, such as top of the hill, the area in space where there is no source

of power. It is well known that SSNTD have large application in Science and day to day life.

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SPECIAL RADICALS WITH GENERAL CLASSES OF NEAR-RING MODULES

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Abstract:

We deal with Special Radicals in Near-ring modules. In this paper, we introduce the concept of Radicals with general classes of Near-Ring Modules for each near-ring R, let M_R be a class (possibly empty) of R-modules M with $RM \neq 0$ and study several features of this radicals with general classes in near-ring modules.

Introduction:

The study of Radicals with general classes of near-ring modules is done by Andrunakievich, G.F Birkenmeier, H. Heatherly introduced another notion of a Radicals with general classes of near-ring modules. G.L. Booth and N.J. Groenewald extended the Andrunakievich-G.F. Birkenmeier definition to near-ring and defined a near-ring R to be classes. In this section, we generalize these ideas to any R-module M.

Preliminaries:

In this section, we recall some preliminary definitions and results to used in the sequel.

1.1 Definition:

For each near-ring R, let M_R be a class (possibly empty) of R-modules M with $RM \neq 0$. Then we define

$$\rho(R) = \bigcap\{(0:M)_R : M \in M_R\}.$$

Now let $M = \{M_R : R \text{ is a near is near-ring}\}$.

1.2 Definition:

The class M is called a general class of near-ring modules if it satisfies the following conditions.

(G1) If $I \lhd R$ and $M \in M_{\frac{R}{I}}$, then $M \in M_R$.

(G2) If $M \in M_R$ and $I \lhd R$ such that $I \subseteq (0:M)_R$, then $M \in M_{\frac{R}{I}}$.

G3) If $\rho(R) = 0$ than $Mi \neq \phi$ for all nonzero ideals I of R.

(G4) If than $Mi \neq \phi$ whenever $0 \neq \lhd R$, then $\rho(R) = 0$.

In view of the above definition, we record the following observations made by Veldsman in [7].

(a) Let $R = \{R$: there exists $M \in M_R$ such that $(0:M)_R = 0\} \cup \{0\}$. Then R is a Kurosh – Amitsur radical class.

(b) If the class M satisfies **(G1)** and **(G2)**, then R is a Hoehnke radical class.

Now let T be a class of near-rings that is closed under homomorphic images. For the near-ring R, let M_R be a class of near-ring modules and let.

$M = \cup\{M_R : R$ is a near-ring$\}$.

1.3 Definition:

The class M is called a T-general class if it satisfies.

(T1) If $I \lhd R$ and $M \in M_{\frac{R}{I}}$, then $M \in M_R$.

(T2) If $M \in M_R$ and $I \lhd R$ with $I \subseteq (0:M)_R$, then $\in M_{\frac{R}{I}}$

(T3) If $R \in T$ and $\rho(R) = 0$, then $M_i \neq \phi$ for every $0 \neq I \lhd R$.

(T4) If $R \in T$ and $M_i \neq \phi$, then whenever $0 \neq I \lhd R$, we have $\rho(R) = 0$.

1.4 Definition:

If M is a T-general class, then the class $R = \{R$: there exists $M \in M_R$ with $(0:M)_R = 0\} \cup \{0\}$ is called a T-radical class.

1.5 Definition:

A class $M = \cup M_R$ of near-ring modules is called a T-special class if it satisfies the following conditions:

(M1) If $M \in M_R$ and $I \lhd R$ with $IM = 0$, then $M \in M_{RI}$.

(M2) If $I \lhd R$ and $M \in M_{RI}$, then $M \in M_R$.

(M3) If $M \in M_R$ and $I \lhd R \in T$ with $IM \neq 0$, then $M \in M_I$.

(M4) If $M \in M_R$, then $RM \neq 0$ and $R_{(0:M)R}$ is a 2-prime near-ring.

(M5) If $I \lhd R \in T$ and $M \in M_I$., then there exists an R-module $N \in M_R$ such that $(0:N)_I \subseteq (0:M)_I$.

(M6) If $K \lhd I \lhd R \in T$ and there exists a faithful $_{IK}$-module $M \in M_{\frac{R}{I}}$ then $K \lhd R$.

1.6 Definition:

A class F of near-rings is called a T-special class if the following conditions are satisfied:

(R1) If $R \in F$, then R is 2-prime.

(R2) If $R \in F \cap T$ and $I \lhd R$, then $I'' \in F$.

(R3) If $K \lhd I \lhd R \in T$ and $_{IK} \in F$, then $K \lhd R$.

(R4) If $I \lhd R$ and $I \in F$, then $R \in F$ (ie. F is closed under essential extensions).

In particular, prime R-ideals of the R-module M led to prime ideals of R and, under certain conditions, the converses also existed. It is, therefore, natural to assume that there is a relationship between special radicals of near-rings and special radicals of their modules. In the one theorem that follow, we show the construction of a special class of near-rings from a special class of near-ring modules and the reversal of the process.

1.7 Theorem:

Let $M = M_R$ be a T- special class of near-ring modules. Then $F = \{R$: there exists

$M \in M_R$ with $(0:M)_R = 0\} \cup \{0\}$ is a T- special class of near-rings.

Proof:

(R1): Let $R \in F$. Then there exists an $M \in M_R$ with $(0:M)_R = 0$. From **(M4)** we have that $_{R(0:M)R}$ is a 2-prime near-ring.

(R2): Let $R \in F \cap T$ and $I \lhd R$. Then there exists $M \in M_R$ such that $(0:M)_R = 0$. If $I=0$, then $I \in F$ and we are done. If $I \neq 0$, then $IM \neq 0$ (for if $IM = 0$, we have that $I \subseteq (0:M)_R = 0 \Rightarrow I = 0$). Hence, from **(M3)**, it now follows that $M \in M_I$. Furthermore, $(0:M)_R \subseteq (0:M)_R = 0$. Therefore $I \in F$.

(R3): Let $K \lhd I \lhd R \in T$ with $\frac{I}{K} \in F$, Since $_{IK} \in F$, there exists an $_{IK}$-module M (ie. $M \in M\frac{I}{K}$) such that $(0:M)\frac{I}{K} = 0$. From **(M6)**, it follows that $K \lhd R$.

(R4): Let $I \lhd R$ and suppose that $I \in F$. So there exists $M \in M_I$ with $(0:M)_I = 0$.

From **(M5)**, there exists $N \in M_R$ such that $(0:N)_I \in (0:M)_I = 0$.

But $0 = (0:N)_I = (0:N)_R) \cap I$. Since $I \lhd R$ and $(0:N)_R \lhd R$, we have that $(0:N)_R = 0$.

Hence we have that $R \in F$.

1.8 Proposition:

Let M be a T-special class of near-ring module and suppose $I \lhd R \in R_0$. Let F be the corresponding T-special class of near-rings. Then $\frac{R}{I} \in F$ if and only if $I = (0:M)_R$ for some $M \in_R$.

Proof:

Suppose $I \lhd R \in R_0$ and $-\frac{R}{I} \in F$. Then there exists $M \in M -\frac{R}{I}$ such that $(0:M) -\frac{R}{I}$ $-=0$. So it follows from **(M2)** that $M \in M_R$. Since $(0:M) -\frac{R}{I} = (0:M) -\frac{R}{I}$, it also follows that $(0:M) -\frac{R}{I} = 0$. Hence $I = (0:M)_R$ as required.

Conversely, suppose that $I = (0:M)_R$ for some $M \in M_R$. Then by **(M1)**, we have $M \in M -\frac{R}{I}$. Furthermore, $(0:M) -\frac{R}{I} = (0:M)$ $-\frac{R}{I} = II = 0$. Hence $-\frac{R}{I} \in F$.

Booth and Gronewald [3] have already shown that the class, $Me = \cup M_R$ where M_R = {M:M is an equiprime R-module}, is a special class of near-ring modules if R belongs to the class of zerosymmetric near-rings. In the results that follow, we prove that similar constructions of classes with respect to 2-prime, 3-prime, c-prime, strongly prime and s-prime near-ring modules result in special classes of the respective near-ring modules. However, we restrict R to the class of A-near-rings (Andrunakievich near-rings). In each case, we show that the six conditions of definition is satisfied. Although proofs of these conditions for the various special classes may seem to be repetitive, we only omit those parts which are exactly the same.

1.9 Proposition:

Let R be an A-near-ring. Let $M_R = \{M:M$ is a 2-prime R-module$\}$ and let $M_2 = \cup M_R$. Then M_2 is an A-special class of near-ring modules.

1.10 Corollary:

If M_2 is an A-special class of near-ring modules, then the A-special radical induced by M_2 on a near-ring R is given by $P_2(R) = \cap\{(0:M)_R : M$ is a 2-prime R-module$\}$.

$= \cap\{I \lhd R : I$ is a 2-prime ideal of R$\}$.

1.11 Proposition:

Let R be an A-near-ring. Let $M_R = \{M:M$ is a 3-prime R-module$\}$ and let $M_3 = \cup M_R$. Then M_3 is an A-special class of near-ring modules.

1.12 Corollary:

If M_3 is an A-special class of near-ring modules, then the A-special radical induced by M_3 on a near-ring R is given by $P_3(R) = \cap\{(0:M)_R : M$ is a 3-prime R-module$\}$.

