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From Editors Desk…….

IRIDESCENT VISONS is a multidisciplinary research journal, which celebrates the oft-neglected connections between humanities, social sciences and physical sciences. It is a platform where these disciplines can unite, collaborate, and engage with one another towards shared research-oriented and educational goals. Pursuant to its mission, IRIDESCENT VISONS considers papers on subjects from all academic fields, though preference is given to papers with topics of an interdisciplinary nature. We are really grateful to the contributors for making the 7th edition of IRIDESCENT VISONS a reality.

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UTILIZATION OF BIOGAS AS GREEN FUEL IN ALAPPUZHA SUBURBS- A CASE STUDY

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INTRODUCTION

Biogas is unique in several aspects when compared to its alternate fuel counterparts. The commendable factor that makes biogas unique is that its substrate is not only absolutely free (*kitchen waste and faeces*) but also something that we always wanted to get rid off, the bio-waste. So installing a biogas plant naturally becomes 'two birds in one shot' type of achievement. Probing further we come across the positive facts that it is non-explosive, non smoky flame, regulatable just like an LPG stove, tank available at subsidized rate, almost repair free, portable, no complicated technology, flame strength equivalent to that of LPG, one hour flame guaranteed for every 3 to 4 kg biowaste per day, space requirement not more than a normal water tank, any non-fibre and non-acidic biowaste can be raw material etc. Biogas is one of the most economical ways to cook or light a home in rural areas of the world when other power sources are unavailable.

The greatest advantage for a budget family is that along with doing away with garbage, they are now able to save their LPG cylinder for an extra month or two. This means savings not only for them but the whole nation. Now in real quantitative terms let us see what the savings is in Indian rupee. Suppose you are a person using 8 LPG cylinders per year. By using LPG it is reduced to 6. You straightly save approx. Rs. 800/- (*400 x 2*) for yourself and 600/- (*300 x 2 in terms of subsidy*) for the nation. Just multiply with crores of citizens and we happily arrive at the magic of biogas in bringing national level savings to the tune of multicrores which can be diverted for better infra structure across the country which as a natural byproduct of biogas usage, would have already become almost garbage free too.

REVIEW OF LITERATURE

According to studies Carried out at the central Mechanical Engineering Research Institute in Durgapur, 1kg of dry water –hyacinth can produce4-6litres of gas following fermentation at temperature between 30-35 degreecelcius. About 10 cm long chopped stem and evenly crushed material with moisture content ranging between 50-60% is appropriate for biodegradation ,chopping of lower part of stems is helpful in quick drying to the desired level of moisture content. Gas yield becomes maximum after 13-15 days of anaerobic fermentation during summer and after 18-20 days during winters.

The action for food production – Canadian Hunger foundation (AFPRO-CHF) net work,

comprising a total of over 100 NGOs, has been unique experiment. It involved the governmental/ voluntary sector in dissemination of biogas technology. By installing over 97000 biogas plants in different parts of each country over a decade, this net work has enabled a wider reach of technology. This publication is an outcome of a study conducted by the Tata Energy Research Institute to assess the impact of the biogas programme implemented by the AFPRO-CHF network.

MATERIALS AND METHODS

The present study is aimed at revealing the status of awareness about biogas and actual usage thereof among the local population, as an alternative fuel for domestic cooking purpose. In the present day the twin evils that require immediate solution are fossil fuel depletion and bio-waste disposal.

The suspected reasons of failure of implementing this noble cause are lack of follow up at the grass root level and over reliance on existing data in this aspect. We apprehend that the on hand data are unempirical and intuitive. Scientific data on the following aspects are inevitable for the successful implementation of government policies on biogas: these are, actual level of understanding, will of people and their expectations from the governing bodies regarding assistance for installation of biogas tanks and also its worth. True data on these could be obtained only by direct interview with a cross-section of the society. Therefore our investigation was carried out in the form of a survey.

Area of assessment included panchayats namely Kanjikuzhy north, Punnapra north, Mararikulam north and Kidangapparambu area of Alappuzha municipality where biogas plants were installed. We collected information using an initial questionnaire comprising of 38 questions relevant to the title of the project. Observing the response, comments and suggestions from the people at the receiving end, the questionnaire was customized for users of biogas with 18 questions (Appendix-I) and non-users of biogas with 5 questions (Appendix-II). Further information was collected using the modified feedback form. About 200 households per panchayath were quizzed.

Method of interrogation was direct with the head of each family with the prepared questionnaire having multiple choice closed ended questions. In situations where the family members were busy, an appointment was fixed and visit was repeated. In any case ample time and mood was ensured so that data acquired was genuine. The fact that survey type research studies usually need larger samples owing to low percentage of responses was born in mind while carrying out the survey. So visiting individual houses was perceived to be quite a time consuming exercise. Therefore towards the later stage of survey, questionnaires were distributed to school and college students at their institutes and were collected back the very next day. This was done with prior permission and involvement of principals to ensure accountability .

For the ease of survey we divided into houses and institutes. Houses were further divided into rural, urban and semi urban based on degree of crowdedness and area possessed by individual

household for waste disposal. Institutions included Hospitals, Schools and Hostels. Total of about 150 houses and 30 institutions were covered per panchayat area.

Whereabouts of users of biogas were collected from various biogas agencies and they were located for interview. In the next and final stage of information collection, we mustered details of efforts from the government through panchayats and municipalities on the subject of biogas, its awareness and installation. This was done through right to information. The copy of questions drafted is displayed in Appendix-III.

Right to information: We got very valuable information through Right to Information from Kanjikuzhi, Alappuzha, and Punnapra panchayat.

Method of survey conducted:

1) Panchayat area was divided into five parts.
2) Each area was again divided into two parts.
    a) Houses
    b) Institutions
3) Houses are again divided into three.
    a) Rural (More than 15 cent)
    b) Semi urban (More than 5 cent)
    c) Urban(Less than 5 cent)
4) Institutions
    a) Hospitals
    b) Hostel
    c) School
5) Total houses=30x5=150
   Total Institutions=30

Apart from survey, the project had aimed to find out some correlation if any between content of proteins and carbohydrates of vegetable and fruit inputs to biogas plant. A possible list was identified among fruits as well as vegetables the waste of latter being used raw and cooked.

The method followed was simple spectrophotometric using a visible automated spectrophotometer manufactured by 'Systronics'.

METHOD SUMMARY for total protein in veggies:

The pellet of vegetable tissue is treated to remove lipids *(the tissue sample is homogenized with 18 volumes of a mixture of hexane/2-propanol (3/2) for 1 minute, the suspension is filtered and the filter rinsed with 3 x 2 vol of the same solvent. The whole liquid phase is evaporated and the dried extract dissolved)* then allowed to dissolve in 0.1 N Sodium Hydroxide (NaOH) for 15 minutes to generate a crude protein extract. The solution is centrifuged, and duplicate 0.1 milliliters (mL) aliquots are pipetted into separate test tubes. The protein content is determined on these duplicates

using the Bicinchoninic Acid (BCA) method. This involves mixing the sample with reagents which react to form a product with a color intensity that is proportional to the amount of protein in the sample. The color is quantified as an absorbance reading in a spectrophotometer at a wavelength of 562 nanometers (nm). To normalize enzyme activity, the determination is made directly on a portion of the same crude extract assayed for enzyme activity. Duplicate 0.1 mL aliquots are pipetted into separate test tubes and also assayed by the BCA method. For any purpose, when protein is determined on unknown samples, solutions with known protein are used as standard.

RESULTS

The use of biogas is still limited to few individuals in spite of enough awareness programs from the government. The answer could only be obtained through house to house survey. Initial survey was done during 2012 and later during 2015. Primary data obtained from the surveys are presented here.

In the amateur survey conducted during 2012 we found that people depending on LPG as the lone source of cooking fuel (46.67%) far out numbered those using other fuels like firewood electrical equipment etc (Table 1). However, people who use both LPG and firewood users registered 43.33%which was immediately close to LPG alone users. Only a small number of people were found to use electrical equipments along with LPG (6.3%). Urban and sub-urban population who depend upon firewood alone registered only 3 per cent. None of the households were detected using biogas as the main cooking fuel. It was revealed that even those who use biogas as a supportive of supplementary fuel source with LPG and other equipments were negligible.

In the survey area covered by us, percentage of people who are concerned about how long a single cylinder of LPG lasts was 93.67% (Table 1.3). A minority do not bother to have such a check. Table 1.4 shows that in 83.67% of households, the general duration of usage of one cylinder ranged from 1-3 months. A small number users up LPG in less than one month time (4.33%) and the percentage of those who use it for more than three months was found to be 5. It was interesting to note that although 93.33% of people were worried about the present rate of LPG, only 74.33% believe that the rate of the LPG rate may hike up to rupees 1000/- within a year. About 5% did not respond to this question.

From the survey it was found that 70.33% of people felt problems in rebooking and in the availability of fresh cylinder of LPG (Table -1.7) Almost 56% (Table-1.8) feel the need of at least one more none-electrical source of fuel for domestic cooking as convenient as LPG. The survey also revealed that 31.3% do not have enough land to dispose their kitchen waste (Table-1.9). Table 1.10 shows that 90.33% of people believes kitchen waste can be useful in some or other way, but not sure exactly how.

Percentage of people who had an alternative idea for LPG was found to be 55.33% (Table-

1.11). A minority (1.67%) did not answer to this question. It was good information we found from this survey was that 92.33% of people have heard about biogas through media (51%), studies (7%) exhibition (11%) etc (Table-1.13). But only 2.67 % of people said they were informed through panchayats / municipalities about biogas.

As expected , majority of people (96.33%) had no clear idea about different types of biogas tanks available (Table-1.14). Only 0.33% were aware about cement tanks and 2.34% on gobar gas plants . From the table1.15 it was clear that 87.67% people considered biogas tank in their house. The reason they showed for their unwillingness are lack of enough waste (12.33%), lack of space (13.33%) etc. People who were willing to install biogas tank exposed the reason too. It was mainly to save LPG (13.67%) and to dispose waste (19.7%) (Table-1.18).

The results of survey conducted during 2015 January onwards proved that people of urban Alappuzha are largely interested in using biogas at their households. The efforts of Municipality and special interest of Dr. Thomas Isaac, MLA has played a major role in the pro-biogas mindset of people of this town. However, the initial momentum in the installation of biogas tanks was not maintained towards later periods. Table 1 show that maximum percentage of people (37.8 %) are still in the 1 year segment regarding the duration of use of biogas.

It was seen that among fruits, Jackfruit had the second highest quantity of carbohydrates (23.5 gram per 100 gram tissue) after extreme high in Dates (64) and the least was shared by Orange and Water melon (6 gm each). Pine apple (3.8 gm) and Dates (3.6) hit the top of fruits chart for protein content and lowest protein carriers were found to be Grapes (1.09), Mango (1.06) and Papaya (0.85).

Among vegetables, beans, cauliflower and amaranths shared the least carbohydrate content (1 gm each). In the case of protein content in veggies, Soya and green gram registered the highest (11 gm).

Analysing these results, the property of jack to induce a sudden boost in the biogas generation may be attributed to its high carbohydrate content combined with high moisture content. The reason behind Dates as an average biogas performer despite its very high carbo content, may be attributed to being a dry fruit coupled with the fact that it is available in Kerala house holds as a processed one.

DISCUSSION

The thought of a survey on usage of biogas was raised out of twin problems that we face today. First one is the fast depleting LPG source and its hiking cost as the natural consequence of depletion. The second issue is that of waste disposal which continues to be permanent head ach to society and local self governments. At this juncture, biogas could be and should be the right alternative both the concerns. First of all, biogas is highly economical as the recurring cost is almost zero. This is because, source of energy in biogas plants is the readily available domestic kitchen waste discarded from each household. For the same reason, waste disposal at public places is also taken care of automatically. However, use of biogas is still limited to few individuals in spite of enough

awareness programs from the government. The answer could only be obtained through house to house survey. Primary data obtained form individual house holds were consolidated and analyzed. This was done to get and idea on lapse between government moves and the level of its actual implication or effect in the society regarding environmental issues

The fact that the urban and semi - urban population depend solely on LPG for cooking purpose is definitely a dangerous issue. This fuel is supplied by the government in a highly user friendly from through an orderly sysyem for the past so many years. Therefore the new generation families have become over dependent on it without realizing the fact that it is a vestige gas and may not last household near future owing to its fossil status. The survey results showed that people who use both LPG and firewood was also not too less. That situation is also risky for the already delicate greenery we enjoy today. No one is planting new trees these days but go on cutting down existing ones. Even educated citizens and those who advocate environment friendliness in the public also are among the culprits clandestinely. A small number of people use electrical equipments also which because regarding production of electricity we are still a poor nation. Keeping a long term goal the Government must make use of biogas in each house hold, mandatory by law.

SUMMARY AND CONCLUSION

Biogas is unique in several aspects when compared to its alternate fuel counterparts. The commendable factor that makes biogas unique is that its substrate is not only absolutely free (*kitchen waste and faeces*) but also something that we always wanted to get rid off, the bio-waste. So installing a biogas plant naturally becomes 'two birds in one shot' type of achievement. Probing further we come across the positive facts like: it is non-explosive, non smoky flame, regulatable just like an LPG stove, tank available at subsidized rate, almost repair free, portable, no complicated technology, flame strength equivalent to that of LPG, one hour flame guaranteed for every 3 to 4 kg biowaste per day, space requirement not more than a normal water tank, any non-fibre and non-acidic biowaste can be raw material.

Being a highly government dependent society we almost forgot to find out new vistas with a vision for self help. Cooking fuel is such an issue today. Therefore mere awareness programmes will not do. Keeping a long term goal the Government must make use of biogas in each house hold, mandatory by law. Future prospects of this investigation suggest a modified version of biogas usage for urban users and flat dwellers which involve cultured vials of anaerobic methanogenic bacteria developed through research.

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A SERIES OF CALIX[4]ARENE PEPTOIDS: AN UGI PATHWAY

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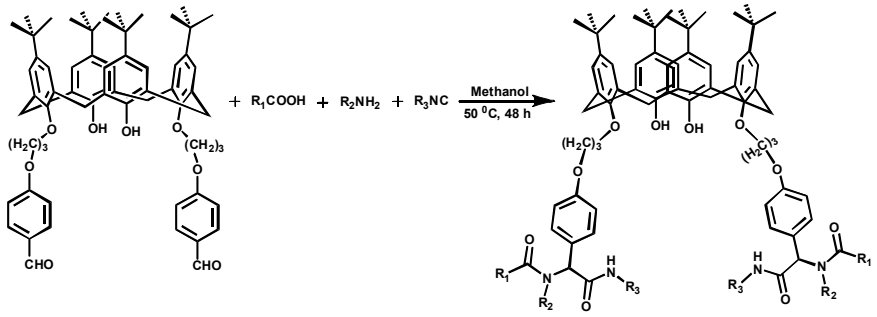


ABSTRACT

Adaptation of Ugi-4CR for the narrow rim modification of calix[4]arene towards the synthesis of a series of tripeptoid and tetrapeptoid calix[4]arenes is described. The metal ion/organic cation binding properties of the newly synthesized peptoid calix[4]arenes were also investigated.

Keywords: calixarenes, peptidocalixarenes, multi-componenet reactions, Ugi reaction.

INTRODUCTION

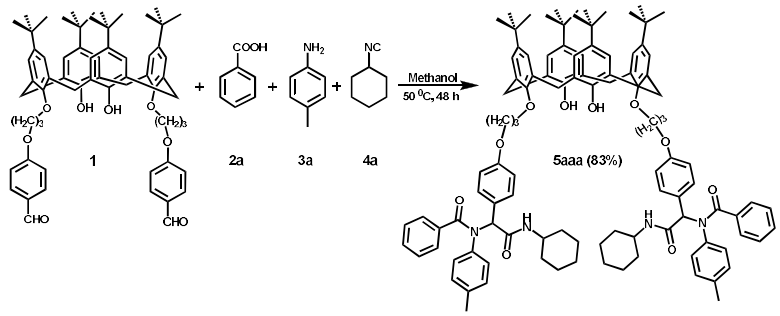
Calixarenes, which are probably the most readily available synthetic molecular baskets, enjoy considerable reputation of being applied in diverse areas.[1]Among the various calix[4]arene derivatives, those adorned with multivalent groups like peptides or peptide-like motifs are attractive in the host-guest chemistry since they provide a variety of functional groups-hydrophobic, polar and charged groups- that can interact with other molecules through hydrogen bonding, electrostatic and van der Waals interactions.[2]Here, we demonstrate a versatile synthesis of the lower rim substituted calix[4]arene peptoids based on Ugi 4-CR of calix[4]arene diametrically substituted with benzaldehyde group.

RESULTS AND DISCUSSION

We commenced our investigation on the feasibility of Ugi reaction at the narrow rim with the 1,3-disubstituted aldehyde functionalized calix[4]arene in the hope that this method will enrich the chemical repertoire of calix[4]arene because the method provides easy access to tripeptoids.[3-5] The required starting material **1** was synthesized in good yields using previously reported synthetic procedures.[5-9]

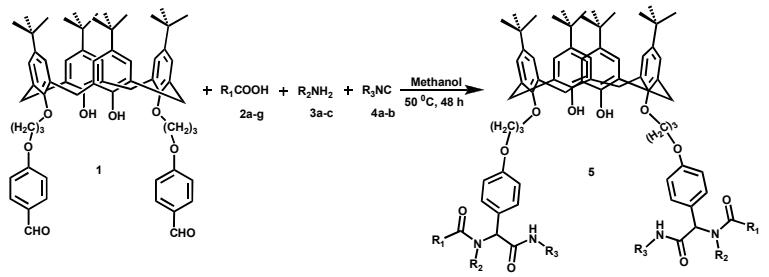
The dialdehyde **1** was then reacted with benzoic acid **2a**, toluidine **3a** and cyclohexyl isocyanide **4a**by simply combining the four components in 2,2,2-trifluoroethanol (TFE). Stirring the mixture at room temperature after 48 h gave highly functionalized α-acylaminocarboxamide derivative **5aaa** in 52% yield. When we replaced TFE with more benign and common solvent such as methanol at room temperature, the product was obtained in 58% yield. However the same reaction at 50 ^{o}C furnished the product **5aaa** in 83% yield (Scheme 1).

In order to study the scope of the method, we applied the same procedure to different acids and amines. In all cases, the expected products were obtained in good yields (Table 1). When the reaction was repeated with naphthyl isocyanide as one of the components under optimal conditions it failed to give the desired product. However moderate yield of the corresponding product was obtained when the reaction was conducted in TFE at room temperature affording the tripeptoid **5aab** (Table 1, entry 10) in 52% yield.



Scheme 1. Ugi reaction of compound**1**

To increase the scope and utility of this route, we then incorporated some biologically relevant amino acids such as N-BOC-gly, N-BOC-L-ala and N-BOC-L-trp (Table 1, entry 7-9) which would further introduce one more peptoid bond equivalent at the narrow rim. Synthesis of tetrapeptoid derivatives of calix[4]arene is otherwise very difficult and involves multiple steps. We also incorporated biologically important pyramidine unit as well (Table 1, entry 6). The reaction was shown to be tolerant to a wide range of substituents on the different components.



Entry	R_1	R_2	R_3	Yield (%)
1	2a	3a	4a	**5aaa**, 83
2	2a	3b	4a	**5aba**, 79
3	2b	3a	4a	**5baa**, 77
4	2a	3c	4a	**5aca**, 80
5	2c	3a	4a	**5caa**, 74
6	2d	3a	4a	**5daa**, 75
7	2e	3c	4a	**5eca**, 76
8	2f	3c	4a	**5fca**, 74

[a]The reaction was carried out in TFE at room temperature

Table 1**: Ugi-4CR of compound**1

That several useful functionalities such as halo group containing substrates capable of undergoing further manipulation were readily incorporated into the final products was particularly pleasing. The products have been characterized by the usual spectroscopic techniques, and their IR, ^{1}H NMR, ^{13}C NMR, and HRMS spectroscopic data are in agreement with the proposed structure.

CONCLUSION

In conclusion we have successfully introduced operationally simple multicomponent synthetic route at the lower rim of calix[4]arene toward a new series of peptoid derivatives of calix[4]arene which accommodate rich multivalent groups that could find potential applications in supramolecular chemistry. We incorporated biologically relevant amino acids such as N-BOC-gly, N-BOC-L-ala, N-BOC-L-trp and pyramidine unit as well. Several useful functionalities such as halo group containing substrates capable of undergoing further manipulation also were readily incorporated into the final products.

