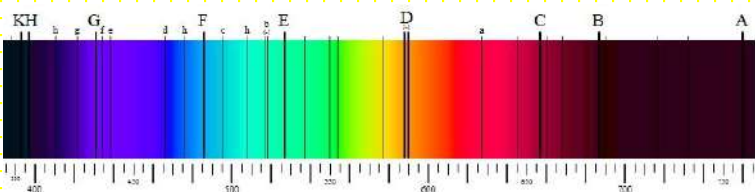
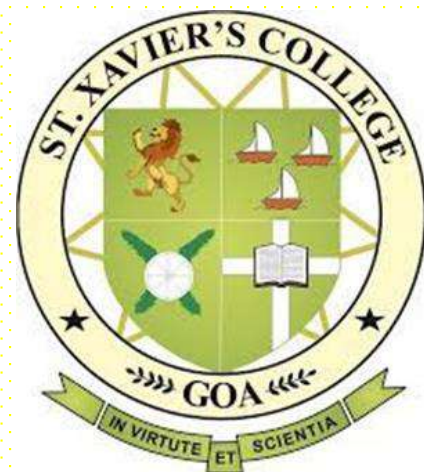


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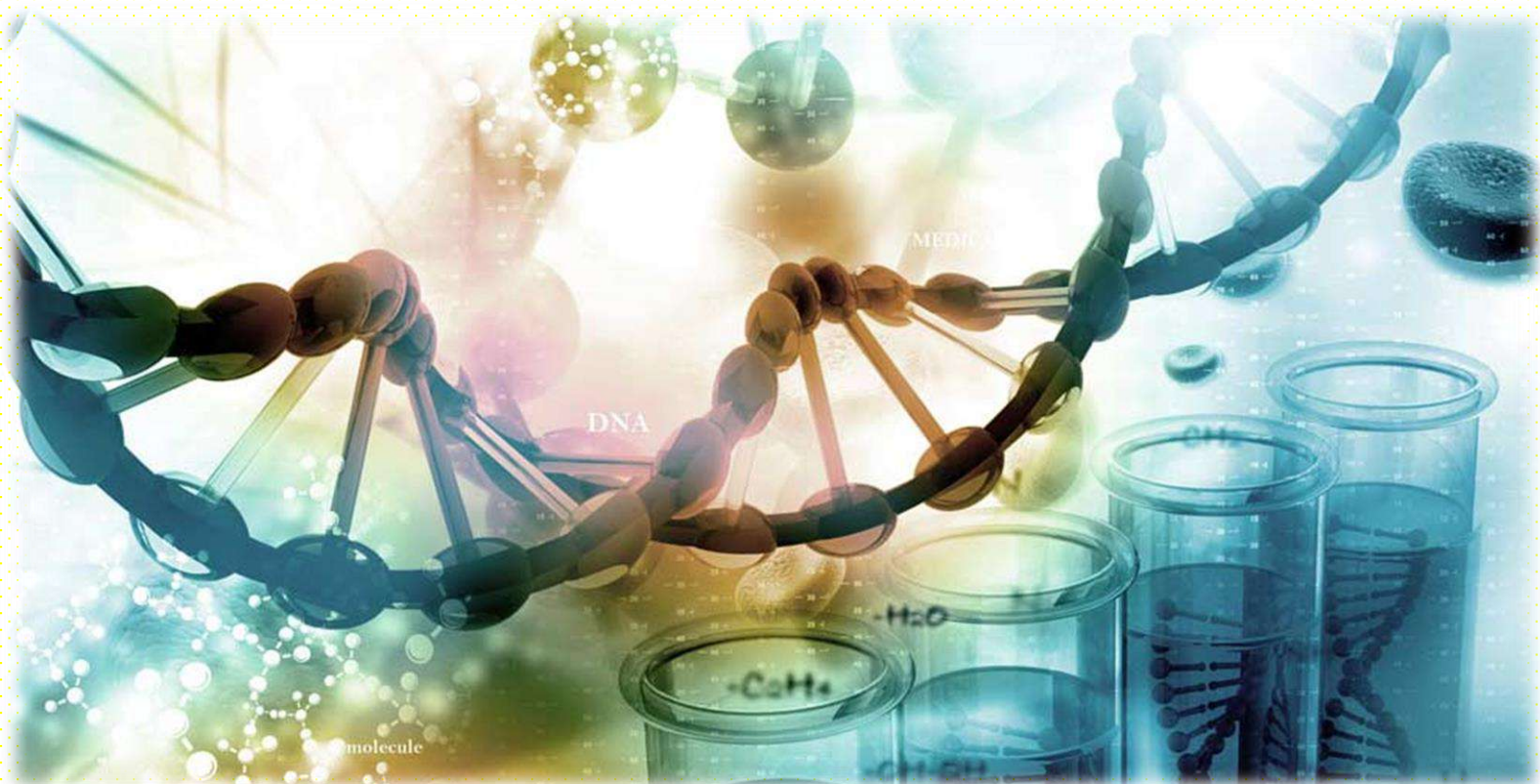
October 2024



SPECTRUM

INTERDISCIPLINARY RESEARCH JOURNAL

*Research & Development Cell
St. Xavier's College
Mapusa – Goa*



Awarded 'College with Potential for Excellence' by UGC [2004]

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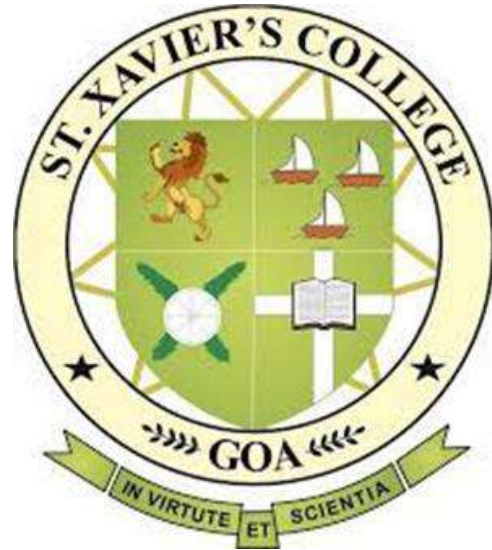
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From the Principal's Desk



It is with great pleasure that I pen these few lines for the XVI edition of our college Interdisciplinary Research Journal Spectrum.