1.13 Proposition:

Let R be an A-near-ring. Let $M_R = \{M:M$ is a c-prime R-module$\}$ and let $M_C = \cup M_R$. Then M_C is an A-special class of near-ring modules.

Proof:

(M1): Let $M \in M_R$ and let $I \lhd R$ such that $IM = 0$. Then M is an $-\frac{R}{I}-$module with respect to $(R+I)m = rm$ where $r \in R$ and $m \in M$. Now let $a+I \in -\frac{R}{I}$ (where $a \in R$) and $m \in M$ such that $0 = (a+I)(m) = am$. Since M is a c-prime R-module, it follows that $0 = aM = (a+I)M$ or $m = 0$. Thus M is a c-prime $-\frac{R}{I}-$ module and so $M \in M-\frac{R}{I}$.

(M2): Let $I \lhd R$ such that $M \in M-\frac{R}{I}$. Then M is an R-module with respect to $rm = (r+I)m$ where $r \in R$ and $m \in M$. Let $a \in R$ and $m \in M$ such that $0 = am = (a+I)m$. Since M is a c-prime $-\frac{R}{I}-$module, it follows that $0 = (a+I)M = aM$ or $m = 0$. Therefore M is a c-prime R-module and so $M \in M_R$.

(M3): Let $M \in M_R$ and $I \lhd R \in A$ such that $IM \neq 0$. By previous Proposition, M is a c-prime I-module. Hence $M \in M_I$.

(M4): If $M \in M_R$, then by definition of a c-prime R-module, we have that $RM \neq 0$. Furthermore, by Corollary, (0:M)R is a c-prime ideal of R whence $_{R(0:M)R}$ is a c-prime near-ring. But any c-prime near-ring is also 2-prime. Hence $_{R(0:M)R}$ is a 2-prime near-ring.

(M5): Let $I \lhd R \in A$ and $M \in M_I$. Since M is a c-prime I-module, $(0:M)_I$ is a c-prime ideal of I. The rest of the proof follows as in Proposition by replacing 2-prime with c-prime.

(M6): Let $K \lhd I \lhd R \in A$ and let $M \in M\frac{I}{K}$ be a faithful $\frac{I}{K}$-module. Since M is a faithful $_{IK}$-module, $(0:M)\frac{I}{K} = 0$. But M is a c-prime $\frac{I}{K}$-module. Hence $0 = (0:M)\frac{I}{K}$ is a

c-prime ideal of $\frac{I}{K} \Rightarrow \frac{I}{K}$ is a c-prime near-ring. So K is a c-prime ideal of I and hence, it follows that, since I is an A-ideal of R, $K \lhd R$.

1.14 Corollary:

If M_c is an A-special class of near-ring modules, then the A-special radical induced by M_c on a near-ring R is given by $P_c(R) = \cap\{(0:M)_R : M \text{ is a c-prime R-module}\}$.

1.15 Lemma:

Let R be an A-near-ring and let $I \lhd R$. Then

(a) $\aleph(I) \subseteq \aleph(R)$

(b) If $I \lhd R$ such that $\aleph(I) = 0$, then $\aleph(R) = 0$.

Proof:

(a) From Lemma, $\aleph(I) \subseteq I \cap \aleph(R)$. Hence $\aleph(I) \subseteq \aleph(R)$.

(b) : Suppose that A is a nonzero nil ideal of R. Since $I \lhd R$ we have that $A \cap I \neq 0$. Furthermore, $A \cap I \lhd I$. Since $\aleph(I) = 0$, $A \cap I$ cannot be a nil ideal of I which implies that there exists $x \in A \cap I \subset A$ such that $xm \neq 0$ for all $m \in \mathbb{N}$. This contradicts the fact that A is a nil ideal of R. Hence $\aleph(R) = 0$.

1.16 Corollary:

Let $v = 2, 3$. If M_{vs} is an A-special class of near-ring modules, then the A-special radical induced by M_{vs} on a near-ring R is given by

$P_{vs}(R) = \cap\{(0:M)_R : M \text{ is a } v\text{-s-prime R-module}\}$.

Conclusion:

The result in this paper gives only the concepts of Special Radicals with General classes of near-ring Modules. Many more information regarding its properties and applications can be expected.

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STUDIES ON MEDICINAL PLANTS OF SUALKUCHI AREA OF KAMRUP DISTRICT, ASSAM

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ABSTRACT:

The present study is carried out to document and analyze the medicinal plants of Sualkuchi area of Kamrup district, Assam during the year 2018 -2019. The study includes the plants which are traditionally use directly as medicine or use for preparation of various alternative medicines. During the period of survey a total 199 species of medicinal plant belonging to 163 genera and 78 families are recorded. The most dominant families are Asteraceae and Euphorbiaceae with 11 numbers of species each and Solanaceae with 9 species. Some rare medicinal plants reported from the area are *Andrographis pandiculata, Acorus calamus, Asparagus racemosus, Bacopa monnieri, Boerhaavia diffusa, Butea monosperma, Rauvolfia serpentina, Mucuna Pruiens, Corton tiglium, Piperlongum, Wdellia calendulacea.*

Key Words: - Sualkuchi area, Medicinal plants

INTRODUCTION:

The term **"medicinal plant"** includes various types of plants used in herbalism ("herbology" or "herbal medicine"). The earliest literature on Indian medical practice appeared during the Vedic period in India (Joshi and Joshi, 2013). Most of the drugs used in modern medicine and ancient Indian medicinal system are of plant origin. Among ancient civilizations, India has been known to be rich repository of medicinal plants. The forest in India is the principal repository of large number of medicinal plants, which are largely collected as raw materials for manufacture of pharmaceutical products. About 8,000 herbal remedies have been codified in AYUSH systems in India. Ayurveda, Unani, Siddha and Folk (tribal) medicines are the major systems of indigenous medicines. Indian systems of medicine 'Ayurveda', 'Sidha' and 'Unani' entirely, and homeopathy to some extent, depend on plant materials or their derivatives for treatment of human ailments (Prajapati *et al.*, 2003, Saikia and Khan, 2011).

Recently, WHO (World Health Organization) estimated that 80 percent of people worldwide rely on herbal medicines for some aspect of their primary health care needs (Salio *et al.*, 2017). More than 30,000 plants specimen of medicinal importance are grown all over the world, but only around 2,500 plants species are known to be useful for medicine preparation (Sultana and Mukherjee 2015).

The state of Assam has diverse topology. It has riverside, hills and valleys. The diverse topology of the state provides platform for diverse biodiversity of Assam. In consideration of above, the present study entitled "Studies on Medicinal Plants of Sualkuchi Area of Kamrup District, Assam" is taken up to understand and find the use of plants which are available in Sualkuchi area as a source of medicine in their own medicine lore. The earlier studies indicated that the present study area is rich in respect of biodiversity (Choudhury and Kalita in 2015, 2017). So present work is carried out to study and document the medicinal plants of this area. The findings of this study are expected to provide baseline information on diversity of medicinal plants of Sualkuchi area of Assam.

MATERIALS AND METHODS:

Study Area:- The present study is carried out at Sualkuchi and its surrounding areas of Kamrup District, Assam to find out medicinal plant diversity of the area during the year 2018 - 2019. The study area is situated at the north bank of the river Brahmaputra, about 35 km away from Guwahati city of Kamrup District, Assam and is located at 6.17°N latitude, 91.57°E longitude and 33 m altitude. It covers a total area of about 9.37 square kilometres. The hilly areas and Brahmaputra river bank areas of Sualkuchi have a rich plant diversity including many medicinal plants.

Methodology:- Field survey in different parts of Sualkuchi area are done randomly and recorded the medicinally important plant species occurred in the area. The information about common name and medicinal value of these plants have been obtained or gathered from different literature such as Saikia *et al.*, 2011; Sharma and Das, 2018; Sarkar and Devi, 2017; Gogoi *et al.*, 2019, Dharma and dharma, 1994; Paranjpe, 2001; Joshi, 2003 and consulting with relevant experts also. The collected plants are preserved as dried herbarium specimen using standard herbarium techniques (Jain and Rao, 1977) and photographs are taken. The species are identified following *Flora of Assam* (Kanjilal *et al.*, 1934 – 1940; Bor, 1940), *Flora of British India*, (Hooker, 1872-1897) and comparing the herbaria of Department of Botany Gauhati University. For the up to date nomenclature www.theplantlist.org and Plant Diversity of Assam (Barua and Ahmed, 2014) has been consulted.

RESULTS AND DISCUSSION:

The result of the analysis of medicinal plants diversity of Sualkuchi area are presented in tabular form (Table 1; Plate 1 and Plate 2). The study has recorded 199 medicinal plants belonging to 78 families and 163 genera. Maximum number of species have been recorded from the family Asteraceae and Euphorbiaceae (11 species each) followed by Solanaceae (9 species), Papilonaceae, Malvaceae, Apocynaceae, Lamiaceae (8 species each), Caesalpinaceae, Polygonaceae (7 species each), Rutaceae and Araceae (6 species each), Amaranthaceae and Poaceae (5 species each). Rest of the families contains 1 species to 4 species each.