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WOMEN ENTREPRENEURSHIP IN EMERGING ECONOMIES – A STRATEGIC ANALYSIS

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ABSTRACT

Women entrepreneurship has become an issue that has raised the attention of developed and developing countries. Despite the global increase in the number of women entrepreneurs and their high potential to boost economic success, contribute to the ecosystems and the world economic development, particularly in low- and middle-income countries, they are still considered to be unexplored and undervalued resource. Women are often considered as the agents of change. Their talent should not be left un-noticed and they should be given ample opportunities to capitalize themselves so as to take part in the national building process. This study is inspired by the inner urge to figure-out the factors that directly or indirectly and positively or negatively influence the growth of women entrepreneurs in the emerging economies. Studies conducted across different parts of the world in different contexts have been clubbed to analyse the impact of such variety of factors on the women entrepreneurs in every dimensions. Certain themes were recognized through the Systematic Literature Review and as a result, seven clusters were also identified. This is a review paper which focuses on women entrepreneurship in developing countries wherein the challenges and problems faced by them in an array of entrepreneurial platforms are discussed collectively. Moreover, proposed strategies for development of women entrepreneurship have also been examined. Bibliometric analysis charts and tables derived using R software have been incorporated in the study.

Keywords**:** economic system, women entrepreneur, women entrepreneurship

INTRODUCTION

Entrepreneurship is a process through which an individual creates opportunities for innovation leading to additional and novel contributions to the society (Ghouse et al., 2017). Women entrepreneurship is synonymous with women empowerment, tremendously contributing to growth of the economy (Nair, 2020). The role of women entrepreneurs in the expansion of world economy have gained momentum in the emerging markets. In recent years, women entrepreneurship have become a growing field of entrepreneurship research (Rosca et al., 2020). Women in the nation-building role play an integral part in the progressing human kind (Qureshi et al., 2022). The worldwide literature says that women entrepreneurs are considered inferior to men entrepreneurs in creating national wealth, no

matter what their real talent are. Researchers argue that unless the gender bias embedded into entrepreneurship is addressed properly, efforts aimed at benefiting women entrepreneurs would not make much significant macroeconomic or social impact (Nair, 2020). The Gender Gap affects entrepreneurship negatively and it has been observed as one of the most proliferated issues to be addressed globally. Sustainable entrepreneurship calls for innovations and successful diffusion. Barriers like lower entrepreneurial ability, lack of funds and so on often inhibit women entrepreneurial innovations (Nair, 2020). Women are often described as the agents of change. Their path should not be constrained by any external or internal forces. The contributions of women to production as well as productivity within the household and in formal business organizations crucially influence economic and social growth (Khan, 2015). The present study aims to identify different themes in the present scenario of women entrepreneurship. Furthermore, several factors that magnify the performance of women entrepreneurs in developing countries are identified. This is a review paper which focuses on women entrepreneurship in developing countries wherein the challenges and problems faced by them in an array of entrepreneurial platforms are discussed collectively. Moreover, proposed strategies for development of women entrepreneurship have also been examined. Bibliometric analysis charts and tables derived using R software have been incorporated in the study.

RESEARCH APPROACH

The initial search in the Web of Science database derived around 50 publications consisting of only research articles in about 30 journals with H index up to 5. Articles ranging from the year 2007 – 2021 served as the basis of analysis of the literature. The search focused on universal literature on women entrepreneurship in emerging economies. No criteria were set in terms of timeframe of publications. Delimiters were set for identification of studies conducted in specific disciplines such as Business, Management, Economics, Social Science interdisciplinary, Women Studies and Development Studies. Certain clusters were identified from the selected articles which are Gender, Performance, Framework, Knowledge, Women Entrepreneurs, Self-employment and Management. A list of variables has also been identified from the research articles.

An extensive literature review has been done in this paper which is considered appropriate when aggregating studies of different methodological approaches, covering broad and fragmented topics in different settings (Bastian et al., 2018).

(Brush et al. (2009) speaks in favour of a gender aware framework, they criticize that access to markets, availability of financial networks and management of capabilities are the

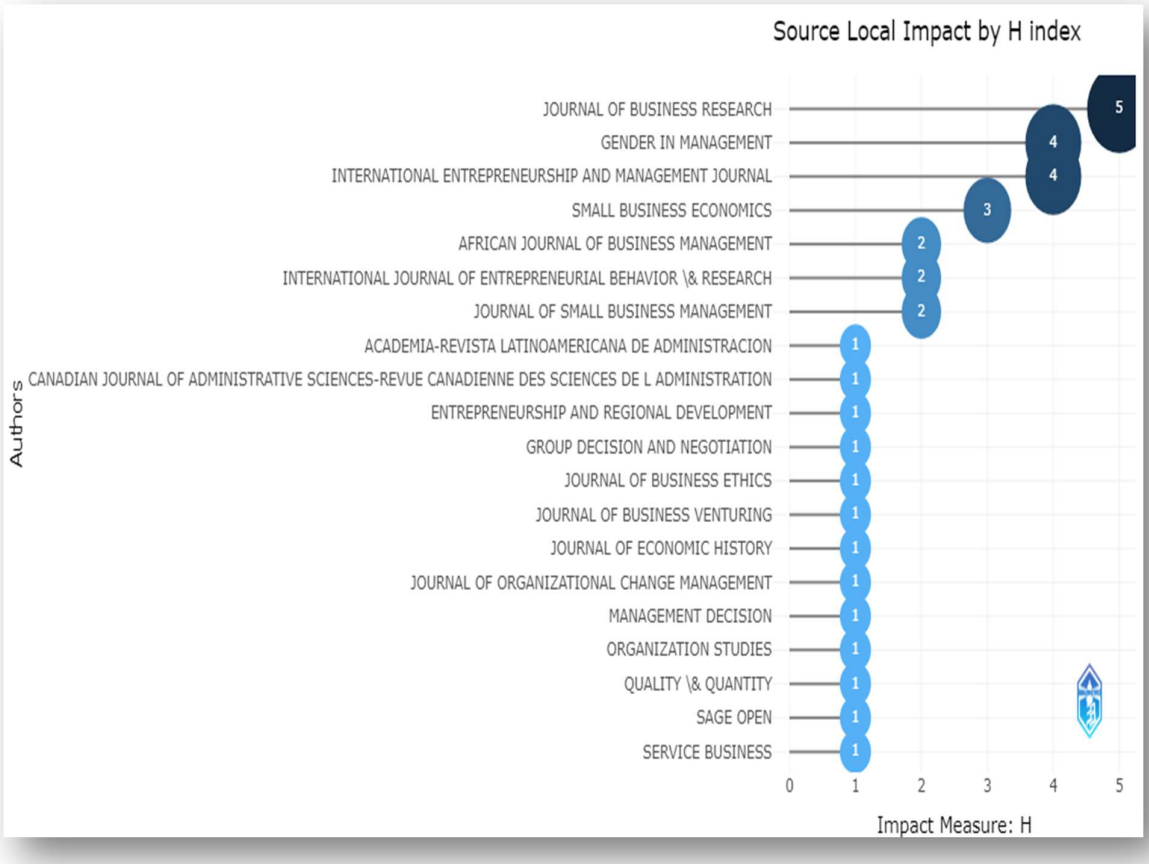
only pivotal factors for business success and viability. Due to the social embeddedness of entrepreneurship, the factors which create specific barriers for women entrepreneurs are visualized.

OBJECTIVES

1. To identify the trends and pattern of women entrepreneurship in the emerging economies.
2. To identify factors that hinders the performance of women entrepreneurs in the emerging economies.
3. To analyse the core factors for accelerating the entrepreneurial culture in the globalized world.

Figure 1

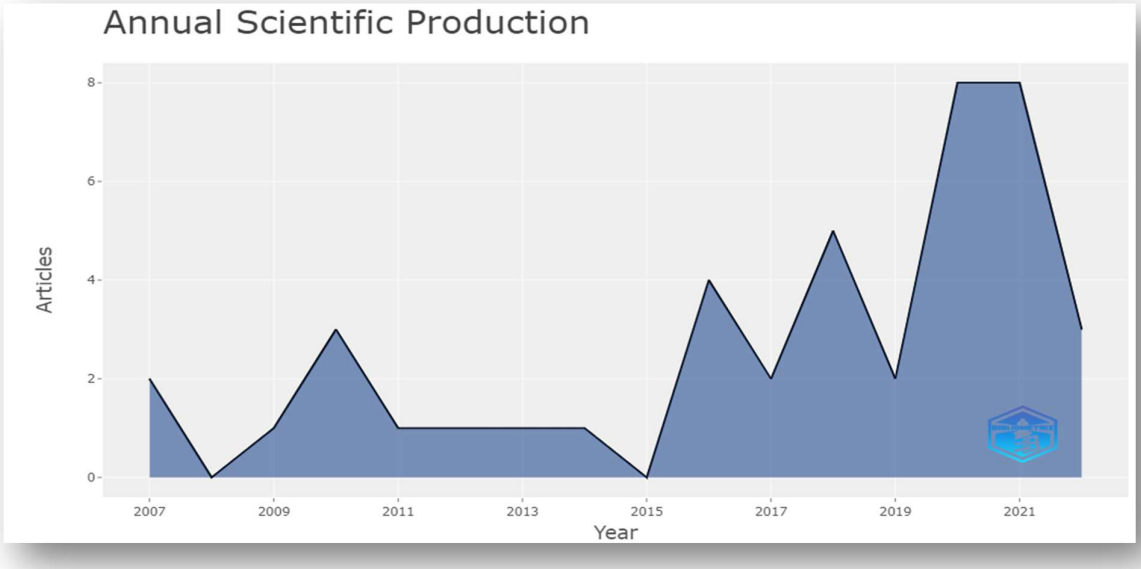
Local Impact by H index



Source 1 An Exploratory Study

Here, a comprehensive list of Web of Science journals with H index from which the articles have been extracted are shown in the above bibliometric indicator.

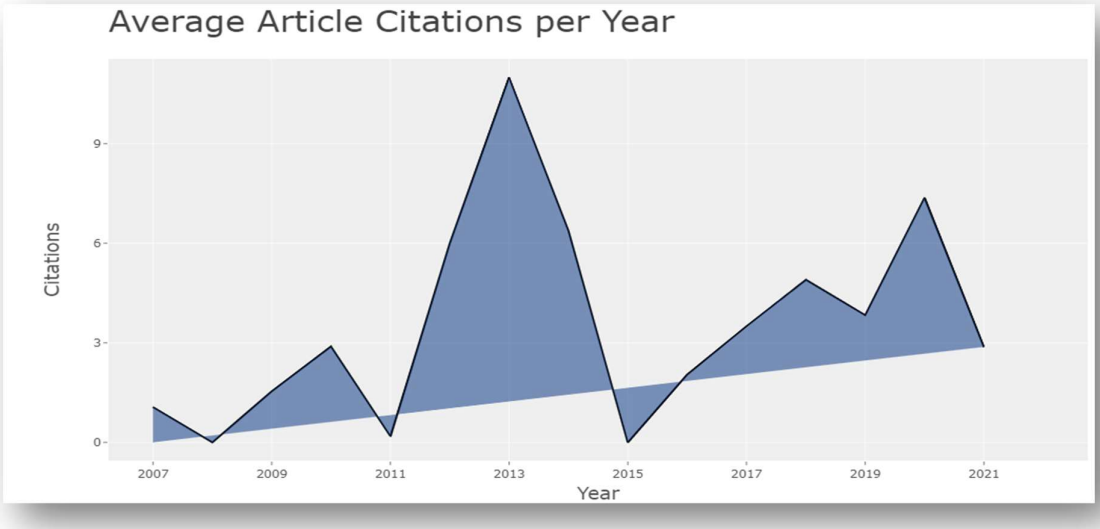
Figure 2
Annual Scientific Production of Articles



Source 2 An Exploratory Study

Here, the bibliometric indicators point to an increase in the number of published articles in women entrepreneurship over a period of time ranging from 2007 to 2021.

Figure 3
Average Article Citations Per Year

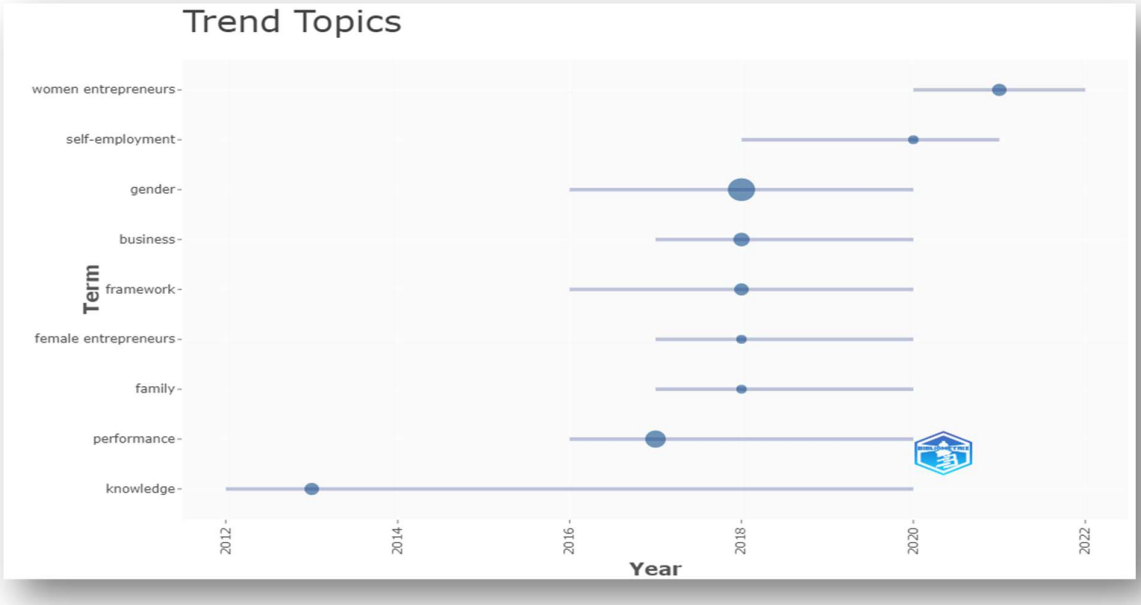


Source 3 An Exploratory Study

The above graph shows the average annual citations of the Web of Science articles with 99 as the highest in 2013.

Figure 4

The Trend Topics



Source 4 An Exploratory Study

REVIEW OF LITERATURE

Female entrepreneurship in Middle-East and North Africa region applied a three-dimensional perspective in analysing literature, which are the micro, meso and macro environments. Micro level research explores the individual entrepreneur. It focuses on women's motives, orientations and self-confidence and explores personal attributes and characteristics of female entrepreneurs. Macro level factors pertain to the larger environment in which women live and act, such as the normative constraints, the government and the economy. The meso level concentrates on factors related to organizations, such as processes, structure and strategy (Bastian et al., 2018).

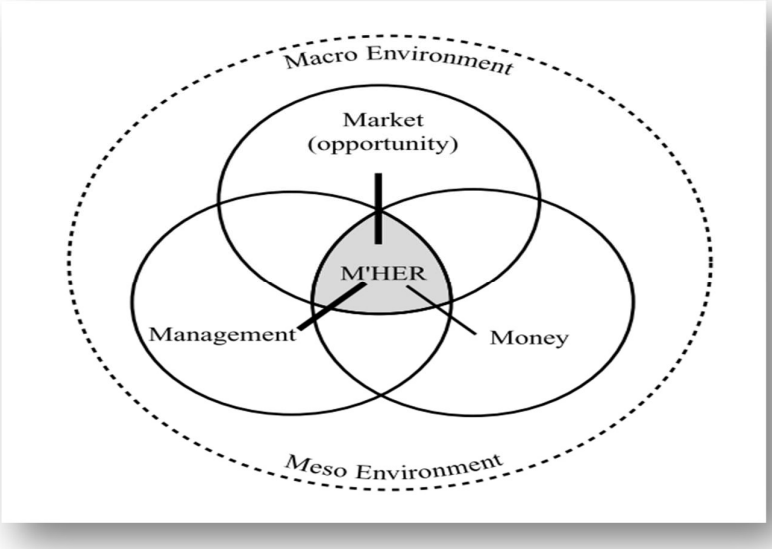
The significance of several Push and Pull factors are quoted in certain studies. It has been stated that women are driven to entrepreneurship owing to pull factors when they exactly crave for such a platform. They are intentionally attracted by the rewards whether monetary or non-monetary. On the contrary, when women are into entrepreneurship due to push factors when they thrive hard for a decent living. They re pushed or compelled to choose a platform which they are not interested because of some adversities in their life (Bastian et al., 2018).

In a study, 5M Framework had been built with Motherhood in its centre, not only pointing to the importance of considering the role and position of a woman in the family but symbolizing the centrality of meaningful gender awareness (Brush et al., 2009). Motherhood surrounded by Money Market and Management; the whole surrounded by Macro (social norms) as well as Meso (mediating institutions) environments. Market is also shown as encapsulating Opportunity. Entry and survival in the market requires Money and Management (Brush et al., 2009).

A research conducted among the women entrepreneurs in Saudi Arabia found that Saudi women entrepreneurs are very confident about their skills such as idea generation, general management, product innovation, dealing with people and organizational skills (Welsh et al., 2014). In addition to running their own family business is what gives them more confidence and they exponentially exhibit quest for knowledge when compared to running a non-family business. Saudi women entrepreneurs' major obstacles to running their businesses are; difficulty in finding local employees, high rent, difficulty in finding trained employees and retaining them, advertising costs, liquidity, managing the business with a family member instead of outside employees, dealing with government entities and difficult customers(Welsh et al., 2014).

Figure 5

Diagram of Conceptual Model of Entreprenuerial environment



Source 5 - A gender-aware framework for women entrepreneurship (Brush et al., 2009)

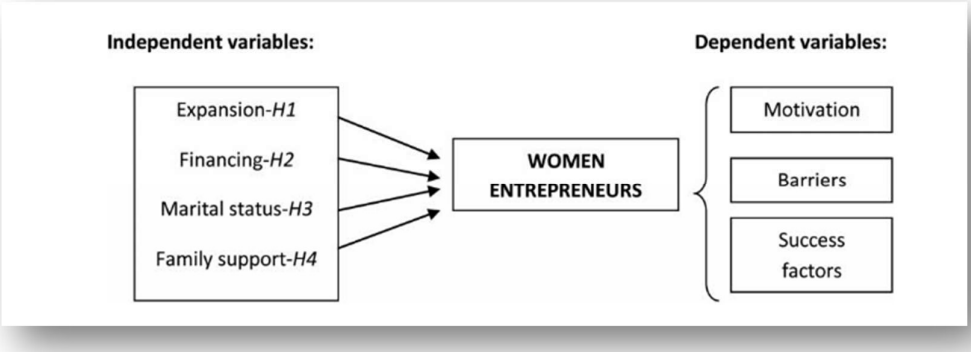
It has been found that for women entrepreneurs, motherhood or family embeddedness

will directly influence entrepreneurial self-efficacy and the aspirations for the exploitation (Brush et al., 2009). Family role will influence information networks used to identify the market opportunity. Hence women with high commitment to family will be less likely to interact in market/finance/industry networks, which affects the growth prospects or even novelty of the venture (Brush et al., 2009).

A Study conducted in Valencia region in Spain shows that different internal and external factors affect the motivation, obstacles to success and performance of firms created by women (Akehurst et al., 2012). Here it is observed that size of the firm sometimes acts as a deciding factor of their performance. Generally perceived thoughts for running a small-sized firms are difficulties in procuring financial resources and absence of specific skills and knowledge in handling a business. Both the factors shows discrimination towards women in the job market (Akehurst et al., 2012). Influence of family can also affect business creation on the part of women.

Figure 6

Influencing factors of Women Entrepreneurship



Source 6- Women entrepreneurship in small service firms; Motivations, Barriers and Performance (Akehurst et al., 2012)

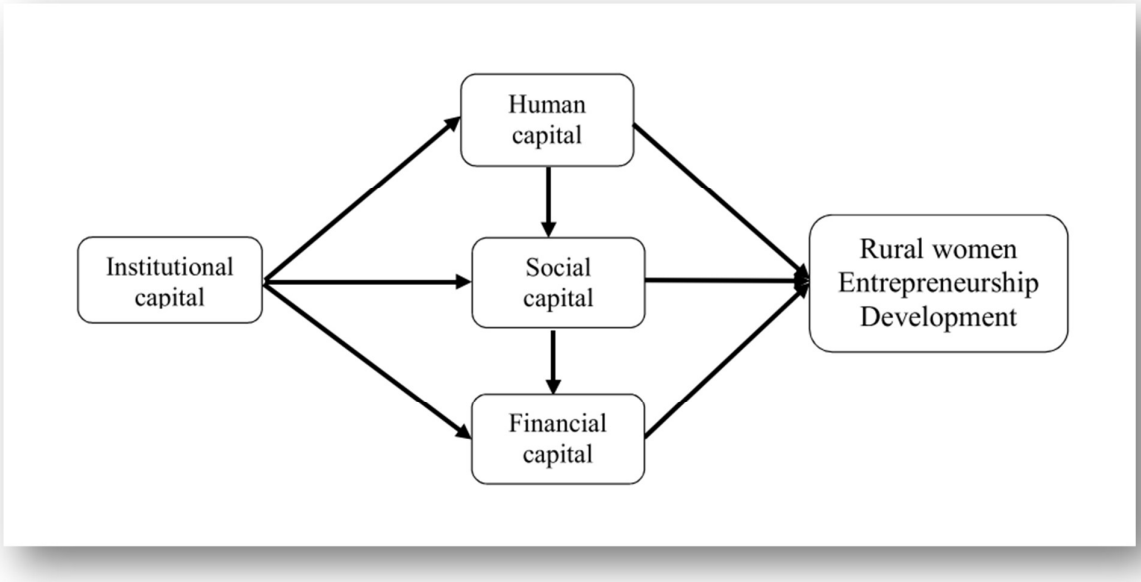
Khan, (2015) had criticized for a lack of integration of women of women in business and for the prevalence of inefficient family firms in the French economy. In the country, middle-class women were extensively engaged in entrepreneurship and innovation and their commercial efforts were seen increasing tremendously increasing when associated with family firms. During nineteenth century, women in France were unable to acquire managerial or innovative human capital through formal schooling but family firms offered an environment that could compensate for external institutional disadvantages. If women were active participants in the business, especially when their male relatives were alive, the transitions to their leadership would be less disruptive and greater longevity of family firms

would be more likely(Khan, 2015).

Kimosop et al. (2016) had identified certain factors that positively as well as negatively influences the women-owned firms' performance. Certain factors were identified which help women to enhance their performance such as strategic capabilities, information technology capabilities, and technological capabilities. Whilst age was identified as the factor that negatively correlates to their capabilities. Result found that women must improve on their information technology, marketing and technological capabilities in order to boost the performance of their business. Therefore, designing, training and developmental programmes which benefits their performance are been recommended by the study. (Kimosop et al., 2016) also recommend women to join associations that enable them amplify their capabilities as they found that women who got registered in such institutions performed better than those who did not. Participation in these associations exposes women entrepreneurs to opportunities and knowledge that enlighten their capabilities. Age was found to have negative and significant effect on performance hence, women entrepreneurs are advised to attend training programmes regularly to keep themselves updated especially in the field of technology, information technology and marketing.

Kungwansupaphan & Leihaothabam, (2016) examined the role played by human, social, institutional and financial capital and rural women entrepreneurship and the inter-related effects among them from a developing country perspective. The study was conducted in the handloom sector in Manipur state in India. It has been found that family entrepreneurial backgrounds influence the start-up phase significantly. Women with family entrepreneurial backgrounds in handloom business depend on internal sources for human, social and finance capital and the rest depend on governmental sources for the same. All four types of capitals are interrelated and bring about synergy in the start-up stage and expansion of a business. Institutional capital directly relates to all the other three types of capital, tightens their interrelationship and provide faster access to obtaining such capital (Kungwansupaphan & Leihaothabam, 2016).

Figure 7
Framework showing inter-relations of capital factors

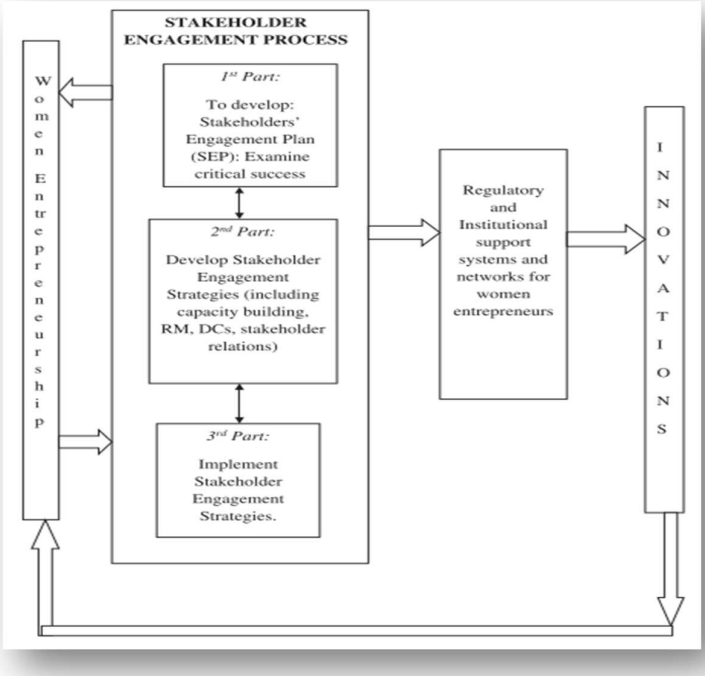


Source 7- Capital factors and rural women entrepreneurship development; A perspective of Manipur State, India (Kungwansupaphan & Leihaothabam, 2016)

Nair, (2020)proposed a conceptual framework to explain the stakeholder engagement in the success of women enterprises. To foster innovations among women entrepreneurs, interlinking of women entrepreneurship to an integrated three-part stakeholder engagement process. It is felt that interlinking of the concepts of women entrepreneurship, the integrated three-part stakeholder engagement process and the external regulatory and institutional support measures should be an ongoing continuous process. Interactive link between all the variables, with the main focus being on the stakeholder engagement process implies that the success of innovative women enterprises will depend upon individual stakeholders and their collaborative endeavours in pursuit of mutually-beneficial goals (Nair, 2020).

Figure 8

The Conceptual Framework of Stakeholders participation in Women Centred Units



Source 8- A link between women entrepreneurship, innovation and stakeholder engagement – A Review (Nair, 2020)

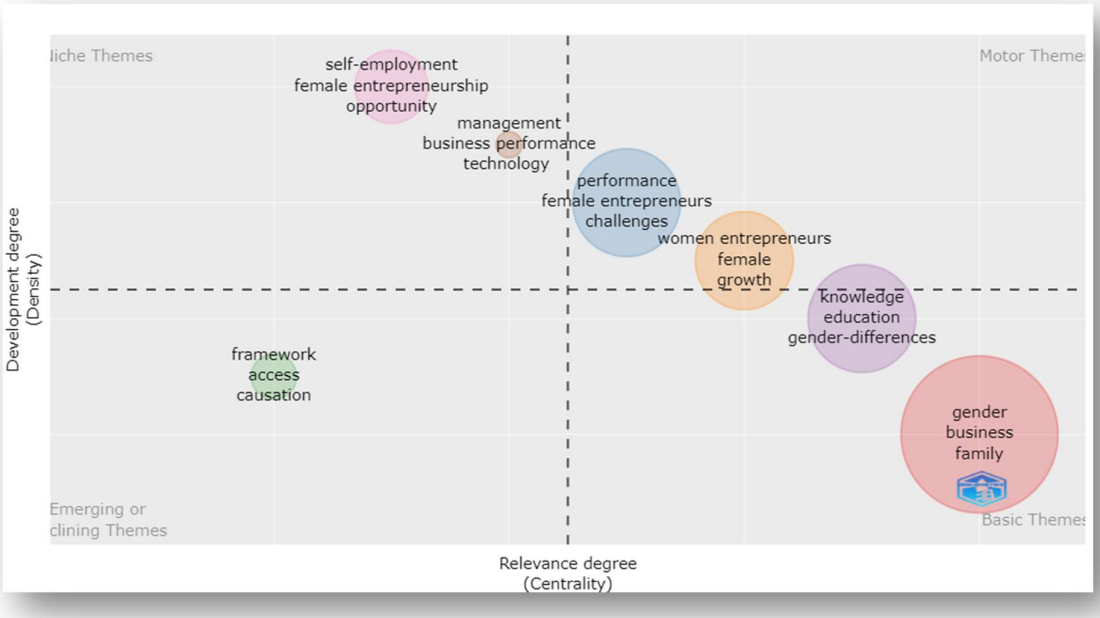
A study conducted among Nigerian women entrepreneurs in garment manufacturing business revealed that women in developing countries own the vast majority of small business hence they do not acquire any sort of support to enable their business to grow (Ogundana et al., 2021). They found that money, market and management are the direct influencers of growth. Motherhood, macro environment and meso environment are the indirect determinants of growth. Being the indirect determinant of growth, macro environment played a key role in enabling business growth among women-owned businesses by regulating access to money through government levies, policies and socio-cultural norms. Moreover, motherhood and macro environment inhibit women's access and utilization of money, market and management due to adverse socio-cultural norms and socio-economic conditions. At the same time, they also found that educational qualifications had little or no effect on the growth of women-owned enterprises. In fact, formal education is ineffective in the attraction and retention of customers in the context of West Africa (Ogundana et al., 2021).

FINDINGS

Different themes were identified through the literature review and as a result, seven Clusters were recognized with R Software such as; Gender, Business, Framework, Women Entrepreneurs, Management, Self-employment, and Education. Below is the thematic map derived using R Software.

Figure 9

Thematic Map



Source 9 An Exploratory Study

CONCLUSION

Most of the research studies so far have been trying to analyse the present situation of the female entrepreneurs. The current scenario is looking forward to welcoming translational researches. Majority of the studies emphasize the fact that governments in many region are sympathetic to the potential role of women in public space in general and the entrepreneurial arena in specific (Bastian et al., 2018). We are unaware of the fact that whether these initiations by government are reaching the real deserving hands of aspiring women entrepreneurs. Some questions need to be answered including whether governmental support has been substantive or mere ceremonial (Bastian et al., 2018). People need to know in detail about the end results of policies and programmes put forth by respective governments. Ample insights are needed into how can governments better stimulate and assist the development and growth of female ventures in the respective regions. The authorities must make sure that

the outcome of policies and programmes are been translated to the physical form to the needy, instead of being in books and papers.

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SOLID WASTE MANAGEMENT: A MODEL OF KUDUMBASREE IN THE END TO END PROCESS

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The earth's atmosphere is being changed at an unprecedented rate by pollutants resulting from magnitude of human activities. Climate change, ozone layer depletion, effects on vegetation and soil, water and other environmental resources as a result of long-range transport of pollutants including acidifying substance, threaten our future world. Much of this damage is avoidable, in particular, by the efficient and sensible use of natural resources. Pollution of air, soil and hazardous wastes are some of the problems which antagonize the Govt. today and demand concerted effort for their solution. Minimization of wastes, in particular, hazardous waste, the application of low and non-waste technology, needs to be incorporated in integrated waste management. By taking full account of the whole life cycle of wastes start from generation, collection, storage, treatment, reuse and final disposal. This comprehensive approach, a dependablemomentous approach, which would comprehend environmental protection strategies with the development of economy in general and industry in particular. Here it emphasizes, in particular, integrated waste management, economizing waste when to consider it as a resource and so on. A concentrated and systematic approach to waste management is absolutely necessary in order to resolve environmental problems.

The concept of management has become broad and dynamic with the introduction of new perspectives by the environmentalist, Sociologists, Economists, Administrators and Behavioral scientist observe management of the solid waste form different viewpoints. Management of solid wastes from the environmental perspective. Management of waste from economic point of view as a resource, max-mini approach. Management of waste from an authoritarian perception. Management of solid waste as a democratic approach. Management of non-degradable solid waste as a project, discipline, carrier and process.

OBJECTIVES

1. To analyse the productivity of the material to be converted.
2. To study the democratic and decentralized approach regarding the solid waste management.
3. To understand decision making process, in consolidating the leadership of waste management at the administrative level.
4. To accrue the result from solid waste management.
5. To define the process of waste management from bottom to top.

Solid wastes may be defined internationally as non-liquid substances generated from mining and exploration activities and from public services. It affects our environment and daily life very

seriously. The consequences of the same can be cited as; problem to mankind in particular and problem to living ecosystem in general. The growth of consumer culture and aimless throwing of refuse by people create the delicacy and now it is commonly known under the heading, environmental pollution. The problem to mankind is that environmental pollution endorses most of the infectious diseases. The problem to environment is that it creates discrepancy in the normal environment.

HARITHA KARMA SENA- A KUDUMBASREE INITIATIVE IN SOLID WASTE MANAGEMENT

The Kudumbashree Mission –Haritha Karma Sena -will work with Haritha Keralam Mission, Suchitwa Mission and Clean Kerala Company for a garbage-free Kerala. The powers to select Haritha Keralam Sena are with help of the local bodies.

The Haritha Karma Sena collects non-biodegradable waste, especially plastic,not at freee of cost but a nominal collection charge levied , from houses and establishments to send to grating units for recycling. The waste is segregated into different sections based on its features. H.M White, P.P, H.M, LDPrint, Bajar, Ganny, Bulb, PVC, steel, tubes, bottle, E-waste, LD(Glucose), Bottle caps, Spray bottle etc. The mission, the tattered plastic is being given to the local bodies for road tarring by Clean Kerala Company. Each Kudumbasree worker will visit minimum 250 houses to collect non-biodegradable waste. The manufacture of environment-friendly materials, maintenance of waste disposal mechanism, organic farming, environment-friendly equipment on rent and compost making are associated works will be taken up by Haritha Karma Sena member

PRIMARY MANAGEMENT

The solid waste management is a threshold of concern on local bodies. Corporations, Municipalities and Panchayath have serious concern about the problem. It is highly intensive and catch headache for them. They took some initial steps like street sweeping, household waste collection etc. as an initial step to consolidate the solid waste. The major constraints are the non-availability of suitable land for waste disposal, inadequate infrastructure for processing, lack of machinery for recycling and above all the high resistance from the part of the people against the waste disposal and the resultant pollution at their residence places. So management of solid wastes, especially in urban areas is very difficult. That is why they are searching innovative methods of solid waste disposal. The unacceptability of solid waste as a part of solid waste management is unreasonable. As far as the cities, especially metropolitan cities are concerned; they are even scanty of dwelling places. Today the urban local bodies are thinking about more scientific methods of solid waste disposal.

The scientific approach starts from the systematic collection of solid wastes and find reusable from waste. First of all, collection of solid wastes will be systematic, if not doing so the entire

programme will became futile. The systematic collection starts from our doorsteps. For each and every variety of solid wastes separate collection bins are needed and the separate collection bins contain items like this. They are:

- Bio degradable solid wastes
- Non degradable solid wastes
- Other Solid wastes

Bio degradable solid wastes have its own separate bins. It includes vegetable wastes food etc. The urban local bodies collect the entire wastes form their door steps and kept it in separate large bins. It can be either disposed of or use it as bio fertilizers after treating it. It can also be used for making bio fuels.

Non – degradable solid waste includes wastes like plastics. It is very dangerous. It should be collected in a separate bin and the Haritha karma Sena will keep them in separate big bins. It cannot be disposed. It should be treated in plants. The table here shows how much amount of wastes are disposed by the human beings – Residential and commercial it is the total disposal shown in millions towns. It shows how big the problem of solid wastes.

4. POST CONSUMER SOLID WASTE – RESIDENTIAL AND COMMERCIAL

Solid wastes Generated and Recycled in Major cities (A general analysis)

Major Cities in India	**Solid wastes**		**As a Percentage of solid wastes generated and collected**
	Generated (Tonnes)	Collected (Tonnes)	
Mumbai	3200	3100	96.9
Madras	1819	1637	90.0
Banglore	1800	1225	68.1
Ahamadabad	1200	1080	90.6
Kanpur	2124	1500	70.0
Pune	1000	700	70.0
Luknow	600	500	83.3
Total	11761	9742	82.8

Source : J.C Kerala, R.R.Khaw, " Management of Solid Waste"

5. TYPES OF RECYCLING

Non degradable solid wastes like plastics it can be treated in plants. While they are treated in plants, we again get usable from this solid wastes. The common process of such treatment is known as' Recycling.' The type of non–degradable solid waste recycling are

- Primary recycling
- Secondary or Mechanical recycling
- Tertiary or chemical recycling
- Quaternary recycling

Primary recycling is the processing of clean factory waste in to product with equal chemical properties as the processed waste. The second is mechanical process of recycling. It is also done in factory itself but in facts it is like primary treatment. In the secondary recycling process, the waste is converted into inferior quality of the original products. This type of recycling is generally used in farming activities and packaging. waste. In the tertiary process, a mixed recovered waste plastic by changing the chemical structure transforming it into basic chemical stocks. For example, Hydrolysis, Glycolysis and Methanolysis. Quaternary recycling means direct utilization of energy value of the material by incineration.

ROLE OF KUDUMBASREE

In our current philosophy solid waste are resources. The primary way of economizing solid waste is a kind management. It includes three main steps they are:

1. **Collection**
2. **Storage**
3. **Disposal**

Collection form households, Storage by the local authorities, Disposal / recycling by local authorities or any agency or NGOs .

The simple management principle lies in the first and second steps of management. From the third step onwards the process economization of solid waste take place.

ECONOMIZING SOLID WASTE

Before explaining the process of economization, a typical classification of solid wastes is to be made. The typical classifications of solid wastes are;

1.Garbage – decomposable – put for bio fertilizers – Add productivity in the agriculture sector – As manure – production increases and it just adds to Gross Domestic Product (GDP)

2.Rubbish – either combustibles or non – combustibles- put for recycling – can reduce the additional resource use - Highly creative- it directly economize resources – waste then it became a resource. It also adds to GDP after consumption of newer ones.

3.Ashes – Truly wastes – exit in loose from – used as insecticides – Ashes from wood burned are traditionally used as pesticides – Highly helpful in agriculture production – A pollution free

material – it fills the gap of chemical pesticides – it also adds to productive efficiency of the economy. It can improve the Gross Domestic Product level of the economy.

4.Large wastes – Demolishing and construction waste it can be used for landfills at its primary use or it can be recycled. But it needs modern technology. So it can be used for landfills. It needn't advisable because sometime it is not eco-friendly. But it is used for deep land fills. It thus reduces the resource available for land filling. Dead animals, House hold pets, Anatomical and pathological wastes- it is not often raised as a question of solid wastes – it will be put for incineration and so much space can be saved while they are put for incineration. Sewage process solids–used for making biogas so it can reduce the use of natural gas, a high priced material, by using sewage process solids. Mine wastes – usually used for filling the same land used for mining – it minimizes the use of resources need for further land filling at the same area.

5.Industrial Solid wastes – Here it takes plastics as the main consideration. Plastics of high density (HA), Low Density (LD) and PVC are put under recycling process. Plastics are the byproducts of crude oil. It is not abundant in supply plastic recycling is a method of economizing plastic solid waste material. It is highly on economic process because; plastic solid wastes act as a resource itself in true sense. The simple decision of plastic solid wastes as the following.

It acts as a resource, minimizes the use of further, new or additional material needed. It can reduce the cost of further exploring and the purification of crude oil. So when the solid waste is recycled, it is a new technique of cost effectivenessand a new source of resource for the mankind. When we compare the cost and benefit, its benefits are very much higher than costs.

Plastic solid wastes are truly harmful to environment. It is not at all eco- friendly. So it need to be destroyed at its opening stage. In this way it seems to be a good material for recycling or put it in the incinerator. Plastics, as a weightless material compared to metals, has its own role in the modern society. It acts as a material for reuse and recycling. By counting its economics, is positive. It also adds productivity of the nation.

ECONOMIC VIABILITY OF SOLID WASTES

Economic viability in cost sense. The costs are money costs and social costs. If money cost and social costs together reduced, then it is called economic viability. Social cost is very difficult to determine. Open dumping creates social cost. Total cost of solid waste is equal to economic costs (money costs) and social cost. Solid waste management services absorb up to one percent of Gross National Product efficiency of the system. The system requires high labour participation. Recycling is the ultimate method of economizing solid wastes. Recycling is a value added method, that is, produce valuable from junk.

CONCLUSION

Various common methods are used reproduce valuables from solid waste. The disposability depends on various things like the nature, content, and the extent of the availability of solid waste. Above all local local conditions are favourable for the solid waste disposal. The availability of land,

high-tech machineries and the availability of skilled labour are considered as basic parameter for economization of solid waste. To conclude the study, the following common methods are adopted for economizing solid waste are: Compositing, Recycling, Incineration and Landfills

POSSIBILITIES AND SUGGESTIONS

1.Construction of recycling plants through public and private participation

2 Scientific methods butchering

3.Building up of bio fertilizer plants and construction of recycling units

4.Prevention of waste dumping in open spaces and it should be prevented by law.

5.Proper placing of bins for waste collection.

6.Eco- development/ Kudumbasree projects for awareness and action

7.Punishment to the aimless throwing the waste. The concerned officials like health inspectors and environmental managers who take care of these matters.