Table 1: - List of medicinal plants of Sualkuchi area have documented along with their scientific name, family, local name and parts used

S. No	Scientific Name	Family	Local Name	Part Use
1	*Dillenia indica* L	Dilleniaceae	Outenga	Fruits, Leaves
2	*Michelia champaca* L.	Magnoliaceae	Titasapa	Leaves, Flows
3	*Tinospora cordifolia* (Willd) Miers	Menispermaceae	Sagunilata, Giloi	Stems, Leaves
4	*Euryale ferox* Sailisb	Nymphaeaceae	Makhana	Seeds
5	*Nelumbo nucifera* Gaertn	Nelumbonaceae	Padum	Flowers, Seeds
6	*Argemone maxicana* L.	Papavaraceae	Sialkata	Roots, Seeds
7	*Nasturticum indicum* Dc	Brassicaceae	Ban sariah	Leaves, Seeds
8	*Cleome viscosa* L.	Cleomaceae	Bhutmula	Leaves
9	*Tamarix dioica* Roxb	Tamariaceae	Jhau	Twigs
10	*Garcinia cowa* Roxb. ex. DC	Clusiaceae	Kuji thekera	Fruits
11	*Abutilon indicum* G. Don	Malvaceae	Japabandha	Leaves, Bark
12	*Hibiscus rosa-sinensis* L.	-do-	Ghanta phul	Leaves, Flowerers
13	*H. mutabilis* L.	-do-	Stha;padma	Flowers, Leaves
14	*H. subdarifa* L	-do-	Tengamara	Leaves, Fruits
15	*Sida cordifolia* L.	-do-	Son-borial	Roots, Leaves
16	*S. rhombifolia* L.	-do-	Borial	Leaves
17	*Urena lobata* L.	-do-	Bonagra	Roots
18	*Triumfetta rhomboidea Jacq.*	-do-	Agra	Leaves, Roots, Bark
19	*Corchorus capsularis* L.	Tiliaceae	Marapat	Leaves, Roots
20	*Grewia helicterifolia Wall ex G. Don*	-do-	Agra	Roots, Bark, Leaves
21	*Oxalis corniculata* L.	Oxalidaceae	Tengesi	Whole plant
22	*Averrhoa carambola* L.	Averrhoaceae	Kordoi	Fruits
23	*Aegle mormelos* (L.) Correa	Rutaceae	Bel	Fruits
24	*Citrus aurantifolia* Swing	-do-	Kaji nemu	Fruits
25	*C. maxima* (Bum.) Osbeck	-do-	Rabab-tenga	Fruits, Leaves
26	*C. limon* (L.) Burn.f.	-do-	Nemu tenga	Fruits, Leaves
27	*C. paradise* Macfadyen	-do-	Gol nemu	Fruits, Leaves
28	*Murrya koenigii* (L.) Spreng	-do-	Narasigh	Roots, Leaves
29	*Azadirachta indica* A. Juss.	Maliaceae	Maha neem	Leaves, Bark, Bark, Seeeds
30	*Malia azedarach* L.	-do-	Ghora neem	Leaves, Roots, Fruits
31	*Ziziphus mauritiana* Lam	Rhamnaceae	Bagari	Fruits
32	*Cissus quadrangularis* L.	Vitaceae	Har-jora lata	Leaves, Stems
33	*Cardiospermum helicacabum* L.	Sapidaceae	Kapalphota-lata	Roots, Leaves
34	*Mangifera indica* L.	Anacardiaceae	Aam	Leaves, Fruits

35	*Spondias pinnata* (L.f.) Kurz.	-do-	Amara	Fruits, Bark Leaves
36	*Moringa oleifera* Lam.	Moringaceae	Sajina	Barl, leaves, Fruits
37	*Acassia farnesiana* (L.) Willd.	Mimosaceae	Taruakadam	Bark
38	*Mimosa pudica* L.	-do-	Lajuki lata	Leaves, Roots
39	*Bauhinia purpurea* L.	Caesalpiniaceae	Ranga-kanchan	Leaves, Bark
40	*B. variageta* L.	-do-	Baga-kanchan	Roots, Flowers.
41	*Cassia alata* L.	-do-	Kharapat	Leaves
42	*C. fistula* L.	-do-	Sonaru	Leaves, Fruits
43	*C. occidentalis* L.	-do-	Madelua	Roots, Leaves, Seeds
44	*C. tora* L.	-do-	Saru medelua	Leaves, roots
45	*Tamarindus indica* L.	-do-	Tateli	Fruits
46	*Butea Monosperma* (Lamk) Taub	Pappilonaceae	Palas	Fruit and Root
47	*Clitoria ternatea* L.	-do-	Aparajita	Seeds, Roots
48	*Crotalaria juncea* L.	-do-	Junjunia-ban	Seeds
49	*C. pallida* Aiton.	-do-	Ghantakarna	Seeds
50	*Flemingia strobilifera* (L.) Br.	-do-	Makhiyoti	Roots
51	*Mucuna pruriens* (L.) DC	-do-	Bandarkekoa	Fruits, Seeds, Roots
52	*Tephrosia purpurea* (L.) Pers.	-do-	Ban-nil	Leaves, Roots
53	*Butea monosperma* (Lam.) Taub.	-do-	Palash	Bark, Roots, Leaves, Flowers, Seeds
54	*Bryophyllum pinntum* (Lam.) Oken.	Crassulaceae	Pategaja	Leaves
55	*Quisqualis indica* L.	Combretaceae	Madhabi-lata	Seeds
56	*Terminalia arjuna* (DC) W.&A.	-do-	Arjuna	Bark, Fruits, Leaves
57	*T. bellirica* (Gaertn) Roxb.	-do-	Bhomora, Bhoira	Fruits
58	*T. chebula* Retz.	-do-	Silikha	Fruits
59	*Psidium guajava* L. Tree	Myrtaceae	Mdhuri-aam	Fruits, Leaves
60	*Syzygium cumini* (L.)Skeels	-do-	Kala-jamu	Bark, Leaves, Fruits, Seeds
61	*Melastoma malabathricum* L.	Melastomaceae	Phutuki	Leaves, Flowers
62	*Lawsonia inermis* L.	Lythraceae	Jetuka	Leaves
63	*Punica granatum* L.	Punicaceae	Dalim	Fruits, Leaves, Bark
64	*Jussiaea repens* L.	Onagraceae	Pani-khutura	Whole plant
65	*Ludwigia adscendens* (L.) Hara	-do-	Saru-halas	Whole plant
66	*Trapa natans* L.	Trapaceae	Pani-singari	Whole plant
67	*Carica papya* L.	Caricaceae	Amita	Fruits, Seeds
68	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Kuwa-vaturi	Fruits, Roots
69	*Momordica charantia* L.	-do-	Tita-kerela	Fruits, Leaves
70	*Opuntia dillenii* (Ker Gawl.) Haw.	Cactaceae	Sagar-phena	Fruits, Milky juice

71	*Centela asiatica* (L.) Urb.	Apiaceae	Saru-manimuni	Whole plant
72	*Coriandrum sativum* L.	-do-	Dhania	Fruits
73	*Eryngium foetidum* L.	-do-	Man-dhania	Leaves
74	*Hydrocotyle javanica* Thumb	-do-	Manimuni	Leaves
75	*Anthocephalus cadamba* Miq	Rubiaceae	Kadam	Bark, Flowers
76	*Ixora coccinea* L.	-do-	Rangan	Flowers
77	*Paederia foeitida* L.	-do-	Bhebeli-lata	Leaves
78	*Oldenlandia corymbosa* L.	-do-	Bon jaluk	Whole plant
79	*Ageratum conyzoides* L.	Asteraceae	Ganheli-ban	Roots, Leaves
80	*Artemisia indica* Wild.	-do-	Sirta	Whole plant
81	*Chromolaena odorata* (L.) Voigt	-do-	Jarmani ban	Leaves
82	*Eclipta prostrate* (L.) L.	-do-	Kehraj	Leaves, Roots
83	*Elephantopus scaber* L.	-do-	Hati-khoj	Roots, Leaves
84	*Emilia soncifolia* (L.) DC.	-do-	Kurkuchi	Leaves
85	*Enhydra fluctuans* DC.	-do-	Helachi	Leaves
86	*Spilanthus paniculata* DC	-do-	Mahavingaraj	Flower
87	*Tagetes erecta* L.	-do-	Narji	Leaves, Flowers
88	*Xanthium strumarium* L.	-do-	Agora	Leaves, Fruits, Roots
89	*Wedelia calendulacea* Lees.	-do-	Vhimraj	Leaves
90	*Mimusops elengi* L.	Sapotaceae	Bakul	Bark, seeds
91	*Nyctanthus arbour-tristis* L.	Oleaceae	Sewali	Flowers. Leaves
92	*Allamanda cathartica* L.	Apocynaceae	Gilashphul	Leaves, Bark
93	*Alstonia scholaris* (L.) R. Br.	-do-	Chatiyana	Bark, Milky juice
94	*Cascabela thevetia* (L.) Lippold	-do-	Halodhia-korobi	Milky juice
95	*Catharanthus roseus* (L.) G. Don	-do-	Nayantora	Leaves, Flowers
96	*Nerium indicum* L.	-do-	Rakta-karabi	Roots, Leaves
97	*Plumeria rubra* L.	-do-	Gulanch	Bark, Milky juice
98	*Rauvolfia serentina* Benth	-do-	Sarpagandha	Roots, Leaves
99	*Thevetia neriifolia* Juss.	-do-	Baga-karabi	Bark, Milky juice
100	*Calotropis gigantea* (L.) Dryand	Asclepiadaceae	Akon	Roots, Leaves
101	*Ipomea aquatic* Forssk.	-do-	Kalmou	Leaves
102	*I. batatas* (L.) Lam.	-do-	Mitha-alu	Roots
103	*I. obscure* (L.) Ker.- Gawl	-do-	Tarulata	Leaves
104	*Swertia chirayita* (Roxb.) Karsten	Gentianaceae	Chirata	Whole plant
105	*Cuscuta reflexa* Roxb.	Cuscutaceae	Raghumala	Seeds, Stems
106	*Datura metal* L.	Solanaceae	Dhatura	Seeds, Roots
107	*D. stramonium* L.	-do-	Dhatura	Leaves, Seeds
108	*Nicotiana tobacum* L.	-do-	Dhopat	Leaves

109	*Physalis minima* L.	-do-	Kapal-phota	Leaves, Fruits
110	*Solanum ferox* L.	-do-	Bon-bengana	Roots, Fruits
111	*S. nigrum* L.	-do-	Titbhakuri	Whole Plants
112	*S. torvum* Swartz.	-do-	Bhotbengena	Fruits
113	*S. spirale* Roxb.	-do-	Tita kuchi	Roots
114	*Withania sominifera* Dun	-do-	Ashagandha	
115	*Bacopa monnieri* (L.) Wetts.	Scrophulariaceae	Brahmi-sak	Whole plant
116	*Scoparia dulcis* L.	-do-	Bon-dhania	Whole plant
117	*Oroxylum indicum* Vent	Bignoniaceae	Takuna	Root, stem, Seeds
118	*Sesamum indicum* L.	Pedaliaceae	Til	Seeds
119	*Andrographis paniculata* Nees.	Acanthaceae	Kalmegh	Whole plant
120	*Justicia adhatoda* L.	-do-	Bahka	Leaves, Flowers
121	*Callicarpa arborea* Roxb.	Verbenaceae	Bon-mala	Bark
122	*Clerodendrum colebrookianum* Walp.	-do-	Nephaphu	Leaves, Roots
123	*C. viscosum* Vent.	-do-	Vetetita	Leaves, Roots
124	*Vitex negundo* L.	-do-	Pasatia	Leaves
125	*Anisomales ovalifolia* (L.) O. Ktze	Lamiaceae	Bantil	Whole plant
126	*Leucas plukentii* (Roth) Spreng	-do-	Doron	Leaves
127	*Leonurus sibricus* L.	-do-	Rang- doron	Roots, Leaves
128	*Ocimum sanctum* L.	-do-	Kala-tulasi	Leaves
129	*O. basilicum* L.	-do-	Bon-tulasi	Flowers, Seeds
130	*Hyptis suaveolens* Poit.	-do-	Tokma-tita	Leaves, Seeds
131	*Mentha spicata* L.	-do-	Pudina	Whole plant
132	*Pogostemon benhalensis* Kuntze.	-do-	Suklati	Leaves, Roots
133	*Boerhavia diffusa* L.	Nyctaginaceae	Punarnava	Whole plant
134	*Mirabilis jalapa* L.		Godhuligopal	Roots, Leaves
135	*Amaranthus spinosus* L.	Amaranthaceae	Kata khutura	Whole plant
136	*A. viridis* L.	-do-	Khutura	Whole plant
137	*Achyranthes porphyristachya* Wall.	-do-	Obhota-kata	Leaves, Roots
138	*Alternanthera sessilis* R. Br.	-do-	Mati-kaduri	Leaves
139	*A. phyloxeroides* (Mart.) Griseb	-do-	Pani-kaduri	Whole plant
140	*Chenopodium album* L.	Chenopodiaceae	Bhotua-sak	Leaves
141	*Basella alba* L.	Basellaceae	Pui-sak	Leaves
142	*Polygonum barbatum* L	Polygonaceae	Bonghehu	Seeds, Roots
143	*P. hydropiper* L.	-do-	Bihlayani	Leaves, Roots
144	*P. microcephala* D. Don.	-do-	Madhu-saleng	Leaves
145	*P. orientalis* (L.) Spach	-do-	Ban kuhiar	Leaves
146	*Rumex nepalensis* Spreng.	-do-	Tor-boura	Leaves, Seeds

147	*Piper longum* L.	-do-	Pipali	Fruits, Roots
148	*P. nigrum* L.	-do-	Jaluk	Fruits
149	*Houttuynia cordata* Thunb.	Saururaceae	Mosundori	Leaves
150	*Cinnamomum tamala* Nees & Eberm.	Lauraceae	Tejpat	Leaves
151	*Santalum album* L.	Santalaceae	Chandan	Wood
152	*Acalypha indica* L.	Euphorbiaceae	Mukuta-manjuri	Whole plant
153	*Croton bonplandianum* Baill.	-do-	Ban-tulasi	Leaves
154	*C. tiglium* L.	-do-	Kanibih	
155	*Euphorbia neriifolia* L.	-do-	Siju	Leaves
156	*E. hirta* L.	-do-	Gakhirati-bon	Whole plant
157	*Jatropha curcas* L.	-do-	Bhotora	Plant juice
158	*J. gossypiifolia* L.	-do-	Bongali bhotora	Leaves
159	*Phyllanthus emblica* L.	-do-	Amlokhi	Fruits
160	*P. niruri* L	-do-	Ban-amlokhi	Fruits, Roots
161	*Ricinus communis* Linn.	-do-	Era	Leaves, Seeds, Roots
162	*Trewia nudiflora* L.	-do-	Bhelkol	Roots, Seeds
163	*Laportea crenulata* Gaud.	Urticaceae	Chorot	Whole plant
164	*Cannabis sativa* L.	Cannabaceae	Bhang	Whole plant
165	*Streblus asper* Lour	Moraceae	Sarua	Bark, Roots, milky juice, Twigs
166	*Ficus hispida* Vahl.	-do-	Khaksa dimaru	Fruits
167	*Curcuma amada* Roxb.	Zingiberaceae	Aam-ada	Rhizome
168	*C. aromatica* Salisb	-do-	Keturi	Rhizome
169	*C. longa* L.	-do-	Haldhi	Rhizome
170	*Musa paradisiacal* L.	Musaceae	Bhim-kol	Stem juice, fruits
171	*Costus specious* (Koen.) Smith.	Costaceae	Jam lakhuti	Roots
172	*Canna indica* L.	Cannaceae	Parijat	Roots
173	*Ananas comosus* (L.) Merr.	Bromeliaceae	Anaras	Leaves
174	*Crinum asiaticum* L.	Amaryllidaceae	Ban-naharu	Bulb, Seeds, Leaves
175	*Polianthes tuberosa*L.	-do-	Rajani-gandha	Flowers, Bulbs
176	*Agave cantala* (Haw.) Roxb.	Agavaceae	Dager-plant	Leaves
177	*Dioscorea alata* L.	Dioscoreaceae	Kath-alu	Tuber
178	*D. bulbifera* L.	-do-	Goch-alu	Tuber
179	*Aloe vera* (L.) Burm.f.	Liliaceae	Chal-kuori	Leaves
180	*Asparagus recemosus* Willd	-do-	Satamul	Roots
181	*Allium cepa* L.	Alliaceae	Piyaj	Bulb
182	*A. sativum* L.	-do-	Naharu	Bulb
183	*Monocharia hastaefolia* Presl	-do-	Khowa-mateka	Whole plant

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184	*Commelina benghalensis* L.	Commelinaceae	Kona-shimolu	Whole plant
185	*Floscopa scandens* Lour.	-do-	Kara-shimolu	Stem juice
186	*Acorus calamus* L.	Araceae	Boch	Rhizome
187	*Alocasia indica* (Lour) Koch.	-do-	Man-kochu	Leaves, Tuber
188	*Amorphophallus campanulatus* BL.	-do-	Olkachu	Tuber
189	*Homalomena aromatica* Schott.	-do-	Gan-kachu	Rhizome
190	*Pistia stratioetes* L.	-do-	Barpuni	Roots, Leaves
191	*Typhonium trilobatum* Schott.	-do-	Sam-kochu	Roots
192	*Segitaria segittifolia* L.	Alismaceae	Pani-kochu	Whole plant
193	*Cyperus rotundus L.*	Cyperaceae	Kenga-bon	Roots
194	*C. brevifolius* L.	-do-	Tupi-bon	Whole plants
195	*Arundo donax* L.	Poaceae	Nol	Roots
196	*Cynodon dactylon* (L.) Pers.	-do-	Dubori-bon	Rhizome
197	*Cymbopogon citrates* (DC) Stapf	-do-	Nemuganghi ban	
198	*Hygroryza aristata* Retz.Ness	-do-	Dol-ghah	Seeds
199	*Phragmites karka* Trin. ex. Steud.	-do-	Khagari	Roots

Some notable plants have been using as Ayurvedic medicine are reported from this area are Aloe vera, Aegle mormelos, Azadirachta indica, Tinospora cordifolia, Cissus quadrangularis, Cardiospermum helicacabum, C. fistula, Citrullus colocynthis, Andrographis paniculata, Clerodendrum colebrookianum, Vitex negundo, Curcuma amada, Costus specious, Bacopa monnieri, Asparagus recemosus, Piper longum, Mucuna pruriens, Calotropis gigantea, Hourttuyania cordata, Chenopodium album, Phyllanthus emblica, P. niruri, Terminalia arjuna, T. bellirica, T. chebula, Withania sominifera etc.