8.Training programmes.

9.Awareness programmes.

10.Extension programmes in schools and colleges.

11. Encourage the use of bio-gas for cooking.

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COPING WITH POST TRAUMATIC DEPRESSION: A STUDY OF THE TRAUMA NOVEL *SPEAK*

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Key words: Y- A fiction, trauma theory, developmental trauma disorder

The relationship between trauma and mental illness was first investigated by the neurologist Jean Martin Charcot, a French physician who was working with traumatized women in the Salpetriere hospital. During the late 19th century, a major focus of Charcot's study was hysteria, a disorder commonly diagnosed in women. Hysterical symptoms were characterised by sudden paralysis, amnesia, sensory loss and convulsions. At that time, such symptoms were thought to originate in the uterus. Until Charcot, the common treatment for hysteria was hysterectomy. Charcot was the first to understand that the origin of hysterical symptoms was not physiological but rather psychological in nature.

Along with the recognition of complex traumatic stress disorder and its impact on all aspects of the person's life, Van der Kolk recommended the inclusion of a ne diagnosis, which he called developmental trauma disorder for children with complex developmental trauma histories. It addresses the consequences of early trauma in relation to abuse and neglect. Children who didn't get proper care and treatment for childhood abuse will likely suffer from behavioural, emotional and cognitive disturbances for the rest of their lives. This can lead to poor impulse control, aggression, difficulty in personal relations, inability to concentrate and poor academic performance.

The term 'trauma novel' refers to a work of fiction that conveys profound loss or intense fear on individual or collective level. The protagonist(s) of the novel are traumatized by some terrifying experience. Some examples are Dorothy Allison's *Bastard out of Carolina* and Toni Morrison's *Bluest Eye* which show the trauma of female sexual violence, Edward Abbey's *Black Sun* which portray the unexpected death of a loved one and Khalid Hosseini's *The Kite Runner* that tells the dark story of male sexual abuse.

Speak is a trauma novel written by the American novelist Laurie Halse Anderson. The novel is based on Anderson's personal experience as she was raped when she was a teenager. The protagonist of the novel is Melinda Sordino, a high school student who was raped by a senior student at a party. After that brutal incident, she did not know what she should do. She called the police, but by the time the police came she ran home without telling anyone what

had happened. Next day, at school she is shunned by her peers for calling the police and ruining the party. But she never gets the guts to tell anyone her traumatic experience. She remains silent and sinks into depression. As Melinda's depression deepens, she begins to skip school, withdrawing from her classmates and already distant parents. She slowly befriends her lab partner David Petrakis who encourages her to speak up for herself. And finally, Melinda tells her story to her art teacher Mr. Freeman and the revelation of the truth takes the burden off her shoulders and she overcomes her post traumatic depression.

Speak belongs to the genre Young Adult Literature (Y-A literature). It is written for 'young adults' or adolescents. It is a coming-of-age novel, telling Melinda's "quest to claim a voice and identity. (Detora, Lisa. Pg.24) The rape troubles Melinda emotionally rather than physically. She is torn between conflicting desires- wanting to suppress the memory of the experience and at the same time yearning to speak about it. Trauma is a compelling and evocative topic in the contemporary world and as reflected in literature. In unravelling trauma's effects, trauma narratives reveal the intricacies of power and the relationship between society's demands and the individual's psychological wellbeing.

The theme of *Speak* is finding one's voice and identity. It is the fight against violence and victimization. Melinda feels guilty even though she was the victim of sexual assault. It shows how women are traumatized and victimized in the society. They are not able to speak or open up about their trauma for fear of social estrangement, public humiliation, physical threat and a sense of guilt for no crime they committed. We can see how film actresses who revealed their abuse stories are being ridiculed and trolled in social media. The aftermath of sexual abuse is not just the physical torture but the violation of one's sense of self and the right to speak. It is in this context that the # Me too Movement gets its significance. Socially visible women come up with their traumatic experiences and they boldly proclaim that "I'm not a victim, I'm a survivor". Hence the conventional picture of a teary eyed victim is replaced with that of a warrior who has survived a physical and emotional battle and who is able to assert her identity and fight back at her enemies.

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ASPALATHUS LINEARIS MEDIATED SYNTHESISAND SPECTROSCOPIC INVESTIGATIONS ON $CUSNO_3$ NANOPARTICLES

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ABSTRACT

This paper contributes to the synthesisand characterization of $CuSnO_3$ nanoparticles using natural extracts from *Aspalathus linearis*. X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), Scanning ElectronMicroscopy (SEM)with EDX and UV-visible diffused reflectance spectroscopy (UV-DRS) were employed for characterization. The crystallographic information obtained from XRD data revealed the coexistence of tetragonal SnO_2 and monoclinic end centered CuO phases, forming a mixed oxide structure in $CuSnO_3$ powder sample, which is also evident from FTIR and SEM images. The strain separated crystallite size estimated from Halder-Wagner analysis is 18 nm for the mixed phase. The optical band gap estimated from Tauc' plot employing Kubelka-Munk function using DRS-UV–vis data is 3.08eV and 3.17 eV, respectively for CuO and SnO_2 phases.

Keywords:Tetragonal, monoclinic, Halder-Wagner, Kubelka-Munk function, Tauc' plot etc

1. INTRODUCTION

The term "nanotechnology" refers to any technology that employs nanometer-scale objects [1]. Nanomaterials are among the most promising components for the next generation of many sophisticated uses of materials in a variety of sectors, including energy storage[2], medicines[3],drug delivery[4], biological sensing[5] and gas sensing[6]. Based on the overall structure, these materials may be 0D, 1D, 2D or 3D[7]. Researchers understood the significance of these materials when they discovered that the size of a substance might affect its physiochemical characteristics[8].Due to their large surface area and porosity nanostructured materials are currently appealing for lithium ion storage devices[9].$LiCoO_2$ and graphiteare the materials that make up the positive and negative electrodes of the majority of lithium ion batteries used in commercial applications. Graphite and $LiCoO_2$ are both hosts for the insertion of lithium ions[9].

In terms of processing temperature and the uniformity of device properties, amorphous semiconductors are favored over polycrystalline ones when it comes to active layer

materials[10]. Copper tin oxide, also known as $CuSnO_3$ is a mixed oxide semiconductor that has a tunable band gap of 3.16 eV, which is manufactured using earth-abundant materials that are very inexpensive[11]. Because of these factors, $CuSnO_3$ is regarded as an appealing semiconductor for a wide variety of applications, including electrochemical characteristics, theoretical models with magnetic properties, electrical, structural aspects and applications relating to energy storage[12].$CuSnO_3$ mixed oxide has been shown to have a high capacity and a low insertion potential in relation to Li metal[13].Because of the reduction in hole effective mass, there is an improvement in the material's mobility, which also leads to an increase in the material's conductivity [14]. Copper and tin are two of the metals that may be used for this function that are both inexpensive and readily available [14-16] ,. Using a density functional theory, Isherwood et al. proved that band gaps and electrical characteristics of $CuSnO_3$ films can be easily modified by varying the Cu concentration[17]. Tin oxide anode has been regarded the greatest choice for the anode material in lithium-ion batteries because of its high specific capacity, which is almost twice that of graphite[13].

Due to the fact that bioactive chemicals bind metal oxide to form nanoparticles, the biosynthesis method is simple and efficient. *Aspalathus linearis* plant functions as an efficient agent for the production of $CuSnO_3$ nanoparticles in a simple and expedient manner[18]. Rooibos is a type of tea that comes from a plant that is native to South Africa and is classified as fynbos. As a caffeine-free herbal tea and an antioxidant food component, *Aspalathus linearis* has become well-known across the world's markets[19].Rooibos tea is a sort of herbal beverage that is made from the leaves and thin stems of a natural plant [20]. Fresh rooibos leaves are high in ascorbic acid and have a low level of tannins and alkaloids; nevertheless, processed rooibos leaves and stems are high in benzoic and cinnamic acids[21]. Rooibos tea, which is prepared from the dried fermented leaves, does not contain any caffeine and has a high fluoride concentration, both of which are considered to prevent tooth decay. Several different phytochemical tests were performed on various portions of these tree species and the results showed that the extracts produced from the *Aspalathus linearis*contained polyphenols, that included flavanols, flavones, flavanones[22], dihydrochalcones[23], aspalathin[24] and nothofagin[25].

Synthesis of photocatalytic material may be accomplished by the use of a variety of techniques, such as co-precipitation[26], the sol–gel method[27], the hydrothermal approach[28], microwave synthesis[29] and gas phase method[30]. Using the co-precipitation approach, we were able to successfully produce $CuSnO_3$ nanocomposite for this investigation.

2. EXPERIMENTAL

The natural extract of rooibos tea was used in the co-precipitation process to precipitate $CuSnO_3$ nanoparticles. In this approach, 8 gm of rooibos tea powder wasboiled in 500 ml of de-ionized water at a temperature between 80-90°C for one hour. The mixture was then allowed to gradually cool and filtered. To the extract of rooibos tea, equimolar concentrations of the aqueous solution of analytical grade $CuCl_2.2H_2O$ and $SnCl_2.5H_2O$ were added. This reaction mixture was stirred at 90°C for one hour. The precipitate was monitored and kept to settle for an overnight. Theresidue obtained was washed several times in distilled water and then filtered using Whatman filter paper in order to eliminate the contaminants and allowed to dry out to a powder form. The crushed powder wasannealed at 600°Cfor three hours.$CuSnO_3$powders were eventually produced at the end of the process. Following this, the sample was sent for recording a variety of analytical measures including XRD, FTIR, SEM with EDX and UV-Visible reflectance spectrum.

3. RESULTS AND DISCUSSION

3.1 X-RAY DIFFRACTION

The XRD patterns of $CuSnO_3$ powders annealed at 600°C are displayed in Fig 1.XRD patterns showed strong peaks corresponding to Bragg reflections (110), (101), (211), (220), (310), (301) and (321) of tetragonal SnO_2 with space group P42/mnm (136) and lattice parameters a = 4.738 and c = 3.188.Shoulder peaks at 2θ values35.3 and 38.45corresponding to monoclinic end-centered CuO phase with space group Cc(9) and lattice parameters a=4.689, b= 3.420 and c=5.130 can be detected, indicating that the $CuSnO_3$ nanoparticles do not appear to be existing in single phase. The ICDD PCPDFWIN numbers 21-1250 and 89-5899 corresponding to tetragonal (SnO_2) and monoclinic (CuO) are of good match with the Bragg reflection planes obtained $CuSnO_3$ powder sample, forming a mixed-phase crystal systems.

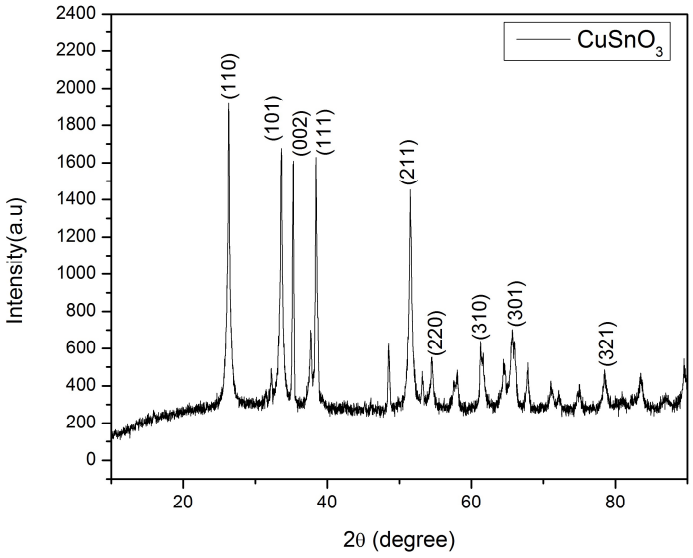

Fig 1: XRD pattern for $CuSnO_3$ nanoparticles annealed at 600°C

In the mixed oxide crystal system of $CuSnO_3$ powder sample, it is apparent from XRD pattern that SnO_2 is the dominant pahase.

3.1.1DEBYE-SCHERRER EQUATION

Crystallite size may be determined using the Debye-Scherrer equation based on the width of the diffraction peaks[31].

$$D = \frac{k\lambda}{\beta \cos\theta_B} \qquad (1)$$

where D is the average crystallite size measured perpendicular to the reflecting planes,$k$is a constant quite near to unity, θ is the Bragg angle, λ is the x-ray wavelength and β is the width of the peak expressed in radians as a result of the crystal's finite size. The average crystallite size of $CuSnO_3$ was determined to be 16 nm.

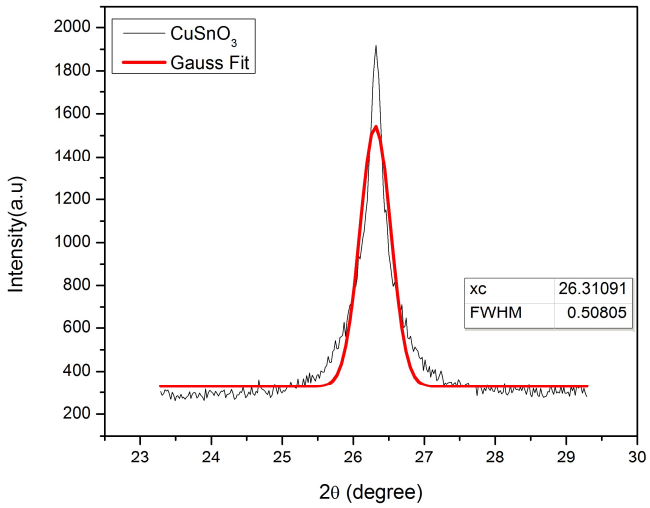

Fig 2: Gauss fit to the XRD pattern's most strong Bragg' reflection peak (110)

Fig. 2 shows the Gauss fit for the XRD pattern's highest Bragg reflection peak (110), from which the FWHM value is computed to be 0.50805°.

3.1.2 HALDER-WAGNER METHOD

The Halder-Wagner approach asserts that peak broadening is a symmetric Voigt function[32]. In the Halder-Wagner method, the Lorentzian function and the Gaussian function are used to define the crystallite size and the strain profiles[33].

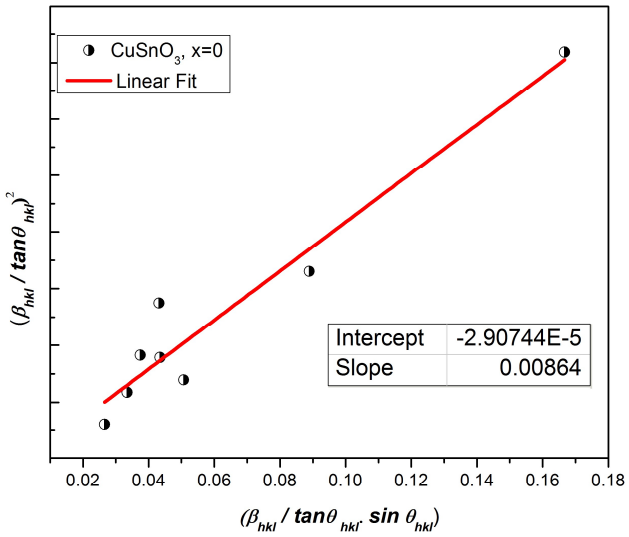

Fig 3: Plot of Halder-Wagner method

The equation may be expressed as:

$$\left(\frac{\beta_{hkl}}{tan\theta_{hk}}\right)^2 = \frac{k\lambda}{D_{H-W}} * \frac{\beta_{hk}}{tan\theta_{hkl}.sin\theta_{hkl}} + 16\varepsilon^2{}_{\mathrm{H-w}} (2)$$

Fig. 3 displays the (β_{hkl} / *tan* θ_{hkl}. *sin* θ_{hkl}) term plotted along the X-axis and the (β_{hkl} / *tan* θ_{hkl})^2 plotted along the Y-axis for each peak of the XRD pattern**.** Thecrystallite size was calculated using the slope($\frac{k\lambda}{D_{H-W}}$) of the straight line that was drawn, while the intrinsic strain of the samplewas determined using the intercept ($16\varepsilon^2{}_{\mathrm{H-w}}$). The calculated size of the crystallites is reported to be 18 nm and the modulus value of micro strain is0.0013480. The H-W size is in close agreementwith Debye-Scherrer size.

3.2 FTIR ANALYSIS

The characteristic portion of the FTIR spectra for $CuSnO_3$ nanopowders is displayed in Fig 4.In the ranges 400- 4000 cm^{-1}, the sample shows numerous notable peaks. The band at 460.48cm^{-1}might be attributed to the Cu-O stretching vibration, whereas the band around 612.39cm^{-1} is caused by the production of symmetrical and anti symmetrical stretching vibrations of Sn-O-Sn groups[12].

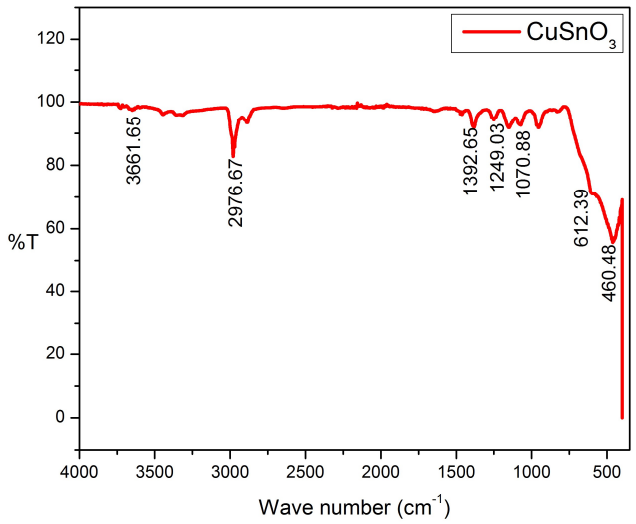

Fig 4: FTIR spectra for $CuSnO_3$nanoparticles

The stretching vibration of O-H groups corresponds to the broad band recorded at 3661.65cm^{-1}, while the bending vibration of O-H groups corresponds to the broad band detected at 1392.65cm^{-1}[12]. The existence of C-H stretching vibrations is responsible for the intense peak seen at 2976.67 cm^{-1}. C-O stretching vibrations are detected in the absorption band between 1070.88 and 1249.03 cm^{-1}.

3.3 SEM-EDX ANALYSIS

Scanning electron microscope (SEM) with EDX was used to conduct an analysis on the surface morphology and related chemical composition of the nanomaterial synthesized.Fig 5 shows the SEM measurements of $CuSnO_3$ at two different magnifications. The dark and bright spots are corresponding to two crystalline phases of monoclinic (CuO) and tetragonal (SnO_2), which is in accordance with the crystallographic information obtained from XRD data.

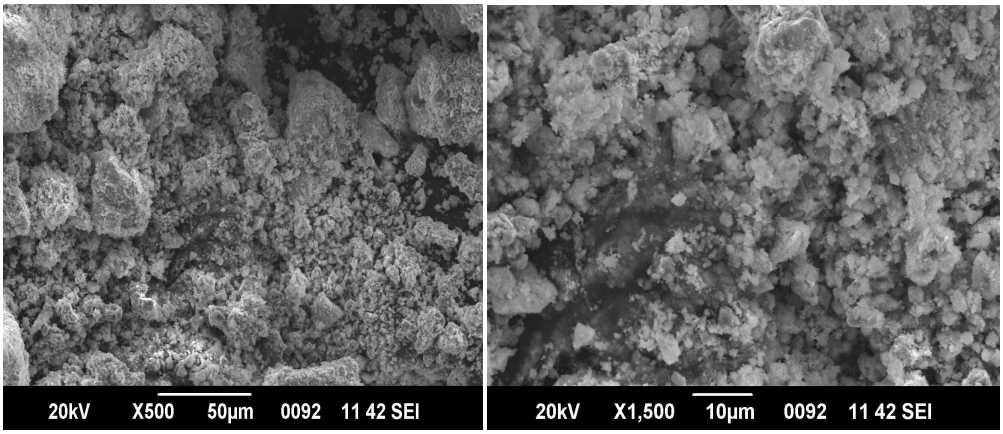

Fig 5: SEM images recorded for $CuSnO_3$ nanoparticles

The EDX data is used to check the elemental composition of the sample.The EDX spectrum of the CuSnO3 nanoparticles is shown in Fig 6. Peaks for the elements Cu, Sn and O were seen in the EDX spectra of $CuSnO_3$ nanoparticles.