Over 300 plants are now traditionally used as drug source in homeopathy (Joshi and Joshi, 2013, Sultana and Mukherjee, 2015). The well known plants reported from the study area are used in preparation of homeopathic drugs are Aegle mormelos, Andrographis paniculata, Justicia adhatoda, Mangifera indica, Centella asiatica, Alstonia scholaris, Holarrhena pubescens, Rauvolfia serpentine, Artemisia indica, Helianthus annuus, Saraca asoca, Cannabis sativa, Carica papaya, Terminalia arjuna, Citrullus colocynthis , Acalypha indica, Croton tiglium, Jatropha curcas, Mentha piperita, Tinospora cordifolia, Syzygium cumini, Datura stramonium, Nicotiana tabacum, Alium sativum, Alium cepa, Arundo donax, Cynodon dactylon, Curcuma longaL, Zingiber officinalis etc.

Bhattacharya *et al.* (2009) reported 30 rare endangered medicinal plants from Assam. In the study area some rare medicinal plants like Andrographis Pandiculata, Acorus Calamus, Asparagus racemosus, Bacops monnieri, Boerhaavia diffusa, Butea Monosperma, Rauvolfia serpentina, Mucuna Pruiens, Corton tiglium, Piper longum, Wdellia calendulacea have been reported.

PLATE - 1


Boch


Nemugandhi ban


Harjora lata


Saguna lata


Masundori


Madhusaleng


Vetetita


Nephaphu


Helachi


Kharpat


Medelua


Kapal phota


Satamul


Bihlayani


Bon kuhiar


Tor-boura


Sialkata


Bon-tulsi


Sarpagandha


Tupi -ban

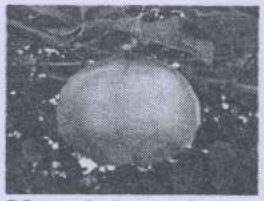

Son-borial


Sirata


Brahmi


Junjunea ban

PLATE - 2


Kapalphota-lata


Kuwa bhaturi


Ou-tenga


Karbi

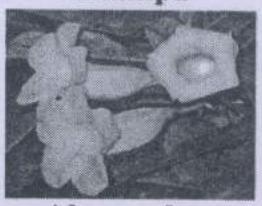

Ranga karabi


Champa


Aparajita


Khutura


Kata-khutura


Alamonda


Bhang


Hatisur


Puroi sak


Pategaja


Bar manimuni


Bantil


Akan


Khaksa dimaru


Bhotora


Gadhuli gopal


Jarmani ban


Jarmani lata


Dron


Ranga dron

CONCLUSION:

Assam consists of rich varieties of medicinal plants and herbs. The active ingredients present in these plants may be used for designing some new drugs and pharmaceutical agents which can pave some new alleys in the world of pharmaceutical sciences and be a blessing for mankind. Plant-derived pharmaceutical formulations used to treat diseases. Alternative medicine is better than our conventional allopathic medication and can enhance the impact of conventional drugs and the natural product derived from plants may be do not have any side effects. Due to over exploitation and lack of conservation, a number of valuable plants have become vulnerable in the study area. So it is needed for cultivation, processing and conservation of rare and threatened plants through appropriate methods to meet the developmental task.

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IMPACT OF INFORMATION AND COMMUNICATION TECHNOLOGY (ICT) ON LIBRARIES

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Abstract:

Information and Communication Technology has transformed library services globally. ICT is playing a significant role in the development of libraries around the world. The traditional manual libraries are changing into modern libraries through ICT tools. In this paper light is thrown mainly on what Information and Communication Technology is and its application in libraries. Discussion is also made about how ICT help to perform different activities in libraries.

Keywords: Information and Communication Technology, ICT

Introduction:

ICT stands for Information and Communication Technology. ICT provides access to information through telecommunication. It is similar to information technology, but focuses primarily on communication technologies. It includes the internet, wireless networks, cell phones and other communication medium.

In modern age Information and Communication Technology has influenced almost all aspects of society. Now libraries are also using ICT for betterment of their services. In order to fulfil Ranganathan's five laws of library and information science, libraries are using ICT for automation of their services. ICT in libraries help not only to avoid obsolescence of information but also enables the librarian to provide the user community, right information at the right time. In this way, it saves the time of users as well as library staffs.

Information and Communication Technology: ICT has been defined by various organizations in different ways. Some of the definitions are given below-

The phrase 'Information and Communication Technologies' (ICT) is defined by UNESCO (2006) as forms of technology that are used to transmit, store, create, share or exchange information. This broad definition of ICT includes such technologies as radio,

television, video, DVD, telephone (both fixed line and mobile phones), satellite systems, computer and network, hardware and software as well as the equipment and services associated with these technologies, such as video conferencing and electronic mail.

ICT applications in Libraries:

ICT includes computer technology, communication technology, multimedia technology etc.

1. Computer technology: Computer technology is very much popular in libraries. A computer can store a large variety of information. We can use that stored information whenever it is needed by us. So, computer can perform all those jobs in the library for which we use many devices with set detailed instructions. Computer technology can be divided into two categories-Computer Hardware and Computer Software.
2. Communication Technology: Communication or telecommunication technologies are used to transmit information in the form of signals between remote locations, using electronic or electromagnetic media as carriers of signals. Some communication tools like telephone, fax, television, e-mail and internet are used in libraries for communication purposes.
3. Multimedia Technology: Multimedia is a combination of text, graphic, sound, animation, and video that is delivered interactively to the user by electronic or digitally manipulated means.
4. Optical Technology: Optical discs are mainly used for storing large quantity of information. In library CDs and DVDs are used for storing a huge amount of records.
5. Networking Technology: Networking technology plays an important role in libraries for sharing purposes. Some of the examples of Library networks are INFLIBNET, CALIBNET, DELNET, NICNET, INDONET, PUNNET.
6. Barcode Technology: Barcode is a predefined format of dark and white spaces which contain a specific data. Barcode technology is mainly used in circulation work of a library.

Library Services where ICT is Used:

1. Library automation: Library automation means use of computer for collection, processing, storage and retrieval of information and other works of library. Many activities of a library are routine in nature, few are repetitive, and automation of these activities help in managing the library resources in a better way. At the same time, it also saves human power and money. In a fully automated library, there are two types of operational works, viz. library housekeeping operation and library information handing operations which are performed with the help of computers. Library housekeeping operation includes acquisition, cataloguing, circulation, and serial control.
2. Digital Library: The term digital library is a most recent term being used for the libraries without books, libraries having information in electronic format and providing access in the digital formats.

Digital libraries are those libraries which are fully automated where all resources are in digital format and the access to the information available is provided to the remote users as well as conventional users electronically.

3. RFID Technology: RFID stands for radio frequency identification device. It is an automatic data capture technology that uses radio-frequency waves to read a movable item to identity, categorize & track. This technology allows transmission of data without contact and line of sight from a data medium, what is called a transponder, to a reader and vice versa.
4. Internet and Library services: Internet plays an important role in a library to enhance library services. In a library, internet is used for checking e-mail, for searching and using e-book, e-journals, e-databases, Web-Opac etc.
5. Resource sharing and library consortium: No library is able to satisfy all the needs of its user due to limited funds and other limitations. This gave rise to the concept of resource sharing. Advent of ICT has opened up new opportunities for greater cooperation among libraries. Emergence of Library Consortia is a promising development for resource sharing.
6. SMS Service: SMS service is used in library to send notice, overdue and other circulation based notifications to users.

Impact of ICT on Libraries:

The application ICT has tremendously changed the way of collection, storage and retrieval of information in libraries. ICT converts the traditional libraries into digital library. ICT has impacted on every sphere of library activity especially in the form of library collection development strategies, library building and consortia. There are many advantages of using ICT in libraries. Some of them are as follows-

1. It enables better management of library
3. It has simplified the collection of different library resources.
4. It enables optimum utilization and sharing of resources among institutions thereby reducing the costs of implementing ICT solutions.
5. It supports library functions such as circulation, serial controls, acquisition control, stock maintenance and other routine office works and development of in-house database.
6. It avoids time-consuming effort by the librarian and reduces workload of the library staff.
7. Improves the quality of library services.
8. It facilitates improvement in the communication facilities.
9. It enables remote access by users.

Conclusion:

Information and Communication Technology has affected almost all activities of a library. Libraries can hardly function today without

computers and information technologies. A well equipped library with all the facilities of modern information infrastructure and technologies could satisfy the ever-growing demands of the users in the present context.