Table 1:Weight percentage and atomic percentage of elements in $CuSnO_3$ nanoparticle

Elements	Weight %	Atomic %
Cu	15.14	39.01
Sn	4.13	11.06
O	52.78	44.45
Cl	27.94	5.48
Total	100	100

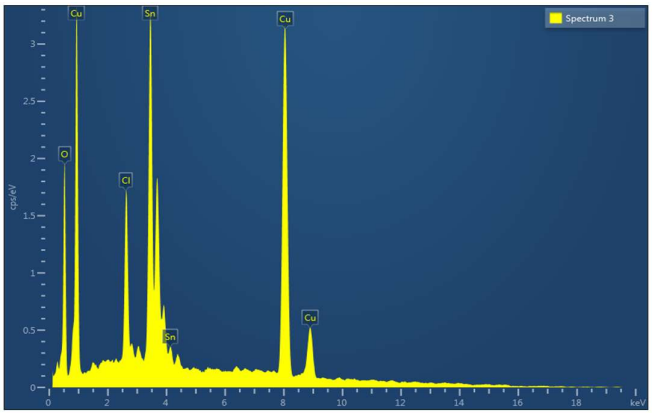

Fig 6: EDX spectra for $CuSnO_3$nanoparticles

Upon doing an analysis of the EDX spectra, we came to the conclusion that there were presence of 39.01% Cu, 11.06 % Sn and 44.45 % O. A trace amount of (5.48 %) of unreacted chlorine is also found.The theoretical values and the weight percentage of the components are quite close to one another, which confirms the purity of the nanoparticle [34].Table 1 shows the weight percentage and atomic percentage of elements in $CuSnO_3$ nanoparticle.

3.4 DRS-UV VISIBLE SPECTRA

The synthesized $CuSnO_3$ materials were examined by Diffuse Reflectance Ultraviolet-Visible spectroscopy (DRS-UV). The DRS-UV–vis spectrum recorded for the sample is shown in Fig 7. $CuSnO_3$ displayed an absorption edge cut at 300 nm. This was caused by the excitation of electrons from the valence band to the conduction band[35].

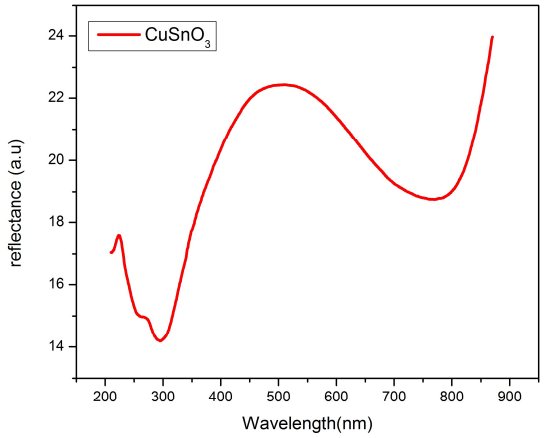

Fig 7: UV-DRS spectra recorded for $CuSnO_3$

The energy needed to drive an electron from the valence band to the conduction band is referred to as the optical bandgap energy.For the purpose of computing the band gap energy, the Kubelka–Munk function was employed.

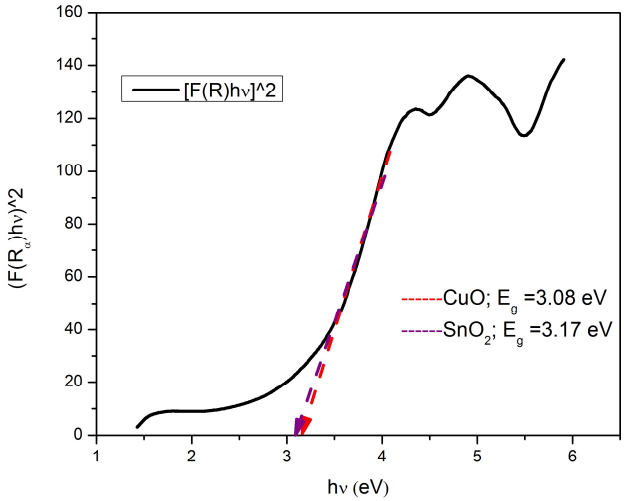

Fig 8:Tauc' plot using Kubelka-Munk function

In UV-vis spectroscopy, optical spectra can be recorded in a variety of modes, such as absorbance A, transmittance T and reflectance R. These modes are dependent on the nature of the substrate and the nanomaterial being studied[36]. The reflectance data were employed to estimate the band gap of the material sample by applying a modified version of Tauc's plot in connection with the Kubelka–Munk equation[37, 38]. The equation that determines the Kubelka-Munk function[37] based on the reflectance data is as follows,

$$F(R_\alpha) = \frac{(1-R)^2}{2R} = \frac{k}{s} \qquad (3)$$

where $R_{\alpha} = R_{Sample} / R_{Standard}$represents the reflectance of a material , k and s stand for the absorption and scattering coefficients, respectively. Tauc' plot using Kubelka-Munk function is shown in Fig 8. For CuO and SnO_2, the band gap was figured to be 3.08 eV and 3.17 eV, respectively.

CONCLUSION

$CuSnO_3$mixed oxide nanoparticles with two crystalline phases corresponding to monoclinic (CuO) and tetragonal (SnO_2)were successfully synthesized through biosynthetic method using the aqueous natural extracts of *Aspalathus linearis*(Rooibos tea). The average size of a crystallite was estimated to be 18 nm.The metal-oxide vibration bands corresponding to Cu-O and Sn-O bonds were evidenced from FTIR measurement.In accordance with XRD results,

the mixed oxide phases corresponding to CuO and SnO_2 were evident from the dark and bright spots in SEM images.The band gaps for the CuO and SnO_2 phases in the sample were calculated to be 3.08eV and 3.17 eV, respectively.

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STUDY ON THE DIVERSITY OF GOATFISHES (FAMILY: MULLIDAE) FROM THE SOUTHERN COAST OF INDIA

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ABSTRACT

Goatfishes (Mullidae) are easily identified by their bright colour, which is predominantly red or yellow, and distinguishing black, yellow, orange, or brown bands or stripes, as well as the presence of two long, unbranched barbels on the chin. They are most commonly found on sandy or muddy bottoms, with a few species connected with coral reefs. They are found in shallow coastal waters, and their concentration is usually limited to a depth of 40 m or less. They are rarely seen deeper than 60 m. Estuaries are frequently visited by *Upeneus sulphureus*. Small schools of *U.sulphureus, U.vittatus,* and *U.bensasi* form, however *U.tragula* is a single species.Although these fishes do not form a major source of commercial catches, they constitute one of the major food fishes of India with considerable regional importance. Recently the catch trend of the goatfishes along the Indian coastal line has declined drastically. Hence, study is needed to assess the diversity of goatfishes based on both classical morphmetric and molecular analysis along the various landing centers of southern Indian coast. The present study may reveal novel diversity ,of goatfishes in the southern coasts of India.

Keywords: Mullidae, Barbels, Chemosensory receptors, Trawlers, Morphometry

INTRODUCTION

Goat fishes from Mullidae family are known and commercially important fish all over the world (Pavlov and Emel Yanova 2018). The Mullidae (goatfishes) comprises 6 genera and about 97 species97 valid species are available globally (Nelson et al. 2016; Eschmeyer and Fong 2017) of almost small (up to 60 cm) marine or rarely brackish water fishes. They are commonly known as Red mullets is an important fishery in by-catch of the commercial trawlers and also possess minor commercial importance, landed in various fisheries harbors along the Indian coast.

Generally, goatfishes, are small, demersal, fishes with a maximum size ranged between 20cm and 60cm. Most of the species are inhabit with shallow waters, maximum up to 60 m depth, over soft bottoms and sandy mud. Some species are conspicuously coloured and are seen associated with coral reefs. They use their barbels as chemosensory receptors

through which they stir the soft bottom to search out the prey such as polychaetes, worms and small crustaceans; some feed almost exclusively on small fishes. Although these fishes do not form a major source of commercial catches, they constitute one of the major food fishes of India with considerable regional importance. Recently the catch trend of the goatfishes along the Indian coastal line has declined drastically.

Taxonomical studies of this imperative and interesting group in India are very meager and few studies have existed with only classical taxonomy. Species belongs this family also exhibit ontogenetic variation in body colour and morphometrics, leads difficulty in identification. An ample integrated method is essential to understand the difference and similarity among different species and to unknot the diversity and evolutionary differences in the genus. Hence, study is needed to assess the diversity of goatfishes based on both classical and molecular analysis along the various landing centers of southern Indian coast. The study may reveal novel diversity of goatfishes in the southern coasts of India, which would pave the way for potential fishing resources for the fisherfolks. Species occurrence, abundance and diversity are discussed in detailGoatfishes are characterized by a pair of chin barbells, which contain chemosensory organs. Their bodies are deep and elongated, with forked tails and widely separated dorsal fins]

Many goatfishes are brightly colored. The largest species, the dash-and-dot goatfish (*Parupeneus barberinus*), grows to 60 cm in length; most species are less than half this size. The present work is a preliminary study on the diversity of goatfishes (Family: Mullidae) from the Southern coast of India based on morphometric characters.The present studyassess the diversity of goatfishes based on based on classical morphmetric analysis along the various landing centers of southern Indian coast..

METHADOLOGY

Total of 75 Goatfish (Family Mullidae) samples were collected from the trawl fishery landings from the kerala , Karnataka, Tamilnadu and Lakshadeep coast in the fishing season during 2020-2021. Samples were separated into the different species. Specimens were preserved in 10% buffered formaldehyde. Morphometric characters were measured with a caliper. Meristic characters that vary among species are referred to in the diagnoses and compared: the number of dorsal fin spines, pectoral fin rays, rudimentary and developed gill rakers on lower and upper limb and lateral line scales are recorded . In order to see the first minute dorsal fin spine in eight spine species a stereomicroscope was used. Colour

photographs for each species were taken with cannon EOS M50 camera. Caudal fin photographs were taken for counts of caudal fin bars, include all bars from the base of each lobe to the lobe tip. Morphometric studies were based on identification procedure followed by Randall JE. 1974.

RESULT

Studies of goatfish occurrence and abundance in natural habitats in the Kerala, Karnataka Tamilnadu and Lakshadeep coast have been documented. Twelve species were identified under the family mullidae., *Upeneus vittatus, Upeneus guttaus Upeneus taeniopterus, Upeneus moluccensis, Upeneus indicus, Upeneus moluccensis, Upeneus sulphurens, Upeneus sundaicus, Parupeneus heptacantus, Upeneus hamster, Parupeneus indicus, Parupeneus macronemous.* Of the the four landing sations the abundance of goat fishes were seen in Mangalore harbor. *Upeneus vittatus, Upeneus guttaus* were the most dominating species (Table 1).

Diagnostic characters: Body moderately elongate and somewhat compressed. Two long unbranched barbels on chin; mouth low on head, the lower jaw inferior, the cleft slightly oblique; dentition variable but teeth conical, either in villiform bands or in 1 or 2 rows, never as enlarged canines (except in adult males of western Atlantic and eastern Pacific species of Pseudupeneus, the teeth of which are slightly enlarged). A single flat spine posteriorly on opercle (a second less developed spine may be present); margin of preopercle smooth. Two well-separated dorsal fins, the first with VII or VIII (usually VIII) slender spines (first spine often very small), the second fin with 9 soft rays (first unbranched); anal fin with I spine and 6 or 7 soft rays; caudal fin deeply forked, with 13 branched rays; pelvic fins with I spine and 5 soft rays; pectoral fins with 13 to 18 rays. Scales finely ctenoid; head and body completely scaly (except preorbital region of some species of Upeneus). Lateral line complete, following contour of back, the pored scales to base of caudal fin 27 to 38. Colour: ground colour in preservative usually pale, in life often whitish to light red; most species with distinctive black, brown, red, or yellow markings; median fins often with stripes or oblique bands (Randall JE. 1974).

Table 1 List of Goat fishes collected fromSouthern coast of India

Sl. No	Coast	Location	Species	Family	Number of specimens
1.	Kerala Coast	Neendakara	*Upeneus guttatus*	Mullidae	5
			Upeneus vittatus	Mullidae	5
		Munambam	*Upeneus vittatus*	Mullidae	5
		Calicut	*Upeneus guttaus*	Mullidae	5
			Upeneus vittatus	Mullidae	5
2	Karnataka Coast	Mangalore	*Upeneus guttaus*	Mullidae	3
			Upeneus taeniopterus	Mullidae	1
			Upeneus moluccensis	Mullidae	3
3	Tamilnadu Coast	Thondi	*Upeneus indicus*	Mullidae	5
			Upeneus moluccensis	Mullidae	
			Upeneus sulphurens	Mullidae	6
			Upeneus sundaicus	Mullidae	12
			Parupeneus heptacantus		
		Mandapam	*Upeneus hamstera*	Mullidae	4
			Parupeneus indicus	Mullidae	3
			Parupeneus macronemous	Mullidae	3
			Upeneus guttaus	Mullidae	4
		Chennai	*Upeneus vittatus*	Mullidae	12
		Thothukodi	*Parupeneus macronemous*	Mullidae	5
4	Lakshadeep coast	Lakshadeep	*Parupeneus indicus*	Mullidae	5
			Parupeneus macronemous	Mullidae	5

Fig 1 ***Parupeneus indicus***

Fig 2 ***Parupeneus macronemous***

Fig 3 ***Upeneus sundaecius***

DISCUSSION AND CONCLUSION

Although these fishes do not form a major source of commercial catches, they constitute one of the major food fishes of India with considerable regional importance. In the present study we have identified 12 species of goat fish from southern coast but the abundance was very poor. Recently the catch trend of the goatfishes along the Indian coastal line has declined drastically. Taxonomical studies of this imperative and interesting group in India are very meager and few studies have existed with only classical taxonomy. Species belongs this family also exhibit ontogenetic variation in body colour and morphometrics, leads difficulty in identification. An ample integrated method is essential to understand the difference and similarity among different species and to unknot the diversity and evolutionary differences in the genus. Hence, study is needed to assess the diversity of goatfishes based on both classical and molecular analysis along the various landing centers of southern Indian coast. The study may reveal novel diversity of goatfishes in the southern coasts of India, which would pave the way for potential fishing resources for the fisherfolks. Species occurrence, abundance and diversity are discussed in detail

ACKNOWLEDGMENTS

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SYNTHESIS, SPECTRAL AND THERMAL STUDIES OF SOME DIOXOURANIUM(VI) COMPLEXES OF SCHIFF BASE AND AN AZO DYE DERIVED FROM 4-AMINOANTIPYRINE

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ABSTRACT

Synthesis of some novel dioxouranium(VI) complexes with a Schiff base derived from 4-aminoantipyrine and 3-ethoxysalicylaldehyde and an azo dye derived from 4-aminoantipyrine and isoeuginol are reported. The complexes have been characterized by elemental analyses, molar conductance, magnetic susceptibility data, IR, ^{1}H NMR, FAB mass spectral studies, powder X-ray diffraction and thermal decomposition techniques.All the complexes are neutral solids with higher stability at room temperature. The physicochemical studies and spectral data indicate that ligand act as a neutral bidentate chelating ligand**.** The complexes have the general formulae $[UO_2(APES)_2(X)_2]$ and $UO_2(IEAP)(X)_2]$, where X = NO_3,Ac, NCS, Cl or Br. Hexagonal bipyramidal geometry has been proposed for dioxouranium(VI) complexes with APES as ligand and octahedral geometry for dioxouranrium(VI) with IEAP as ligand.

Keywords:dioxouranium(VI) ,4-amionoantipyrine,Thermal studies

1. INTRODUCTION

There has been considerable interest on theoretical and experimental chemistry of metal oxocations. Dioxouranium(VI) is one of the stable oxocations[1] and the complexes of dioxouranium(VI) have been studied extensively[2,3] because of the theoretical interest in the linear O=U=O group, different structures, detection of uranium compounds in sea water and its importance in relation to energy problems. The uranyl ion is quite peculiar both in its own structure and in its coordination chemistry. It has a linear shape forming complexes with 4 to 8 donor atoms in the equatorial plane[4-6]. Dioxouranium (VI) is one of the most studied oxocations for which a large number of complexes with varying geometries are possible [7].

In view of the versatile importance of 4-aminoantipyrine and uranium, we report here the synthesis, spectral and physico-chemical characterization and thermal studies of complexes of dioxouranium(VI) species with a Schiff base (APES),derived from4-aminoantipyrine and 3-ethoxysalicylaldehyde and an azo dye derived from 4-aminoantipyrine and isoeuginol(IEAP).

2. EXPERIMENTAL

2.1. Materials

All the chemicals used were of A R grade.

2.2. Synthesis of the ligands

The Schiff base, APES ($C_{20}H_{21}N_3O_3$) in Fig.1 was prepared by mixing methanolic solutions of 3-ethoxysalicylaldehyde (0.05mol, 50 ml) and 4-aminoantipyrine (0.05mol, 50 ml) and stirred the mixture for ~30 minutes. The pale yellow solid, separated on concentration, was filtered, washed with methanol and dried. The azo dye, IEAP ($C_{21}H_{21}N_4O_3$) in Fig.2 was synthesized from 4-aminoantipyrine and isoeuginol by diazotization and coupling[8]. Purity of the ligand was tested by TLC. Ligands were characterized by IR, UV and ^{1}H NMR spectroscopy.

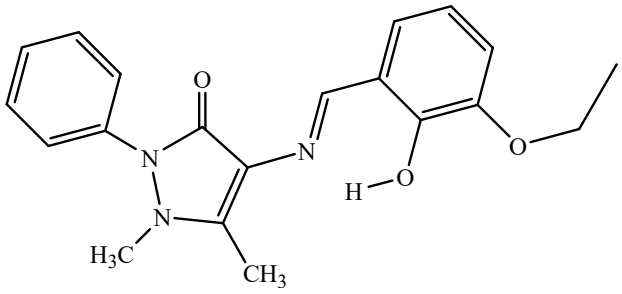


Figure 1

Structure of APES

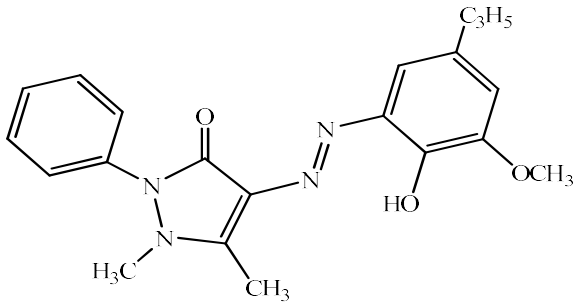


Figure 2

Structure of IEAP

2.3. Synthesis of complexes

a) Synthesis of nitrate and acetate complexes of dioxouranium(VI)

The nitrate and acetate complexes were prepared by the following general method. Uranyl

nitrate/Uranyl acetatein hot methanol(2 mmol, 20 ml) was added in small quantities with stirring to a hot methanolic solution (50 ml) of the corresponding ligands, APES(4mmol) and IEAP (2mmol) containing 1ml of NaOAc/HOAc buffer (pH= ~6). A distinct colour change was noticed on the addition of the ligand. The resulting mixture was refluxed on a water bath for ~5 h. It was then concentrated to reduce the volume. The solid complexes formed were filtered and washed with aqueous methanol and finally with ~15 ml of dry ether. The complexes were dried over P_4O_{10} in *vacuo.*

b)Synthesis of thiocyante complexes of dioxouranium(VI)

Uranyl nitrate in hot methanol(2mmol, 20 ml) containing 2 mmol of NH_4CNS was added to a hot methanolic solution (50ml)of the corresponding ligands, APES(4mmol) and IEAP(2mmol) containing 1ml of NaOAc/HOAc buffer (pH= ~6) . The complexes were precipitated on heating the mixture at 40 °C for ~30 min. The precipitated complexes were suction filtered, washed with aqueous methanol followed by dry ether and dried over P_4O_{10}*in vacuo.*

c) Synthesis of chloride and bromide complexes of dioxouranium(VI)

Uranyl carbonate was precipitated by adding AR Na_2CO_3 to a saturated solution of uranyl nitrate. Dioxouranium carbonate was dissolved in minimum quantity of appropriate dilute acids to get solutions of chloride and bromide. These solutions were evaporated on a water bath to get crystals of the salts. A hot methanolic solution of the metal salt (2mmol, 20 ml) was added to a hot methanolic solution of the ligands, APES (4mmol) and IEAP (2mmol) containing 1mL of NaOAc/HOAc buffer (pH= ~6) with good stirring. Intensely coloured solution obtained in each case was refluxed for 5-6 h. The solid complex separated on volume reduction was filtered off, washed successively with aqueous methanol followed by dry ether and dried over P_4O_{10}*in vacuo.*

2.4. PHYSICAL MEASUREMENTS

Metal, bromide and chloride were estimated by standard methods . The elemental analyses (C, H, N and S) were carried out at the Sophisticated Test and Instrumentation Center (STIC), Kochi. The IR spectra (KBr, cm^{-1}) of ligand and complexes were recorded in the region 4000-400 cm^{-1} on Perkin-Elmer 397 Spectrophotometer. Room temperature molar conductance of the complexes in methanol was recorded on Elico direct reading conductivity meter at a concentration of ~10^{-3} M. ^1H NMR spectra of the ligand and the complexes were recorded on

a 300 MHz FT NMR instrument using TMS as reference. The FAB mass spectrum of $[UO_2(APES)_2(NO_3)_2]$ and $[UO_2(IEAP)(NO_3)_2]$ were recorded in a JEOL JMS600H mass spectrometer at NIIST, Thiruvananthapuram, India. Thermal analysis of the complex $[UO_2(APES)_2(NO_3)_2]$ were carried out by heating in air at a rate of 10ºC per minute on a Mettler TG-50 thermo balance. X-ray powder diffraction patterns were recorded using Philips X-ray PW1710 diffractometer. The magnetic susceptibilities were recorded at room temperature by Gouy method.