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NEED OF ENVIRONMENTAL EDUCATION FOR PRESERVING THE ENVIRONMENTAL DEGRADATION

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Abstract:

Environment is the main source of life.The word "Environment" hasbeen derived from the French word "Environner" meaning encircling or surrounding. Environment not only directs but it determines the existence, growth and development of all living being in the earth. Earth's environment has been changed drastically during the last three decades. The present day world is facing with the great problems of environment degradation and pollution. Urbanization, industrialization, rapid growth of population etc. have given rise to the serious problems of environmental degradation.

Due to degraded nature, the possibilities of natural hazards like drought, inadequate rains, acid rains, etc. causing destruction or health of all living species. At present it has been realized all over the world that the environmental issues like global warming, ozone depletion, acid rains etc. are not only natural issues but are global. Human beings are mainly responsible for all these. The basic objective of this paper is to evaluate the need and significance of environmental education in preserving the environmental degradation.

Keywords: Environmental education, environmental degradation, environmental pollution.

Introduction:

In Present scenario of rapid population growth and globalization, our environment is under serious threat from degradation and losing its biodiversity. In the present century, environmental degradation has emerged as a major global concern for the survival of living species. Both developing and developed nations are facing serious environmental problems. However some of the problems are of global magnitude such as global warming of the planet earth, depletion of ozone layer, while the others are specially confined to localized region. Their divesting effects are on all the

organisms living on the planet earth including plants, animal and of course on human beings. Further, the degree to which a person is exposed to environmental pollution in daily life, might influence the awareness of environmental problems. Suffering from a health disorder due to environmental pollution will definitely enhance the level of involvement and awareness in thisregard. Thus it seems logical to discuss the different environment issues related to the degradation of environment. There is a cry all over the worldfor protection of healthy environment and preservation of natural resources. So everyone of us must have knowledge and awareness of it. Every single human being of this planet should come forward and take part in the environmental conservation and development process.

Objective:

The main objective of the presence study is to analyze the factors that create challenges to save our environment and to discuss the need and significance of education in preserving the environmental degradation, by solving the environmental problems.

Methodology:

The Methodology of this paper is descriptive and required information has been collected for secondary sources such as various books, journals, research articles, internet sources etc.

Discussion:

Environmental degradation is the deterioration of the environment through depletion of resources such as air, water, and soil, the destruction of eco systems and the extinction of wildlife. It is defined as any changes or disturbance to the environment perceived to be deleterious or undesirable. The United Nations International Strategy for Disaster Reduction defines environmental degradation as "The reduction of the capacity of the environment to meet social and ecological objectives and needs". Environmental degradation is of many types. When natural habitats are destroyed or natural resources are depleted, the environment is degraded.

The present concern for preservation and conservation of environment arises from the hazardous impact on the environment due to the injudicious human activities. But comparing to the increasing demands of human being with the growth of population and modernization and to meet such increased demands the resources are limited. Regular exploitation of natural resources is causing serious impact on the purity of environment. The spread of many diseases like Dengue, Viral fevers and the natural problems such as soil erosion, flood, droughts, urban congestion and threat to extinction of many species of plants, birds, animals are the basic visible impact of environmental degradation. Indiscriminate and un-planned industrialization has affected the environmental to a great extent.

But inspite of above all, except natural calamities, man-made environmental pollution is possible to control.Just we have to change our mind and attitude towards our society. All these are possible only through

a well-organized plan of action of education. Education helps in better understanding of the environment and its problems. Education creates awareness about the environmental issues. Awareness is created about the overpopulation which leads to overconsumption and exploitation of the natural resources and reckless use of raw materials by individuals and companies creating problems for sustainability of environment. Education contributes in understanding the threat posed by human in enhancing greenhouse effect, produced by the deforestation and burning of fuel. Education leads tothe evaluation of the environmental problems. It helps to evaluate how human activity is having a significant and scathing impact on the biodiversity of the world's ecosystem reducing the scope of balanced natural environment.

In the domain of the environmental issues, the environmental education plays a key role in sensitizing people of the need and significance of programs which are carried out to address environmental problems by making them confront with them. Environmental education increases public consciousness and knowledge of environmental issues and challenges. Environmental education gives people a deeper understanding of the environment, inspiring them to take personal responsibility for its conservation and restoration. Environmental education helps to develop a sense of responsibility and solidarity among countries which may accelerate a newinternational order that will guarantee the conservation in improvement of environment.

Suggestions:

After discussion on various challenges faced by the environment , we would like to suggests some certain steps in order to preserve environment solving environmental degradation.

1. Each of us should come forward and take part in the environmental conservation and development process.
2. Environmental awareness and consciousness should also be included in non-formal education programs.
3. Knowledge is the first step towards the protection of the environment and attempts should be made to sensitize the common man.
4. NGO's can take step to create awareness among common people about the environmental laws. NGO's can organize people to fight against the persons involved in different activities creating stress on the environment.
5. In order to generate proper awareness and disseminate adequate knowledge in protecting environmental education can be regarded as the most potential instrument and means.
6. People should be aware of various environmental acts of the government.
7. For the survival of ourbeautiful mother nature, we must be environmentally conscious and educated, otherwise the life span of the earth will be short.

Conclusion:

Environmental education is very essential for human society. Almost after forty years of independence, environmental

education became the integral componentof National Policy on Education (1986). The policy says "there is a need to create consciousness of environment which must permit all ages and all sections of the society beginning with the child. Environmental consciousness should be integrated in the entire education process".

"The society beginning with the child"- is very logical and appropriate approach because the children of today would be the future nation of the country. The Centre for Science and Environmental(CSE) did an excellent and worth mentioning job in this direction. A set of four books for children were published by CSE viz; "CHIPKO", "The Rain Drop", "Naina's Village", and "With the Well". These books for children are the outcome of a long lasting understanding of peoples signs and struggle and also creating the importance of conservation of natural resource, environmental awareness is the young's minds. Children's are the future generation of the society, therefore importance should be given to enhance their capacity towards saving the environment from the inhuman activities of modern era and thus the awareness towards the conservation and protection of environment will grow with age - a nation environmentally consciouswill be resulted

Considering the burning problems of environmental degradation, thereis no alternation but the inclusion of environmental education in each and every sphere of the society is of utmost requirements.

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STUDY OF DC CONDUCTIVITY OF MUGA AND ERI SILK FIBRES FOUND IN ASSAM

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3.5.1. Introduction:

Natural fibres, in general, are high polymeric dielectrics and possess a notably high amount of resistivity. As a rule their electrical conductivity should increase in temperature. For the study of dielectric properties normal Muga and Eri fibres is used.

The aim of this paper is to study the DC conductivity of Muga and Eri silk fibres found in Assam with the help of formula $\rho = RA/L$, applying the value from LCR meter which is done in the IASST, Guwahati.

. Materials and Method

Muga and Eri cocoons, the basic materials for the present investigation, were collected from central silk board (Regional Muga and Research station) of Boko and Nalbari Dhamdhama.

Result and Discussion:

DC CONDUCTIVITY OF ERI AND MUGA FIBRES:

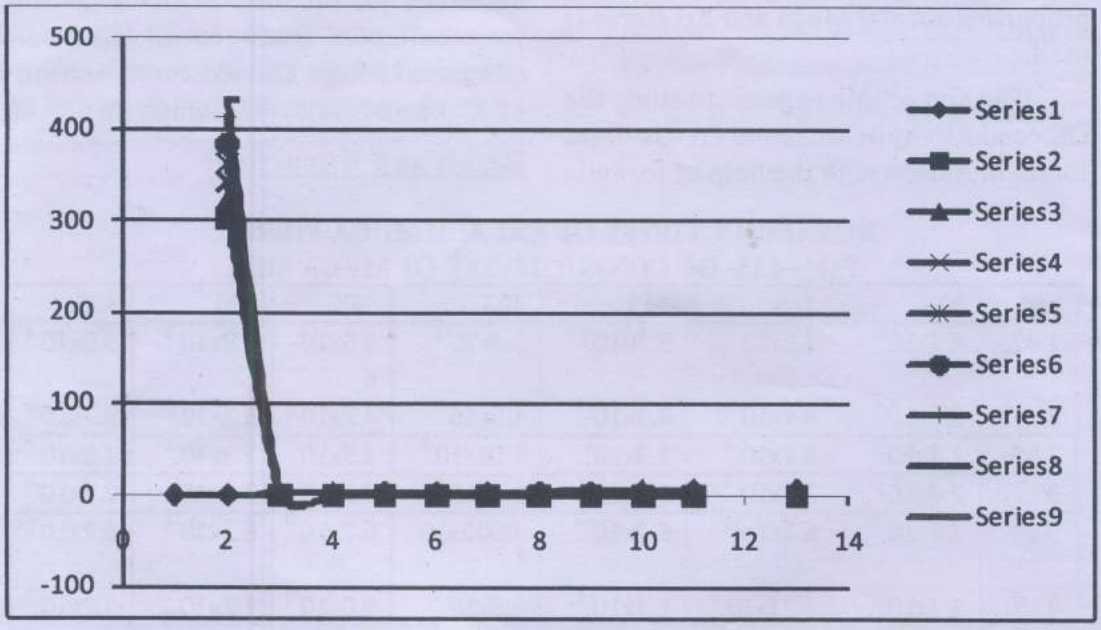
Table 4.15- DC CONDUCTIVITY OF MUGA SILK