3. RESULTS AND DISCUSSION

3.1 Analytical measurements

All complexes are colored, non-hygroscopic solids and stable in air. They are soluble in common organic solvents, like acetone, chloroform, methanol, acetonitrile, DMF and DMSO. The analytical and spectroscopic data (Tables 1 and 2) show that all the complexes are mononuclear with the general formulae $[UO_2 (APES)_2(X)_2]$ and $[UO_2(IEAP)(X)_2]$, where X = NO_3, Ac, NCS, Cl or Br. Molar conductivity data in 10^{-3} M methanol show that all the complexes arenon-electrolytes.

***Table* 1.**

Analytical data of the ligand and complexes

Ligand/Complexes	Yield (%)	Composition % found (calc)							λ_m[a]
		U	Carbon	Hydrogen	Nitrogen	Sulphur	Chlorine	Bromine	
APES	85	-	68.56 (68.35)	5.89 (6.02)	11.64 (11.95)	-	-	-	
$[UO_2(APES)_2(NO_3)_2]$	82	21.82 (21.69)	43.91 (43.79)	3.94 (3.86)	10.01 (10.21)	-	-	-	40.4
$[UO_2(APES)_2(Ac)_2]$	78	21.98 (21.82)	48.58 (48.44)	4.54 (4.43)	7.89 (7.70)	-	-	-	22.4
$[UO_2(APES)_2(NCS)_2]$	74	22.01 (21.86)	46.54 (46.32)	3.68 (3.89)	10.46 (10.29)	5.97 (5.89)	-	-	35.1
$[UO_2(APES)_2Cl_2]$	84	22.92 (22.80)	46.39 (46.03)	3.91 (4.06)	8.22 (8.05)	-	6.72 (6.79)	-	34.2
$[UO_2(APES)_2Br_2]$	80	21.34 (21.02)	42.61 (42.42)	3.88 (3.74)	7.61 (7.42)	-	-	14.23 (14.11)	26.4
IEAP	75	-	66.48 (66.45)	5.79 (5.86)	14.76 (14.81)	-	-	-	
$[UO_2(IEAP)(NO_3)_2]$	80	31.69 (31.42)	33.52 (33.30)	3.12 (3.06)	7.28 (7.39)	-	-	-	26.4
$[UO_2(IEAP)(Ac)_2]$	79	31.79 (31.67)	39.78 (39.96)	3.56 (3.89)	7.63 (7.46)	-	-	-	16.8
$[UO_2(IEAP)(NCS)_2]$	78	31.58 (31.75)	36.96 (36.85)	3.24 (3.09)	11.45 (11.21)	8.64 (8.56)	-		31.3
$[UO_2(IEAP)Cl_2]$	74	33.95 (33.79)	35.92 (35.81)	3.48 (3.29)	7.79 (7.96)	-	10.24 (10.07)	-	19.4
$[UO_2(IEAP)Br_2]$	72	30.16 (30.01)	32.02 (31.79)	2.86 (2.92)	7.18 (7.06)	-	-	20.26 (20.15)	18.1

[a] Molar conductivity, 10^{-3} M Methanol at 298 K.

3.2. Magnetic susceptibilities

All the dioxouranium complexes are found to be diamagnetic as expected for f^0 system.

3.3. Infrared spectra

The spectrum of the ligand APES and IEAP exhibit a broad band of medium intensity at 3058 cm^{-1} and 3390 cm^{-1} respectively assignable to hydrogen bonded –OH group [9]. This band is found to be absent in the spectra of its complexes. Instead, a new band of medium intensity appears ~3400 cm^{-1}, indicating the presence of free OH-group and its non-involvement in complexation. The δ_{O-H}bands (1384 cm^{-1} and 1374 cm^{-1}) and ν_{C-O} phenolic bands (1270 cm^{-1} and 1271 cm^{-1}) observed in the spectra of the free ligands[10,11] occur at the same frequency or slightly shifted to higher frequency in all complexes, supporting non participation of OH group in bonding. The ν(C=O) stretching frequency of the pyrazolone ring observed 1634 cm^{-1} and 1651cm^{-1} in the spectra of the ligands, APES and IEAP respectively, are shifted to lower frequency of ~ 1600 cm^{-1} in the spectra of the complexes, providing evidences for the participation of this group in complexation[12].Another strong band observed 1584 cm^{-1}, assignable to ν(C=N) of the azomethine group in the spectrum of APES shows a downward shift by 20 cm^{-1} in the spectra of its complexes, clearly indicating the coordination through the azomethine nitrogen[13]. The sharp band appearing 1455 cm^{-1} in the spectrum of the free ligand IEAP assigned to ν(N=N) of the azo group is red shifted to ~1435 cm^{-1} in all of its complexes, confirming the coordination of one of the azo nitrogens with the metal ion [14]. Thus both the ligands act as neutral bidentate chelating agents in all the complexes.

The N-coordinated nature of the thiocyanate group is indicated by ν(C-N) ~2040 cm^{-1}, ν(C-S) ~770 cm^{-1} and δ(NCS) ~470 cm^{-1}. The acetate complexes exhibit strong bands ~1580 and ~1380 cm^{-1} assignable to ν_{asym} (COO) and ν_{sym}(COO) respectively.The magnitude of separation indicates unidentate coordination of the acetate group [15].

The IR spectra of the nitrate complexes do not exhibit any bands assignable to ionic nitrate. The strong to medium intensity bands occurring 1460,1331and 1028 cm^{-1} and 1519, 1380 and 1058 cm^{-1}correspond to ν_4, ν_1 and ν_2 respectively of coordinated nitrate. The magnitude of splitting between ν_4 and ν_1 shows the mono dentate nature of the nitrate group[16,17] .

***Table* 2.**

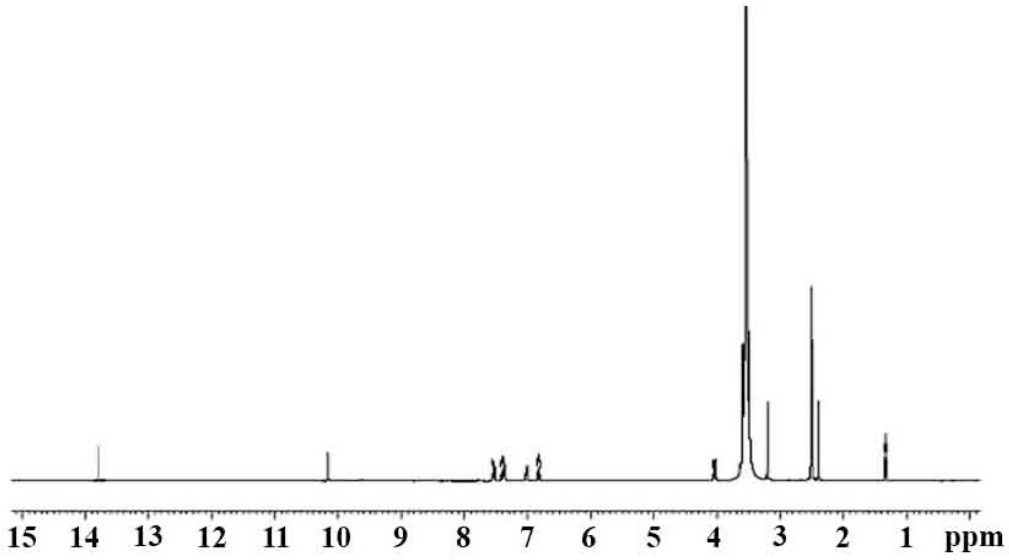
Important IR data of ligand and its metal complexes

Ligand/Complexes	IR data (cm^{-1})				
	νO-H	νC=O	νC=N/ νN=N	ν_{asym}O=U=O	ν_{sym}O=U=O
APES	3058	1649	1584	-	-
$[UO_2(APES)_2(NO_3)_2]$	3428	1598	1562	918	864
$[UO_2(APES)_2(Ac)_2]$	3430	1596	1564	916	872
$[UO_2(APES)_2(NCS)_2]$	3448	1595	1556	922	860
$[UO_2(APES)_2Cl_2]$	3424	1601	1552	912	880
$[UO_2(APES)_2Br_2]$	3436	1587	1548	914	874
IEAP	3390	1651	1455	-	-
$[UO_2(IEAP)(NO_3)_2]$	3457	1614	1439	902	874
$[UO_2(IEAP)(Ac)_2]$	3440	1618	1435	906	860
$[UO_2(IEAP)(NCS)_2]$	3452	1608	1440	904	872
$[UO_2(IEAP)Cl_2]$	3471	1612	1432	908	862
$[UO_2(IEAP)Br_2]$	3470	1610	1430	912	868

3.4 ^{1}H NMR spectra

The ^{1}H NMR spectra of APES and the complex $[UO_2(APES)_2(NO_3)_2]$ were recorded in DMSO-d_6 . The ^{1}H NMR spectrumof the free ligand APES showed a sharp signal at *δ*/ppm 13.796 ppm characteristic of the phenolic OH proton which is present in its complex, suggesting non coordination of phenolic oxygen. The signal at δ = 9.823 ppm of the ligand has shifted to δ =10.158 ppm indicating coordination of azomethine nitrogen in the complexes[18,19]. It is due to the reduction of electron density at the azomethine C-H. Signals at

δ =2.412 ppm (s, C-CH_3, 3H), δ =3.216 ppm s, N-CH_3, 3H), 6.902-6.941 (m, Ar, 3 H) δ = 7.298-7.571 ppm (m, Ar phenyl, 5H) appears in the spectrum of ligand but on complexation, signals are shifted slightly to downfield[20]. The ^{1}H NMR spectra of $[UO_2(APES)_2(NO_3)_2]$ was shown in Fig. (3).



Applied magnetic field (G)

Figure. 3

^{1}H NMR spectrum of $[UO_2(APES)_2(NO_3)_2]$

The ^{1}H NMR spectra of IEAP and the complex $[UO_2(IEAP)(NO_3)_2]$ were also recorded. The ligand, IEAP showed a sharp signal at *δ*/ppm 12.505 ppm characteristic of phenolic OH proton [21],which is present in the spectra of complex, indicating non-participation of the –OH group during coordination. All other signals observed in the spectra of ligands are retained in the spectra of the complexes.

3.5. Mass spectrometry

The FAB mass spectra of $[UO_2(APES)_2(NO_3)_2]$ and $[UO_2(IEAP)(NO_3)_2]$ show molecular ion peaks (M^+) at m/z 1098.13 and 758.56 respectively, suggesting the complexes are monomeric. The mass spectra of $[UO_2(APES)_2(NO_3)_2]$ are shown in Fig.4.

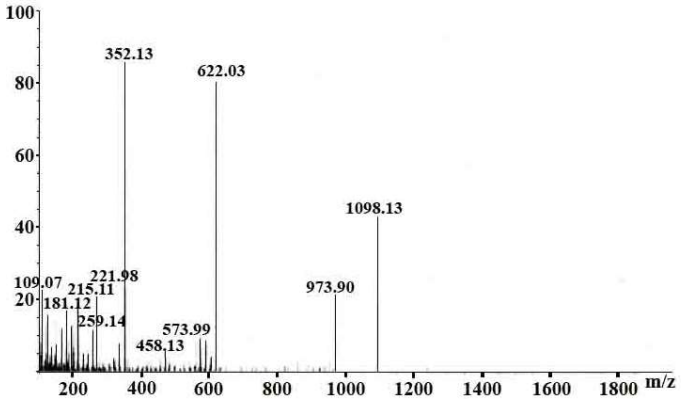


Figure. 4

Mass spectrum of $[UO_2(APES)_2(NO_3)_2]$

3.6. X-RAY DIFFRACTION STUDIES

The X-ray powder diffraction patterns of the complexes $[UO_2(APES)_2(NO_3)_2]$ and $[UO_2(IEAP)(NO_3)_2]$ were recorded using CuK_α radiation (λ=1.54056Å) and the X-ray diffractogram of $[UO_2(APES)_2(NO_3)_2]$ was shown in Fig.5. The diffraction patterns were indexed by the method developed by Hesse (1948) and Lipson's (1949) procedure and the complex was found to be orthorhombic.

The calculated and observed $\sin^2\theta$ values for the corresponding h k l values with the relative intensities of the peaks of the complexes are listed in Table 3. A careful comparison of the $\sin^2\theta$ values of the complexes reveals that there is a good agreement between the calculated and observed values.

The X-ray powder photograph obtained for $[UO_2(IEAP)(NO_3)_2]$ recorded only very few reflections and hence could not be indexed. This may be an indication of the amorphous nature of the complex.

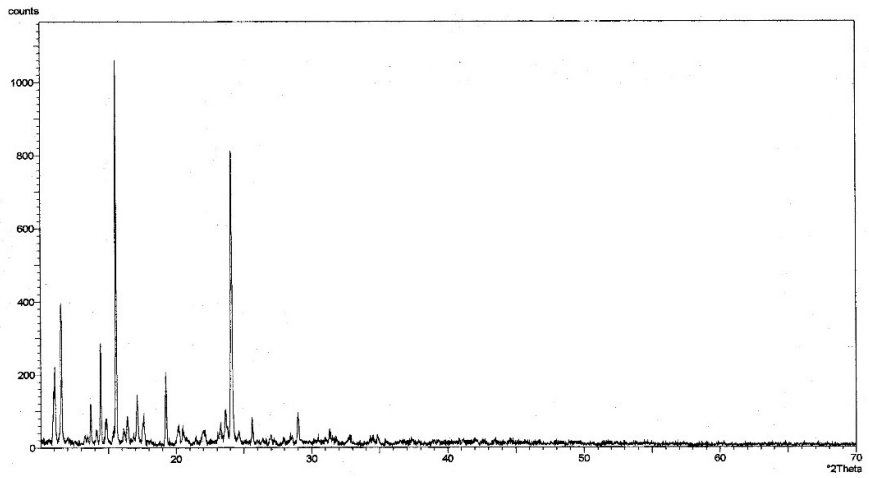


Figure. 5

X-ray diffractogram of $[UO_2(APES)_2(NO_3)_2]$

Table 3

XRD data of $[UO_2(APES)_2(NO_3)_2]$

Line	$Sin^2\theta$(obs)	$Sin^2\theta$(cal)	hkl	Intensity
1	0.009	0.009	110	20.32
2	0.012	0.010	200	37.73
3	0.018	0.018	210	100
4	0.022	0.021	001	13.66
5	0.023	0.024	101	7.23
6	0.027	0.027	011	19.24
7	0.030	0.030	111	4.82
8	0.034	0.033	201	1.55
9	0.042	0.039	211	9.04
10	0.043	0.045	021	77.40

3.7. THERMAL STUDIES

Thermal decomposition behavior of the complex $[UO_2(APES)_2(NO_3)_2]$ was studied by non-isothermal TGA by heating the sample in air at a heating rate of 10 °C per min in conjunction with DTG.

The TG and DTG curves for the decomposition of the complex $[UO_2(APES)_2(NO_3)_2]$

was shown in Fig 6. The decomposition of takes place in two stages as indicated by the DTG peaks at 249 °C and 461°C .The stability range extended from ambient temperature to 220 °C confirming that the complex is stable up to this temperature and the absence of either lattice held or coordinated water molecules . First decomposition stage starts at 230°C and ended at 280 °C. The mass loss of 10.96% (calc.11.31%) is assigned to the loss of anionic part of the complex. The second stage decomposition ranged from 370 °C to 490 °C. The final residue [22] was found to be U_3O_8. The mass loss data obtained from TG experiment (77.31%) are in good agreement with the calculated value (76.76%) for U_3O_8formed by the oxidative decomposition of the complex as the final residue.

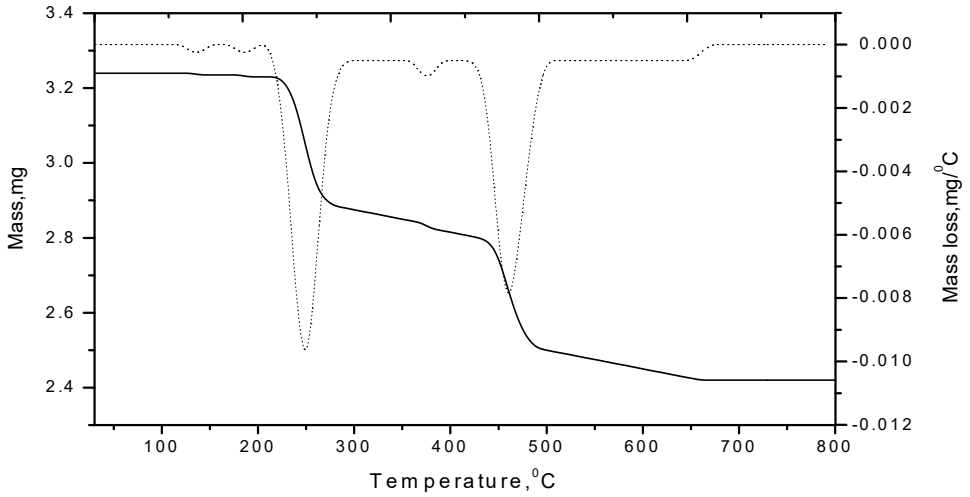


Figure. 6

TG and DTG curves of $[UO_2(APES)_2(NO_3)_2]$

Based on these above observations, the complexes $[UO_2(APES)_2(NO_3)_2]$ have eight coordinated Uranium atoms and have hexagonal bipyramidal structure and $[UO_2(IEAP)(NO_3)_2]$ has a coordination number of six and have octahedral geometry. Tentative structures proposed for the dioxouranium(VI) complexes are given in Figs. 7 and 8.

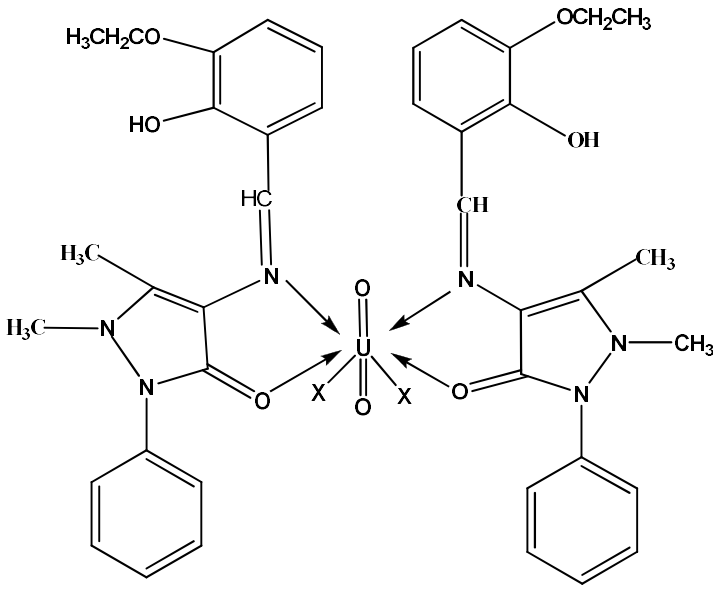


Figure. 7

Proposed 2D structure of $[UO_2(APES)_2(X)_2]$

(X = NO_3,Ac, NCS, Cl or Br)

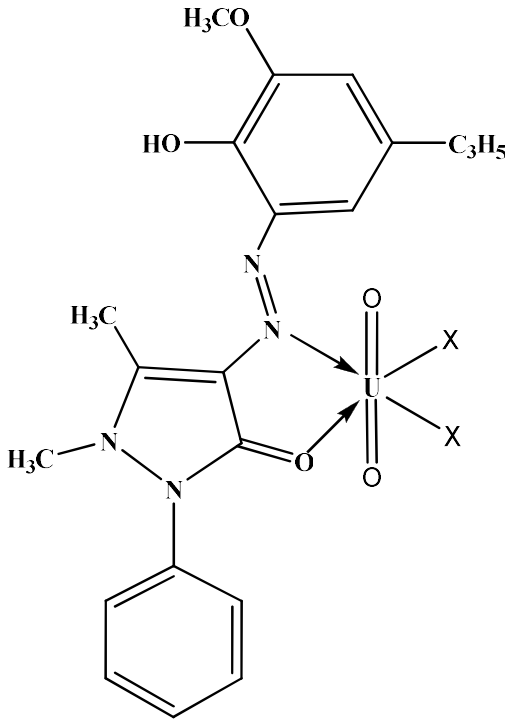


Figure. 8

Proposed 2D structure of $[UO_2(IEAP)(X)_2]$

(X = NO_3,Ac, NCS, Cl or Br)

CONCLUSION

Ten new complexes of dioxouranium(VI) with APES and IEAP have been synthesised and characterized on the basis of their physico-chemical properties. In all the complexes the ligands act as neutral bidentate chelating agents. The FAB mass spectral data suggest the monomeric nature of the complexes. Hexagonal bipyramidal geometry has been proposed for dioxouranium(VI) complexes with APES as ligand and octahedral geometry for dioxouranrium(VI) with IEAP.

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A SURVEY ON THE MATHEMATICAL PERSPECTIVES OF LEVERAGE CENTRALITY

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ABSTRACT

Centrality is an important notion in network analysis and is used to determine the importance of a node in a network. Various centrality measures are employed to identify the central nodes in a complex network. But, every centrality measure is not suitable for every application. In Leverage centrality, the degree of a node is compared to the degrees of all its neighbors. This centrality captures nodes in the network which are connected to more nodes than their neighbors and, therefore, control the content and quality of the information received by their neighbors. This paper is a systematic survey on the mathematical perspectives of leverage centrality. Firstly, some of the basic properties and then the leverage centralities of vertices in different families of graphs were discussed . Here we notice the connection between the number of distinct leverage centralities in the Cartesian product of paths and the triangle numbers. Then we discuss the leverage centrality of knight's graphs and path powers. The concepts of weighted leverage centrality and group leverage centrality is also mentioned. At last the leverage centrality of some infrastructure networks is outlined.

Keywords: Leverage Centrality, Triangle Numbers, Knight's Graphs, Path Powers, Weighted Leverage Centrality, Group Leverage Centrality.

1. INTRODUCTION

The human brain can be modelled as a graph in which neurons are taken as nodes and the physical links between the neurons are taken as edges[1]. In recent times, there is a growing interest in the representation of human brain as a network for understanding its complex structure and function. The identification of regions playing the key role is determined through the centrality measures [3]. Many different centrality measures have been proposed, but the degree to which they offer unique information, and whether it is advantageous to use multiple centrality measures to define node roles, is unclear [12]. Leverage Centrality of a graph was defined by Joyce et al. in 2010 [4] as a means to analyze connections within the brain. This is a simple measure which considers the extents of connectivity of a node in relation to the connectivities of its neighbors. This measure determines the extent to which the neighbors of a node rely on that node to access the network resources [7].It has been used to analyze real-world networks including airline connections, electrical power grids, and coauthorship collaborations [6]. Bounds on leverage centrality were determined by Li, Li,

Van Mieghem, Stanley, and Wang [6]. The leverage centralities of complete multipartite graphs and the Cartesian product of paths were investigated by Sharma, Vargas, Waldron, Flórez, and Narayan [11]. Leverage centrality of Knight's graphs and Cartesian products of regular graphs and path powers were investigated by Roger Vargas, Jr. et al.[10]. The concept of weighted leverage centrality was introduced by Geetha Ramani R and Sivaselvi K [3], while the notion of group leverage centrality was introduced by Amogh Gupta, Harish Balaji, Sundareswaran R, Mahesh V, Geetanjali B [1]. Leverage centrality analysis of some infrastructure networks were determined by Murat Erşen Berberler [8]. By considering neighbors degrees, leverage centrality gives different information about connectivity of a node in contrast with simple degree centrality. Here we survey the results on the leverage centralities of various networks and its properties. A node with negative leverage centrality is influenced by its neighbors as the neighbors connect and interact with far more nodes whereas a node with positive leverage centrality influences its neighbors since the neighbors tend to have far fewer connections [8]. A high-degree node with high-degree nearest neighbors will probably have a low leverage.

2. BACKGROUND

We know that the degree of a vertex v is the number of edges incident to v and is denoted $deg(v)$.

The formal definition of leverage centrality is as follows [9]:

Definition 1 (Leverage Centrality).

Leverage centrality is a measure of the relationship between the degree of a given node v and the degree of each of its neighbors i , averaged over all neighbors Nv, and is defined as shown below:

$$l(v) = \frac{1}{\deg(v)} \sum_{v_i \in N_v} \frac{\deg(v) - \deg(v_i)}{\deg(v) + \deg(v_i)}$$

It is seen from definition that this measure is unique from existing measures and counts not only degree of a given node but also degree of neighbors. This centrality considers the degree of a node relative to its neighbors and operates under the principle that a node in a network is central if its immediate neighbors rely on that node for information. It is key to note here that although leverage is derived from degree centrality, there is a distinct

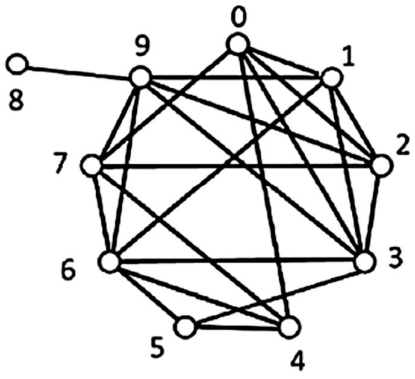
difference between the two. A high degree node is not highly central according to leverage if all of its neighbors are also high degree. Furthermore, leverage centrality does not assume information flows along the shortest path or in a serial fashion, but rather focuses on the disparity in node degrees in a small neighborhood to quantify consolidation and dissemination of information locally. Leverage is defined on the interval (−1, 1), making inter- and intra-network comparisons straightforward. Furthermore, calculating leverage centrality is not computationally burdensome, and as such can easily be computed for networks containing on the order of 10^4 nodes or more. Many networks, and in particular brain networks, have demonstrated hierarchical structure and may be decomposed into modules or neighborhoods of nodes which perform similar processes. Leverage centrality may be of particular use in such hierarchical networks as an aid in identifying hubs, nodes that are important to maintaining local topological structure. A hub is the best connected node within the module and, therefore, is likely to have high leverage centrality since its degree is high with respect to other nodes in the neighborhood [4].

The bounds of leverage centrality is given by the following lemma [6].

Lemma 1

Let G be a graph with n vertices. For any vertex v, $|l(v)| \leq 1 - \frac{2}{n}$.

Furthermore, these bounds are tight in the cases of stars and complete graphs.



0	$\frac{1}{5}\left(\frac{5-4}{5+4}\right) = \frac{1}{45}$
1	$\frac{1}{5}\left(\frac{5-6}{5+6}\right) = -\frac{1}{55}$
2	0
3	$\frac{1}{6}\left(3\left(\frac{6-5}{6+5}\right) + \left(\frac{6-3}{6+3}\right)\right) = \frac{10}{99}$
4	$\frac{1}{4}\left(\left(\frac{4-6}{4+6}\right) + 2\left(\frac{4-5}{4+5}\right) + \left(\frac{4-3}{4+3}\right)\right) = -\frac{22}{315}$
5	$\frac{1}{3}2\left(\frac{3-6}{3+6}\right) = -\frac{2}{9}$
6	$\frac{1}{6}\left(2\left(\frac{6-5}{6+5}\right) + \left(\frac{6-4}{6+4}\right) + \left(\frac{6-3}{6+3}\right)\right) = \frac{59}{495}$
7	$\frac{1}{5}\left(2\left(\frac{5-6}{5+6}\right) + \left(\frac{5-4}{5+4}\right)\right) = -\frac{7}{495}$
8	$\frac{1-6}{1+6} = -\frac{5}{7}$
9	$\frac{1}{6}\left(3\left(\frac{6-5}{6+5}\right) + \left(\frac{6-1}{6+1}\right)\right) = \frac{38}{231}$

A graph with distinct leverage centralities [9].

Proposition 1([9])

For any graph $G, \sum_{v \in G} l(v) \leq 0$.

3. VERTICES WITH POSITIVE/NEGATIVE LEVERAGE CENTRALITY

A vertex of lowest degree (highest degree) cannot have a positive (negative) leverage centrality. In the star graph $K_{1,n-1}$, there are $n-1$ vertices with negative leverage centrality. Therefore, it is possible to have all the vertices in a graph except for one to have negative leverage centrality, similarly all but one have positive leverage centrality.

Theorem 1([9])

In a graph G of order n, the maximum number of vertices with positive leverage centrality is $n - 1$.

3.1 LEVERAGE CENTRALITY ZERO([9])

In regular graphs, the leverage centrality of all the vertices is zero. In fact, $l(v) = 0$ for every vertex v if and only if G is a regular graph. Also, for a vertex v with degree k , if all of the neighbors of v have degree k, then $l(v) = 0$. However, it is possible for a vertex to have a leverage centrality of zero without all of its neighbors having the same degree as the original vertex.

3.2 EXAMPLE

Let G be a graph containing a vertex v of degree 3 and the neighbors of v have degrees $1, 3, and\ 9$. The leverage centrality of v is

$$l(v) = \frac{1}{3}\left(\frac{3-1}{3+1} + \frac{3-3}{3+3} + \frac{3-9}{3+9}\right) = 0$$

3.3 PROBLEM

Determine the necessary and sufficient conditions for a vertex v to have leverage centrality zero, particularly when the neighbors of v all have distinct degrees.

3.4 COMPLETE MULTIPARTITE GRAPHS

We use $K_{t_1,t_2,\ldots t_r}$ to denote the complete multipartite graph with parts of sizes $t_1, t_2 \ldots . t_r$ and each vertex in a part is adjacent to every vertex in each of the other parts.

Theorem 2([9])

Let G = $K_{t_1,t_2,\ldots t_r}$ where $t_i$is the order of part n_i. Then

$$l(v_i) = \frac{1}{\sum_{j\neq i} t_j}\left(\sum_{k\neq i} t_k\left(\frac{t_k - t_i}{\sum_{j\neq i} t_j + \sum_{j\neq k} t_j}\right)\right)$$

4. CARTESIAN PRODUCT OF GRAPHS

Definition 2([9])

Given a graph F with vertex set $V(F)$ and edge set $E(F)$, and a graph H with vertex set $V(H)$ and edge set $E(H)$ we let G define the Cartesian Product of F and H to be the graph $G = F \times H$ which is defined as follows: $V(G) = \{(u,v)|u \in V(F)\ and\ v \in V(H)\}$ and $E(G) = \{(u_1,v_1),(u_2,v_2)$ where $u_1 = u_2 and\ (v_1,v_2) \in E(H)$ or $v_1 = v_2$ and $(u_1,u_2) \in$ E(F)}. We use $\times_m G_i$ to denote the Cartesian product of m copies of a graph G_i .

Theorem 3([9])

Let G be a graph and let G_r be a regular graph where each vertex has degree r . Let $u \in V(G_r)$ and let v_i and v_j be vertices in G with degrees k_i and k_j respectively. For each vertex

$(u,v_i) \in V(G_r \times G)$ we have

$$l(u,v_i) = \frac{1}{r+k_i}\sum_{j\neq i}\frac{k_i - k_j}{2r+k_i+k_j}$$

4.1. CARTESIAN PRODUCTS OF P_n

The bounds of leverage centralities in a lattice, $\times_m P_n$ is given by the theorems 4 and 5.

Definition 3

Any vertex of $\times_m P_n$ can be defined by an m -tuple:$v = (v_1, v_2, \dots v_m)$ such that $v_i \in \{1,2,\dots .n\}$ $\forall\ i \in \{1,2,\dots,m\}$.

Definition 4([9])

We define a corner vertex of $\times_m P_n$to be $v_c = (v_1, v_2, \dots, v_m)$ such that $v_i \in \{1,n\}$ $\forall$ $i \in \{1,2,\dots,m\}$.

A non-corner vertex is a vertex $v = (v_1, v_2, \dots., v_m)$ of $\times_m P_n$ such that at least one $v_i \in \{2,\dots,n-1\}$.

An inner corner vertex of $\times_m P_n$ is defined as follows.

$v_{ic} = (v_1, v_2, \dots, v_m)$ such that $v_i \in \{2, n-1\}$ $\forall i \in \{1,\dots,m\}$.

From definition it follows that all vertices that are inner corner vertices are also non-corner vertices.

Theorem 4 (Minimum Leverage Centrality) ([9])

Let u be any vertex in $G = \times_m P_n$ that is not a corner vertex and let v_c be a corner vertex in G . Then, $l(v_c) < l(u)$. Also $l(v_c) = \frac{-1}{2m+1}$.

Theorem 5 (Maximum Leverage centrality) ([9])

Let u be a vertex in $G = \times_m P_n$ $t$hat is not an inner corner vertex of G, and let v_{ic} be an inner corner vertex in G . Then, $l(u) < l(v_{ic})$. Furthermore, $l(v_{ic}) = \frac{1}{8m-2}$.

4.2. CONVERGENCE OF LEVERAGE CENTRALITY AS M → ∞

Theorem 6([9])

As the number of paths in the Cartesian product increases (m → ∞), the leverage centralities of all of the vertices of $G = \times_m P_n$ converge to 0.

5. LEVERAGE CENTRALITIES IN LATTICES AND TRIANGLE NUMBERS

The next theorem shows the relation between the number of distinct leverage centralities for lattices and the triangle numbers $\binom{m+2}{2}$ where $m \geq 1$.

Theorem 7([9])

If $n \geq 5$, the number of distinct leverage centralities in $G = \times_m P_n$ is less than or equal to $\binom{m+2}{2}$

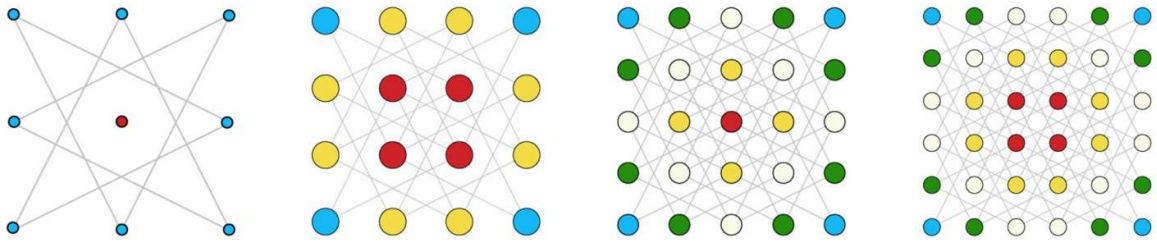
Conjecture 1([9])

Let $n \geq 4k + 1$ and $G = \times_m {P_n}^k$. Then the number of distinct leverage centralities in G is $\binom{m+k+1}{k+1}$.

6 . LEVERAGE CENTRALITY OF A KNIGHT'S GRAPH

We define an $n \times n$ knight's graph to be the graph with n^2 vertices in which every vertex represents a square in an $n \times n$ chessboard. The vertices on the $n \times n$ chessboard can be placed in an $n \times n$ table where two vertices v_i and v_j are adjacent if they are exactly four entries apart and they form an "L" shape. The $3 \times 3, 4 \times 4, 5 \times 5 \; and \; 6 \times 6$ knight's graphs

are shown in the figure given below, where in each graph all of the vertices of same degree are the same color.



The next theorem shows the leverage centrality of each vertex in the n ×n knight's graph.

We use t_j to denote the j^{th} triangular number $\frac{j(j+1)}{2}$.

Theorem 8([10])

Let G_n be the $n \times n$ knight's graph.

(1) The leverage centrality of every vertex of G_3 is zero.

(2) If $n = 4, 6, or\ 8$, then G_n has exactly $t_{\frac{n}{2}}$ distinct leverage centralities.

(3) If $n = 5\ or\ 7$, then G_n has exactly $t_{\frac{n+1}{2}} - 1$ distinct leverage centralities.

(4) If $n \geq 9$, then G_n has exactly 15 distinct leverage centralities.

7. LEVERAGE CENTRALITIES OF P_n^k

Let P_n^k be the graph with vertices $v_1, v_2, \dots, v_n$ and edges (v_i, v_j) when $1 \leq |i-j| \leq k \leq n-1$. Here we assume n >1. This family contains both paths (when $k = 1$) and complete graphs (when $k = n-1$). Note that $\deg v_i = \min\{i+k-1, 2k\}$. The neighbors of v_i are $v_{i-1}, v_{i-2}, \dots, v_{i-s}$ and $v_{i+1}, v_{i+2}, \dots v_{i+t}$, where $s = \min\{k, i-1\}\ and$ $t = \min\{k, n-i\}$.

Next lemma gives the leverage centrality of any vertex in P_n^k.

Lemma 2([10])

Suppose the vertex $v_i \in V(P_n^k)$ has neighbors $v_{i-1}, v_{i-2}, \dots, v_{i-s}$ and $v_{i+1}, v_{i+2}, \dots v_{i+t}$, where $s = \min\{k, i-1\}\ and\ t = \min\{k, n-i\}$. Then

$$l(v_i) = \frac{1}{\delta_i} \sum_{i-s \leq j \leq i+t} \frac{\delta_i - \delta_j}{\delta_i + \delta_j}$$

where $\delta_x = \min\{x+k-1, 2k\}\ \ for\ x = i, j.$

Theorem 9([10])

Let P_n be a path where n ≥ 5.

Then $l(v_1) = l(v_n) = -\frac{1}{3}, l(v_2) = l(v_{n-1}) = \frac{1}{6}$ and for all $3 \leq i \leq n-2, we\ have\ l(v_i) = 0.$

To find the leverage centralities of all vertices in P_n^k for all k would require lengthy computations. The leverage centralities become fixed when n becomes large enough $(n \geq 4k+1)$. Therefore we can compute the leverage centralities in a more formal manner.

The next proposition gives the leverage centralities for the first vertex in any path power.

Proposition 2([10])

If $v_1 \in V(P_n^k)$, then $l(v_1) = \sum_{i=1}^{k} \frac{-i}{2k+i}$

Proposition 3([10])

Let $G = P_n^k$,where $n \geq 4k+1$. Then:

(i) $l(v_i) = l(v_{n+1-i})$

(ii) For all $0 \leq j \leq k-1$, $l(v_{k+j+1}) = \frac{1}{2k}\left(\sum_{i=k+j}^{2k-1} \frac{2k-i}{2k+i}\right)$

(iii) For all $0 \leq j \leq k-1$, $l(v_{k-j}) = \frac{1}{2k-j-1}\sum_{i=k}^{2k-1} \frac{2k-j-i}{2k-j+i} + \frac{k-j}{2k-1-j}\left(\frac{2k-j-1-2k}{2k-j-1+2k}\right)$

(iv) For all $2k+1 \leq j \leq n-2k$, we have $l(v_j) = 0$.

Theorem 10([10])

Let $G = P_n^k$,where $n \geq 4k+1$. Then the vertex with the largest leverage centrality in G is v_{k+1}, and furthermore $l(v_{k+1}) > l(v_k) > \cdots > l(v_1)$ and $l(v_{k+1}) > l(v_{k+2}) > \cdots > l(v_{2k+1})$.

The above theorem gives two separate linear orderings both starting with the largest leverage centrality $l(v_{k+1})$.

The remainder of this paper includes the formulae for the leverage centralities of the nodes of some infrastructure networks including wheels and related networks and centrality analysis is performed to rank the nodes in each type of network.

8. LEVERAGE CENTRALITY OF SOME INFRASTRUCTURE NETWORKS

8.1 Wheels and related networks

The wheel W_n , with n spokes is a graph that contains an $n-$cycle and one additional central node c that is adjacent to all nodes of the cycle. The central node c of W_n, has a node degree of n, where as the nodes of the n-cycle are of degree three. Label the nodes of the $n-$cycle sequentially as $v_0, v_1, \ldots, v_{n-1}$.

Theorem 11([8])

Let $G = W_n$, of order $n + 1$. Then, for v belongs to $V(G)$,

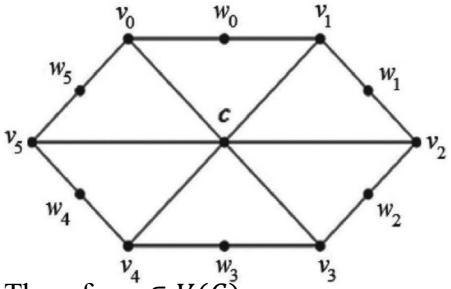
$$l(v) = \begin{cases} \frac{(n-3)}{(n+3)}, & if\ v = c \\ \frac{(3-n)}{3(n+3)}, & if\ v \neq c \end{cases}$$

The central node has the maximum node degree and is the best connected node within the network.