logf	303	323	343	363	383	403	423
1.62	$4.2x10^{-5}$	$3.5x10^{-5}$	$3.7x10^{-5}$	$3.5x10^{-5}$	3.6x10-6	$2.9x10^{-6}$	$3.9x10^{-2}$
2	$2.2x10^{-5}$	$4.4x10^{-5}$	4.3x10-5	$3.5x10^{-5}$	$4.2x10^{-5}$	$3.3x10^{-5}$	$7.2x10^{-5}$
2.69	$1.4x10^{-7}$	$4.2x10^{-4}$	$1.3x10^{3}$	$5.08x10^{-5}$	$1.3x10^{-5}$	$1.3x10^{-6}$	$1.3x10^{-7}$
3	2.4x10-7	2.2x10-4	$2.2x10^{-7}$	$1.3x10^{-6}$	$2.3x10^{-7}$	$2.3x10^{-7}$	$2.3x10^{-4}$
3.69	$1.6x10^{-4}$	$6.3x1o^{-4}$	$6.2x10^{-4}$	.0002x10-7	$6.2x10^{-4}$	$6.3x10^{-4}$	$6.2x10^{-5}$
4	$1.2x10^{-3}$	$1.21x10^{-3}$	$1.1x10^{-3}$	$6.3x10^{-4}$	$9.0x10^{-3}$	1.2x10-3	$1.2x10^{-2}$
4.69	$1.2x10^{-2}$	$1.2x10^{-2}$	$1.1x10^{-2}$	$1.1x10^{-7}$	$1.2x10^{-2}$	$1.2x10^{-2}$	$1.1x10^{-2}$
5	$2.1x10^{-2}$	$2.1x10^{-2}$	$2.2x10^{-2}$	$1.1x10^{-2}$	$2.2x10^{-2}$	$2.2x10^{-2}$	$2.2x10^{-2}$
5.69	$1.7x10^{-3}$	$1.7x10^{-3}$	$1.7x10^{-5}$	$2.2x10^{-2}$	$1.7x10^{-6}$	$1.7x10^{-6}$	$1.7x10^{-6}$
6	$2399x10^{-3}$	$2399x10^{-3}$	$1.4x10^{-6}$	$1.7x10^{-2}$	$4.1x10^{6}$	$4.1x10^{-5}$	$4.2x10^{-5}$

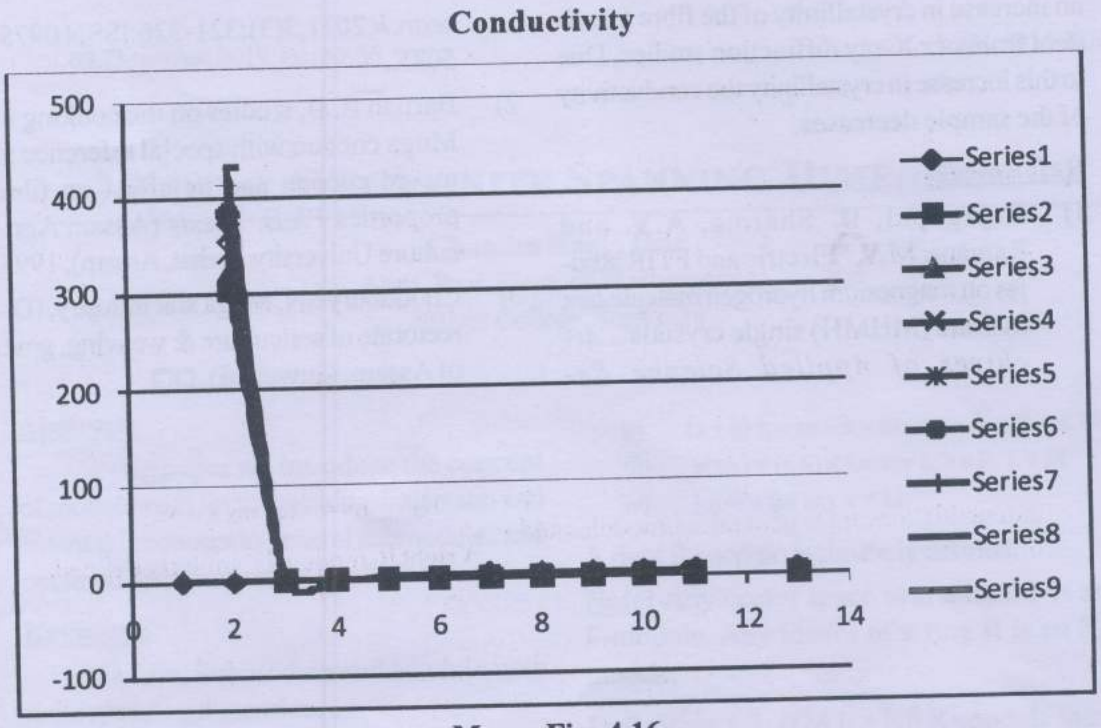
Table 4.16 -Dc conductivity of Eri silk

logf	303	323	343	363	383	403	423
1.62	$8.3x10^{-4}$	$3.7\text{-}x10^{-5}$	$3.4x10^{-5}$	$3.8x10^{-5}$	$3.8x10^{-5}$	$3.5x10^{-5}$	$3.6x10^{-6}$
2	$4.8x10^{-5}$	$7.5x10^{-5}$	$6.3x10^{-5}$	$3.5x10^{-5}$	$6.3x10^{-5}$	$4.0x10^{-5}$	$4.8x10^{-5}$
3	$2.02x10^{-7}$	$2.4x10^{-7}$	$2.4x10^{-7}$	$2.4x10^{-7}$	$2.4x10^{-7}$	$2.4x10^{-7}$	$2.4x10^{-7}$
3.69	$5.3x10^{-7}$	$2.6x10^{-7}$	$1.1x10^{-7}$	$1.3x10^{-7}$	$1.4x10^{-7}$	$1.4x10^{-7}$	$1.4x10^{-7}$
4	$1.04x10^{-6}$	$1.2x10^{-6}$	$1.2x10^{-6}$	$1.3x10^{-6}$	$1.2x10^{-6}$	$1.2x10^{-6}$	$1.2x10^{-6}$
4.69	$1.02x10^{-5}$	$1.0x10^{-5}$	$1.0x10^{-6}$	$1.0x10^{-4}$	$1.0x10^{-5}$	$1.0x10^{-5}$	$1.0x10^{-5}$
5	$1.9x10^{-3}$	$1.9x10^{-5}$	$1.1x10^{-2}$	$1.9x10^{-2}$	$1.9x10^{-2}$	$1.9x10^{-2}$	$1.9x10^{-5}$
5.69	$1.4x10^{-9}$	$1.3x10^{-5}$	$1.4x10^{-8}$	$1.5x10^{-8}$	$1.4x10^{-8}$	$1.4x10^{-8}$	$1.4x10^{-8}$
6	$35x10^{-5}$	$349x10^{-10}$	$35x10^{-10}$	$35x10^{-10}$	$35x10^{-10}$	$35x10^{-5}$	$3.5x10^{-5}$

DC CONDUCTIVITY OF Eri silk



Frequency Fig. 4.15



Masas Fig. 4.16

The DC conductivity at room temperature for Muga silk is less than the Eri silk.

At the temperature is increased, the mobility of the ionic groups increases and the conductivity of the fibers rises. The change in volume caused by glass transition enhances the ionic conduction106 due to considerable increase in mobility of the chain units.

The mobility of the ionic groups of short macromolecular sections takes place mainly in the amorphous regions or near the boundaries of the crystalline regions of the fibres. Hence, the conductivity of the fibers depends to a great extent, on their crystallinity. With increasing crystallinity the conductivity of the fibre decreases. The lowest value of conductivity of Muga in the steady region is thus attributed to its highest degree of crystallinity between the fibers under study as observed in our X-ray diffraction analysis. However, the crystallinity only is not of substantial importance. The nature of side-chains defects and type crystalline formation in a fibre also affect the ionic conductivity.

The rate of increment of conductivity with temperature for all the three fibers falls beyond 500 K. This may be due to decomposition of the fibers. The removal of crystal waters at this decomposition stage also retards the growth of current.(GAGAN CHANDRA BARUA,1991,Pp---165)

The conductivity of Muga fibre sample is found to decrease as the annealing temperature increases. The annealing effect produces

an increase in crystallinity of the fibre as evident from our X-ray diffraction studies. Due to this increase in crystallinity the conductivity of the sample decreases.

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MODULE WITH FINITE SPANNING DIMENSION

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Abstract:

In this paper we introduce the concept of module with finite spanning dimension and extent this concept to general submodules and obtained some important results.

Keyword:

Module, Submodule and Module with finite spanning dimension.

Introduction:

Let R be a (not necessarily commutative) ring with unity. Throughout this paper by a module we mean a left R-module. M stands for a module with finite spanning dimension and A,B stand for submodules of M.

Preliminaries:

In this paper we collect together preliminary definitions and results which are needed in this sequel.