8.2 Gear networks

Gear network is a wheel graph with a node added between each pair adjacent graph nodes of the outer cycle. G_n has $2n + 1$ nodes and $3n$ links . G_n includes an even cycle C_{2n}. The nodes of degree two are referred to as minor nodes and nodes of degree three as major nodes . The central node c of G_n has degree of n. Label the major and minor nodes, respectively, as $v_0, v_1, \dots, v_{n-1}$ and $w_0, w_1, \dots, w_{n-1}$ and let w_i be adjacent to the nodes v_i and v_{i+1} for $0 \le i \le n-1$, where $i + 1$ is taken modulo n .

Gear network G_n for $n = 6$



Theorem 12([8])

Let $G = G_n$, of order $2n + 1$. Then, for $v \in V(G)$

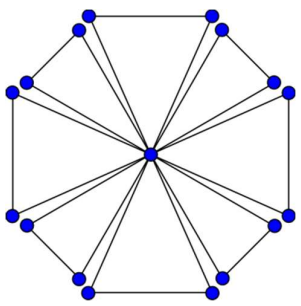
$$l(v) = \begin{cases} \dfrac{(n-3)}{(n+3)} & if\ v = c \\ \dfrac{(7-n)}{5(n+3)} & if\ v = v_i \\ \dfrac{-1}{5} & if\ v = w_i \end{cases}$$

Minor nodes of the underlying network are of the lowest degree and so cannot have a positive leverage centrality. Therefore, minor nodes with negative leverage centralities are being influenced by their neighbors.

8.3 Friendship networks

Friendship graph f_n , is collection of n triangles with a common point. The central node c of f_n has a node degree of $2n$, where other nodes of the triangles are of degree two.

Friendship network f_n for $n = 8$



Theorem 13([8])

Let $G = f_n$ of order $2n + 1$. Then, for $v \in V(G)$,

$$l(v) = \begin{Bmatrix} \frac{n-1}{n+1} & if\ v = c \\ \frac{1-n}{2(n+1)} & if\ v \neq c \end{Bmatrix}$$

Remark:

For $n = 1$, since $G \cong K_3$, $l(v) = 0$ for $\forall\, v \in V(G)$. For $n > 1$, the central node has a positive leverage centrality whereas other nodes of the triangles have negative leverage centralities. The central node is the best connected node within the network and, therefore, is likely to have high leverage centrality since its degree is high with respect to other nodes in the neighborhood.

9. WEIGHTED LEVERAGE CENTRALITY[3]

To improve the scoring ability of leverage centrality in the aspect of indirect neighbor's influence, the concept of weighted leverage centrality has been introduced. Here, in addition to the degree of a neighbor, the eigenvector measure is multiplied as a weight factor.

The weighted leverage measure is calculated as follows:

$$N_{wi}(i) = \frac{1}{N_{dc}(i)} \sum_{n_i} \frac{W(i) * N_{dc}(i) - W(j) * N_{dc}(j)}{W(i) * N_{dc}(i) + W(j) * N_{dc}(j)}$$

$$W(i) = \frac{N_{ec}(i)}{TOTAL}$$

$$Total = N_{ec}(i) + \sum_{n_i} N_{ec}(j) * a_{ij}$$

where, $N_{dc}(i)$ is the degree of node i, $N_{dc}(j)$ is the degree of immediate neighbor node and n_i is the total number of neighbors of node i. $N_{ec}(i)$ is an eigenvector measure of node i, $N_{ec}(j)$ is an eigenvector measure of neighbor of node i, a_{ij} denotes the connectivity between the nodes. TOTAL is the sum of the eigenvector of a node i and its neighbors. $W(i)$ is the weight factor of the node obtained from the fraction of contribution among its neighbors. The implication of value is similar to the leverage measure, where positive value represents the influence of node on its neighbors and vice versa in the case of negative value.

10. GROUP LEVERAGE CENTRALITY

Group leverage centrality is a new metric of leverage centrality for a group of nodes. Two different ways of defining this centrality as:

Definition 5 (Total Group Leverage centrality) ([1])

Total Group Leverage centrality (TG) is defined as the average of leverage centralities of all the nodes in a given set of nodes S where S is the subset of V, the vertices of the graph in consideration.

$$TG(S) = \frac{1}{|S|}\sum_{v\in S} l(v) \qquad S \subseteq V$$

Definition 6(Complement Leverage Centrality) ([1])

Complement Group leverage centrality (CG) is defined as the average of leverage centralities of all the nodes in a given set of nodes S where S is the subset of V, and only the vertices in the set $V\backslash S$ are considered for computing the leverage centralities. Here k_v and N_v represent the degree and the set of neighbors of the node v respectively.

$$CG(S) = \frac{1}{|S|}\sum_{v\in S}\frac{1}{k_v}\left(\sum_{i\in \acute{S}\cap N_v}\left(\frac{k_v - k_i}{k_v + k_i}\right)\right) \text{ where } \qquad \acute{S} = V - S$$

11. CONCLUSION

In a lattice G = $\times_m P_n$, the vertices with minimum leverage centrality and maximum leverage centrality are the corner vertices and the inner corner vertices respectively. The number of distinct leverage centralities for lattices has a connection to the triangle numbers $\binom{m+2}{2}$ where $m \geq 1$. If $n \geq 5$, the number of distinct leverage centralities in G = $\times_m P_n$ is less than or equal to $\binom{m+2}{2}$. Another result is that there will be exactly three distinct leverage centralities in any path P_n, with $n \geq 5$. In a wheel graph, for n > 3, and in a friendship network, for $n > 1$, the central node has a positive leverage centrality .Weighted leverage centrality plays significant role in hub determination in brain networks and group leverage centrality can be used to quantify the effect of meditation on different parts of the brain and their relation to other parts.

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EXPLORING THE IDENTITY: A TRAVERSE THROUGH THE NOVEL *THE BASTARD OF ISTANBUL*

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It is a phenomenon worth investigating that the authors of bestselling novels written in English have increasingly exotic names like Elif Shafak, Arundhati Roy, Ruth Ozeki, Jhumpa Lahiri, Amy Tan, and so on, especially as they have all faced identity problems, as individuals raised in bi-cultural, bilingual families or having experienced at least a major geographical displacement in their life, before becoming global individuals, feeling at home in several cultures. They are also addressing a generation who appreciates literature that mirrors contemporary aspects of globalization, and who are themselves involved in this world of emigration, immigration, travel, multiple authenticities of diaspora and its attendants, a kind of self-conscious hybridity, of language that stretches the borders of nations, communities and ironically, ideas of purity. Identity issues may occur not only at the clash of different ethnic and religious forces, but also when individuals are faced with their past.

Elif Shafak is the most-read female author in Turkey, where she is as famous for her descriptions of backstreets of Istanbul as she is for her global and multicultural perspective. Her writing is at once rooted in her politically feminist education and her deep respect for and knowledge of Sufism and Ottoman culture. Using these paradoxes, she unwinds and understands the convoluted history of Turkey in her own way. *The Bastard of Istanbul,* which crosses two family histories, Turkish and Armenian, she faced charges for insulting Turkishness. The case was later dismissed, and Shafak's role in the rare combination of radical and sentimental writer remains uninterrupted.

The Bastard of Istanbul added her an extensive popularity at home and worldwide. This paper is trying to showcase how the conflictual search for identity of the youngest off-springs of a complex Armenian and Turkish family, Armanoush and Asya, is resolved as they discover the truth about their family history.

Armenian genocide happened in 1915 which became a reason for the shattering of Armenians' identity. The novel tells the story of an Armenian family and a Turkish family whose roots are connected to each other somewhere in the present time. The methodology for the present study involves an investigation of diverse ways in which Elif Shafak evolves an inclusive, non-evasive sense of order through her novel *The Bastard of Istanbul*, her

protagonists' troubled identities, and momentary insights into reality.

Shafak's *The Bastard of Istanbul* narrates the story of an Armenian family that had to flee from Turkish Empire during the First World War. The book pivots around two main characters: Asya Kazanci and Zeliha Kazanci. Zeliha Kazanci is Asya Kazanci's mother, who owns a tattoo parlor, and her daughter, Asya Kazanci, is born out of wedlock. Since being born out of wedlock is considered a sin and the baby, Asya, a bastard in conservative Turkey, the book is named *The Bastard of Istanbul*. No one knows about her father's identity, and in her women-dominated family where there is no male guardian around, no one bothered to know about him either. There is no male alive in their family except Mustafa Kazanci. But he has migrated to the United States in a bid by his family to save him from a weird curse that has befallen the Kazanci family for generations. Due to this strange curse, no Male family member survives to live any longer than the age of forty years.

In order to get rid of the evilspell fallen on the men folk of the family, Zeliha, the elder sister of Mustafa, decides to send him to the United States. There he marries a single mother, Rose. She has a daughter named Armanoush and the father of Armanoush, Barsam is an Armenian. As Armanoush Tchakhmakhchian, the half-cousin of Asya Kazanci comes from the United States and enters the story, a great part of the book deals with the Turkish and Armenian history, especially the 1914 genocide of Armenians.

Asya, Zeliha's illegitimate daughter, is the eponymous Bastard of Istanbul in the novel. The story jumps a few years and follow Asya as much as her mother and her aunts. Asya grows to be stubborn like her mother, Zaliha. Though Zeliha is her mother, Asya calls her Aunt Zeliha, as she is so used to addressing the older women in the family as aunt and they all live together in the family home. Asya does not entirely fit in. Indeed, at one point she attempts suicide. She uncovered respectively three other truths about her life, that other families were not like hers and some families could be normal; that in her ancestry there were too many women and too many secrets about men who disappeared too early; and that no matter how hard she strived, she was never going to be a beautiful woman.

Asya clashes with her aunts and mother though she hated to see that with the passing of each year she more and more resembled them but, as she says to them, "This is a nuthouse! We are all nuts, each and every one of us." (74) However, she finds solace with a group of people she regularly meets in the Café Kundera.

Asya has never met her uncle Mustafa, who never returned from the United States, not even to visit his family. While there, he met and subsequently married a divorced woman, Rose. She had one daughter from her previous marriage, Armanoush Tchakhmakhchian,

generally known as Amy by her mother and her friends, though always as Armanoush by her father's family. She spends her time between her mother and Mustafa in Arizona and her father (never remarried) and his family in San Francisco. Armanoush is very well aware of her Armenian roots and, if she had not been, her father's family would have reminded her frequently. The topic comes up all the time, particularly the Armenian Genocide, not least because most of the family was killed in the Genocide.

Armanoush has her equivalent of Asya's Cafe Kundera club, an online Armenian chat room, where the participants discuss in some detail about Armenian Genocide and what it means to be an Armenian in today's world. They also discuss the issue of the Janissary paradox which, basically, means choosing between fighting for one's past but paying a price for it or giving up one's past for a better future. Armanoush's Armenian family can be seen, in many ways, to be similar to Asya's Turkish ones, though Armanoush gets on better with her family than Asya does with hers.

The survivor of the Armenian family, Armanoush returns to Turkey in search of her ancestral roots and her identity. Asya suspects if Armanoush is coming to Istanbul as a part of her research on Islam and oppression of women or something. Which will satisfy the curiosity of Americans. But Armanoush turns to be the connecting link between Turkey's past and present. She narrates the Story of her grandmother and her family who was deported from Turkey. And leaves their belongings there during Armenian genocide.

Shafak attempts to reconnect Turkey and Armenia through a re-reading of history that is common in both countries. Armanoush represents the survivors of millions of Armenians who were deported or executed in Turkey. She has a tormented past which is disturbed between the Armenian father and the anti-Armenian mother who are divorced. As an Armenian, she wants to define her identity and searches for her past in Turkey. Her desperate need for a solid identity is evident in her words when she says, "...I have been constantly fluctuating between a proud but a Traumatized Armenian family and a hysterically anti-Armenian mom. For me to be able to become an Armenian- American I need to find my Armenianness first" (119).

Armanoush decides to visit Turkey and find her grandmother's house by staying in her step-father's house. She tells neither of her two families, each of which thinks that she is with the other one. She is warmly welcomed, as they know her as Armanoush and have no idea of her Armenian background. Even when she does arrive and they learn of her Armenian antecedents, it soon becomes clear that, for the Turks, the Armenian Genocide is completely unknown, because Turkey has always denied it and it is not discussed at school or in history

books. Asya translates Armanoush's words into Turkish for the entire family. Armanoush narrates the cruelty inflicted on her ancestors to the Kazanci family. All of them were shocked to listen to the story and sympathize with Armanoush. However, when Armanoush utters the term, the Turks, they do not identify themselves with the perpetrators of the crime. The Armenian society, which was more sophisticated and cultured than the others, suffered the most under the new plan of nationalization. Shafak tries to bring out the predicament of the Armenian society through the story of Hovhannes Stamboulin in The Bastard of Istanbul - A man of letters who lived with his wife and three children in Istanbul. It was the time when the entire Ottoman Empire was stated with grandiose undertakings, revolutionary moments and nationalist divisions and the Armenian community pregnant with innovative ideologies and ardent debates. The Armenian community had started printing its own books and texts long before Muslims started using the printing press. Turkish police arrest Hovhannes Stambotilin one night, and no one sees him after that. He is accused of instigating and provoking the Armenian insurgents against the Ottoman Sultanate through his poetry.

The problem of Armenians deserves special attention today as their rights are violated in the name of westernization/modernization, and they are marginalized in the Republic of Turkey. The Predicament of Armenian youth is represented in Shafak's *The Bastard of Istanbul*. The rise of unemployment and suicide rates due to the lack of opportunities and suppression of rights is described in it. Shafak prevents herself from representing the poor and the under privileged; instead, she allows the characters to voice their concerns and present their statements.

Hovhannes Stamboulin is blamed for promoting insurgency through his work of art, whereby questioning the freedom of an artist or a writer. He speaks to the sergeant, "You are an educated man yourself and you'll understand the difficulty of my situation. My poems are the echo of my imagination. I write and publish poems, but I cannot possibly control who reads them and with what particular intention" (237). The freedom of a writer or an artist to express his thoughts is questioned from time to time by the ruling regime whether it is the Ottoman Empire or Turkish Republic. Authorities may change new forms of nationalism but they seem to function in the same pattern. The minorities are always treated and forced to keep themselves at the margin or to wither away.

The conversation between Stamboulin and another fellow mate of his community sheds light on the predicament of the Armenian community and the atrocities inflicted on them by the Turkish regime. During the World War I, many Armenian men were drafted into the army. At the outset all the soldiers were given arms just like their Muslim peers. After a

short time, they were asked to return those arms. Unlike the Muslim soldiers, the Armenians were taken into special labour battalions. They were employed in hard labour for road construction and were made dig to pits deep and wide enough to bury themselves. Kirkor Hagopian, an eminent lawyer and member of Ottoman Parliament states, “Turkish authorities have announced that the Armenians are going to dye their Easter eggs with their own blood” (233).

According to Starnboulin, “Nationalism is no more than a replenishment of oppressors. Instead of being oppressed by someone of a different ethnicity, you ended up being oppressed by someone of your own” (232). The nationalist project of Turkey and its westernization have failed to raise Turkey’s status among European nations because of its continual internal conflicts. The rifts and the violent clashes between the secular forces and the extremists have caused a threat to the peace and stability of Turkey. Moreover, being an Islam dominated Country, Turkey seems to be viewed with an eye of suspicion by the western world for its pan Islam policies and internal conflicts. The statement of aunt Cevriye implies it, “The problem with us Turks is that we are constantly being misinterpreted and misunderstood. The Westerners need to see that we are not like the Arabs at all. This is a modem secular state” (135).

Meanwhile, Rose finds out that Armanoush is in Istanbul, she and Mustafa hurry there, leading to the inevitable grand end. When Mustafa reaches in the US, he meets a single mother, Rose, who has been married to an Armenian man. Knowing the historical and longstanding grudges that exist between the Turkish people and the Armenians, their former population that accuses the Ottoman empire of their ethnic genocide, Rose marries Mustafa Kazanci. This step by Rose enrages her former Armenian family-in-law, the Tchakhmakhchian, but life continues, and nineteen years pass.

At the same time, Auntie Banu looks to her djinn, and particularly Mr. Bitter, to uncover information about Armanoush. She learns about Armanoush’s ancestors’ experiences in Istanbul during the 1915 Armenian exile and genocide. She also later learns that Asya, who has always been regarded as a “bastard,” is the product of Mustafa’s rape of their younger sister, Zeliha. Auntie Banu becomes a witness to disturbing histories. The only other person who knows about Zeliha’s secret is her partner, Aram Martirossian, an Armenian Istanbulite. Auntie Banu uncovers a familial link between the Tchakhmakchians and the Kazancis: Grandma Shushan was the first wife of Riza Selim Kazanci and the mother of Levent Kazanci, whom Shushan abandoned to move to the United States.

Following the return of Armanoush Tchakhmakhchian back to Turkey, her stepfather,

Mustafa Kazanci, also returns home to meet his family after almost twenty years. But quite unexpectedly, with the return of Mustafa Kazanci, two great mysteries of the family and the story reveal themselves: the identity of Asya's father and the family curse Mustafa was to be protected from. Unfortunately, Mustafa Kazanci cannot survive his family curse and dies inside his family house; it also emerges that he was the real father of Asya Kazanci, his niece, who was born because he had raped his elder sister Zeliha twenty years ago.

Armanoush is connected to Turkey through her grandmother Shushan, a survivor of the trauma inflicted on Stamboulin and Armanoush's family, the Armenians. Shushan is Hovhannes Stamboulin's youngest daughter who happens to be rescued by the Armenian missionaries during the catastrophe.

The narrative unfolds the present century through Armanoush and gets delineated through Aunt Cevriye, who learns about Armanoush's family with the help of dijnn. Shafak uses the aid of clairvoyance and intuition to narrate the story of Armenians particularly the story of Armanoush's family. The mythical concept of invoking spirits and djinns to know the past of Armenians is exploited to reveal the creation of Turkey as a nation. The unexplored part of Turkey's history comes out through the eyes of Auntie Banu and her dijnn. Identification enhances connotation with the past generation. By having an identification, one can survive in the world with tranquillity. It makes one able to breathe in peace and stroll in the street or walk in a society with ease. If it is lost, then half of a society's members enjoy teasing and cruising around, getting a chance to raise fingers to blame somebody. In the novel, without an identity, Asya suffers several times. She thinks, of the past but fails to gather her memories as she has no idea about her identity. She is even called a "bastard" by her own grandmother while she is watering the plants. Asya learns the word "bastard" and starts calling the plant "bastard" too. Moreover, when Armanoush and Asya sit together over a chat in Cafe Constantinople, she comes to realise that its members also enjoy calling her a 'bastard'. They tell her that she has no idea of who her father is. Therefore, she is a 'bastard,' according to them. The novel does not only talk of identification but the behaviour of people as well. The people of a society get a chance to poke gossip and blame when somebody's 'identification' is not known to them.

In the novel the theme of struggling with one's identity is highlighted through Shafak's use of paralleling the characters like Asya and Armanoush. Both the characters display the struggles they face because of their cultural backgrounds. Some of the textual evidences are reflecting the theme of identity and cultural differences.

In the modern world with the increase of immigrant members, hybrid nations and

constitution of countries with different cultural diversities, the question of identity came to the surface. Some individuals are nevertheless burdened about their originality just like most of diaspora, immigrants, refugees and writers classify as contemporary authors who impose new methods in fashion and themes. Instead, they dedicated themselves to write about things associated to identification inside the sense of cultural displacement, fragmentation, immigration, diaspora and exile. This thesis studies the identity crisis faced by the characters and the quest for identification reshapes new diversified classifications of identity. Thus Mustafa, Zeliha, Armanoush and Asya are the major necessary identities in the novel.

The study is worthy, since it dealt with a novel crowded with a lot of figures that can be a little hard of keeping track of, it is these two families conspicuous by their national and cultural differences that come with the gist of the conflict. Althogether, Shafak in The Bastard of Istanbul explores how the unclear past makes female and male protagonist suffers from identity issues and makes their existence harder. Besides she sheds the mild of how the characters changes the more they face a new culture with new traditions, this would be similar if one needs to find more about identity crisis. Crossing the bridges of Istanbul and America helps Shafak to expose a lot of factors in the Anatolian, hereby the metropolis of nexus spot via which all the topics of the novel are attached and ultimately the new human beings with their new identity are being created.

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