1.Preliminaries on Modules:

Definition 1.1: Let R be a ring (not necessarily commutative). An abelian group (M,+) is called a left R-module if there is a mapping

$\lambda : R \times M \to M$ s. t. thefollowings are satisfied :

i) $a(x+y = ax+ay$ for any $a \in R, x\, y \in M$

ii) $(a+b)\,x = ax + b\times$ for any $a, b \in R, x \in M$

iii) $a(b\times) = (a\,b)\times$ for any $a, b \in R, x \in M$

iv) $1.x = x$ for any $x \in M$.

A right R-module is similarly defined.

Note: Any vector space over a field F is an F-module. Any ideal I of a ring R is an R-module.

Definition 1.2: If M is a left R-module then a non-empty subset A of M is called a left R-submodule if

i) $x, y \in A \Rightarrow x - y \in A$

ii) $x \in A, a \in R \Rightarrow ax \in A$.

Similarly we define right R-submodule.

Definition 1.3: Let A, B be two left R-modules. Then the mapping

$f : A \to B$ is called an R-module homomorphism if

i) $f(x+y) = f(x) + f(y)$

ii) $f(a\,x) = a\,f(x) \; \forall\, a \in R, x, y \in A$.

We note:

i) Hom(A, B)= The set of all R-module homomorphisms from A to B.

ii) $\text{Ker}f = \{x \in A : f(x) = 0\}$

iii) $\text{Im}h = \{y \in B : y = f(x)\}$

Definition1.4: A simple module is a non-zero module N in which the only submodules are 0 and A. Equivalently a right (left) R-module A is simple if and only if $A \cong R/M$ for some maximal right(left) ideal M of R.

Definition1.5: For any module A, the sum of all simple submodules of A is called the socle of A, denoted by Soc(A).

Definition1.6: Let A and B be two submodules of M. Define $(A, B) = \{a \in R: aB \subseteq A\}$. It is an ideal of R. In particular $(0: M) = \{a \in R : am = 0\}$ is called the annihilator of M and it is denoted by Ann(M).

We note :

i) $Ann(M+N) = Ann(M) \cap Ann(N)$

ii) $(A : B) = Ann\{A+B/A\}$

Definition1.7: Let M be a module over a ring R. A submodule A of M *is* called an essential submodule of M if every non-zero submodule of M has non-zero intersection with A. We denote it by $A \overset{\leq}{e} M$. That is $A \overset{\leq}{e} M$ if and only if for any $B (\neq 0) \leq M \Rightarrow A \cap B \neq 0$. If B is submodule of M s.t. $A \overset{\leq}{e} B$ then we say B is an essential extension of A in M. It is easy to note that.

$M \overset{\leq}{e} M$. Also $0 \overset{\leq}{e} A$ only if A=0.

Definition1.8: A submodule A of a module M is said to be a closed submodule of M if A has no proper essential extension in M, that is if only solution of the relation $A \overset{\leq}{e} B$ M is B=A.

For example 0 and M always closed submodules of M. Also every direct summand of M is a closed submodule of M.

Definition1.9: A submodule K′ of M is a direct summand of M if and only if there is a submodule of M s.t, $K' = 0$ and $K + K' = M$.

Definition1.10: A subnmodule A of M is small (superfluous) in M, we denote it $K \overset{\leq}{s} M$ in case $K + L = M$ implies $L = M$.

Definition1.11: Let M is a left R-module. We call M hollow if every submodule of M is small in M.

Definition1.12: If A be a submodule of M, we say the submodule B is a supplement of A in M if $A + B = M$ and $A + C \neq M$ for any proper submodule C of B.

2. Modules with finite spanning dimension

We recall that a module is said to have finite Goldie dimension if it doesnot contain an infinite direct sum of submodules, in other words if it is finite dimensional.

An equivalent version of finite Goldie dimension is that for any increasing sequence of submodules of M,

$A_0 \subset A_1 \subset A_2 \subset \ldots\ldots\ldots\ldots$, there is an i s.t. $A_i \overset{\leq}{e} A_j$ forevery $j \geq i$.

Similarly we shall call a left R-module M with finite spanning dimension (F.S.D.module) if any decreasing sequence of submodules

$A_0 \supset A_1 \supset A_2 \supset \ldots\ldots\ldots\ldots$, there is an i s.t. $A_j \overset{\leq}{s} M$ for every $j \geq i$.

It is noted "finite Goldie dimension" and "finite spanning dimension" in modules are generalisations of the dimension of finite dimensional vector spaces.

2.2 Some results on modules with finite spanning dimension

Proposition2.2.1: For any module C the following conditions are equivalent:

i) C is semisimple

ii) C has no proper essential submodule

iii) Every submodule of C is a direct summand of C.

Proof: i) implies ii): If A is a proper submodule of C then C must have a simple submodule M s.t. $M \leq A$. Then $M \cap A \neq M$, hence $M \cap A = 0$.

Thus $A \underset{e}{\leq} C$. ii) implies iii): Given any A $\leq C$ let B be a complement for A in C. Then $A \oplus B \underset{e}{\leq} C$ where ii) says that $A \oplus B = C$. iii) implies i): In view of iii), we have $C = Soc(C) \oplus A$ for some $A (\leq C)$ and our aim is tyo show that $A = 0$. If not choose a non-zero element $x \in A$ and set $J = \{r \in R/xr = 0\}$ so that $R/J \cong xR$, since J is a proper right ideal of R, it must be contained in a maximal right ideal M and we observe that

$xR/xM \cong R/M$, which is a simple module. According to iii), xM is a direct summand of C, and thus of xR. Consequently, $xR = B \oplus xM$ for some B. Now $B \cong \frac{xR}{xM}$ and so R is simple, where $B \leq Soc(C)$. However, we also have $B \leq A$, which is impossible. Therefore $A = 0$ and so $Soc(C) = C$.

Theorem2.2.2: For a submodule K of M the following statement are equivalent,

i) $K \underset{s}{\leq} M$

ii) The natural map $\lambda : M \rightarrow M/K$ is a superfluous epimorphism.

iii) For every submodule N and for every $h \in Hom(N, M)$,

$Imh \neq K = M$ implies$Imh = M$.

Proof: We prove i) implies ii) for this let $K \underset{s}{\leq} M$. Then the natural epimorphisml $\lambda : M \rightarrow M/K$ is s.t.$Ker(\lambda) = K$. Thus Ker $(\lambda) \underset{s}{\leq} M$. Therefore $(\lambda)$is superfluous epimorphism.

ii) Implies i) isobivious.

We now show that ii) implies iii). Let $N \leq M$ and $K \leq M$ and for any $R \in Hom$ (N, M) that is for any $h : N \rightarrow M$, Imh+K=M. Since $\lambda : M \rightarrow M/K$ is superfluous, Ker $(\lambda) = K \underset{s}{\leq} M$. So it follows that h (N) = M. Therefore h (N) + K=M implies h (N)=M.

Next we prove iii) implies i).

Assume that for any module N and for any $h \in Hom (N, M)$, $h (N) + K = M$ implies h (N) = M where $K \leq M$. We shall show that $K \underset{s}{\leq} M$.

LetL $\leq$ M s.t. K+L=M. Let $I : L \rightarrow M$ be natural inclusion map, $i(x) = x$, if $x \in L$. Then i(L)=L clearly i(L) is a homomorphism. So K+L=M implies K+i(L)=M. By hypothesis i(L)=M that is L=M. Thus K+L=M implies L=M. So $K \underset{s}{\leq} M$.

Theorem2.2.3: An Artinian left module M over a left Artinian ring R is an F.S.D. module over itself.

Proof: If $M_1 \supseteq M_2 \supseteq M_3 \supseteq$ .....is a descending chain of steps; that is we get on artinian module M, then it will stopafter a finite number of steps; that is we get on integer j (say) s.t. $M_j = M_j =$..... Thus we get a strictly descending finite chain of submodules. If any onethem is small then clearly all the submodukes contained in it are small. If all the non-zero submodules are small then clearly these contain the trivial submodule that is the 0 module.

Lemma2.2.4: Let M be an F.S.D. module. Then every submodule of M has a supplement.

Proof: Let N be a submodule of M. If N is small then for a submodule X of M, N+X=M given X=M. Therefore the supplement of N is M itself. Suppose N is not small in M. Then it is possible to find a submodule X ($\subset$ M) such that $N + X = M$. If X is a supplement of N we are done. Suppose X is not a supplement of N, then we get a submodule $X_1 < X$ s. t. $N + X_1 = M$. We note that if X_1 M then $N + = M$, implies N = M, which is not the case. Therefore $X_1 \leqslant_s M$. Now if X_1 is a supplement then we are done. Suppose X_1 is not a supplement then we get a submodule X_2 s.t. $X_2 \subset X_1 \subset X$ and $N + X_2 = M$. As the above case we also get $X_2 \leqslant_s M$. This way we obtain a chain

$X \supset X_1 \supset X_2 \supset$ ..... of non-small submodule. Since M has finite spanning dimension, we get a submodule X of this chain s.t. any proper submodule of X is small in M. Thus we get a contradiction with the choice of $X_1, X_2,$ ..... Therefore the above process cannot be obtained for infinite times. Thus for some, a X_a is a supplement of M that is the submodule of M has a supplement X_a in M.

Conclusion: The result in paper gives the structural properties of modules and modules with finite spanning dimension in rings. Many more information regarding it and applications can be expected.

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Hexagon

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