This publication showcases the varied research endeavors of our faculty and students, highlighting the institution's commitment to innovative inquiry.

Besides fostering a culture of critical thinking and intellectual curiosity this publication provides a platform for interdisciplinary collaboration and knowledge sharing.

This issue features six original research papers and articles from disciplines of science and languages. I congratulate the Authors on their publications and the Editors for their diligent efforts.

I urge our faculty members to enhance research activities at their respective departments and make this publication a rich collection of research articles and papers to inspire the research community.

Wishing all our researchers the very best!

**Ms. Ursula Barreto
Acting Principal**

Message from the **Administrator**



I am indeed happy to write these few words for Spectrum, Vol. XVI, which, as always, contains research papers and articles written by the College Faculty. I wish to express my sincere congratulations to all those who have contributed to the Spectrum.

Even simple writing needs lot of references to be done, and which work only gets multiplied when it is a research paper. Hence, all those, whose papers or articles are being published here, deserve to be congratulated for doing a commendable job, in spite of their many other duties. These efforts are not only steps in self-growth, but also enrich the students when the insights gained are shared with them. But, at the same time, it would not be out of place, if I were to remind our faculty that their research work needs to be published in UGC recommended journals for a wider readership.

Once again congratulations to all the contributors, and to the editorial board for encouraging the faculty to share their knowledge.

God bless you all.

Fr. Tony Salema
Administrator

From the Editor's Desk

The Research and Development Cell of St. Xavier's College, takes pride in the release of *Spectrum Vol. XVI*, the Interdisciplinary Research Journal of St. Xavier's College, Mapusa.



This publication represents the collective effort of our academic community to push the boundaries of knowledge, foster intellectual growth, and promote a culture of research and innovation within our institution.

I would like to express my heartfelt gratitude to our Principal Ms. Ursula Barreto and Administrator Fr. Tony Salema for their unwavering vision and guidance, which continue to inspire our institution to strive for academic excellence.

I am especially grateful and extend my gratitude to all the authors and researchers who have contributed their valuable work to this journal. Your insights, discoveries, and innovative ideas add immense value to our collective understanding and open new avenues for exploration and discussion.

The successful release of *Spectrum* Volume XVI would not have been possible without the tireless efforts of our editorial team. I extend my

deepest appreciation to each member of the team for their dedication, attention to detail, and relentless pursuit of the highest standards in academic publishing.

I hope that the articles and research featured in this edition inspire readers to think critically, explore new concepts, and engage in meaningful discussions that lead to further advancements in your fields of study.

Dr. Harshala Shetgaokar
Assistant Professor,
Department of Botany



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Exploring the themes of violence, cruelty and torture in select plays of Harold Pinter

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Abstract: The plays of Harold Pinter illustrate the trio themes of violence, cruelty and torture. Although these terms appear synonymous, the nuances of each term can be lucidly differentiated through the actions and behaviour of characters in the plays. The plays chosen for this study include: *The Birthday Party*, *The Dumb Waiter*, *The Homecoming*, *One for the Road* and *The Room*. The objectives of this study are two-fold: (1) to delineate the violent, cruel and tortuous relationships among families and colleagues through the behaviour and language of characters and (2) to view these plays in light of events of the twentieth and twenty-first centuries. The method employed for this study is critical reading and analysis of select plays and research articles. The result showcases the reflections of war, espionage, dictatorship, domestic tension and sexual abuse in the aforementioned plays. Verbal abuse is also evident through the utterance of harsh vocabulary. In conclusion, the plays of Pinter encapsulate the sense of threat and distrust relevant to the past and the present.

Keywords: Violence, Torture, Cold War, Repressive State Apparatus, Abuse

Introduction

The British playwright cum actor and director Harold Pinter (1930-2008) holds a towering position in English Literature of the post-war epoch. His plays are often subsumed in the ambit of “comedy of menace” or “the theatre of the absurd”. Pinter begged the prestigious Nobel Prize for Literature in 2005 and the prize motivation is articulated in the following words: “his plays uncover the precipice under everyday prattle and forces entry into oppression’s closed rooms” [The Nobel Foundation, 2005]. As an individual who has witnessed the macabre war days and has girded aerial bombings, it’s no surprise to view violence and torture in Pinter’s plays. We will shortly observe how Pinter’s plays are relatable to significant scenarios of the twentieth and twenty-first centuries.

Materials and Methods

The primary sources for this study include the six plays of Pinter chosen for this study: *The Birthday Party*, *The Dumb Waiter*, *The Homecoming*, *One for the Road* and *The Room*. Secondary sources involve research articles by Merve Aydoğdu, Suha Fayadh, Bakhtiar Hama and Katarina Ivelja. The writer conducted a critical analysis of these plays and articles to explore the themes of violence, cruelty and torture.

Results and Discussions

“The world is a pretty violent place, it’s as simple as that, so any violence in the plays comes out quite naturally. It seems to me an essential and inevitable factor.” Harold Pinter [Fayadh S.].

Let us engage with the definite meanings of the terms ‘violence’, ‘cruelty’ and ‘torture’. According to the Oxford Dictionary, ‘violence’ denotes “use of physical force intended to harm or hurt” [2012]. ‘Cruelty’ too refers to behaviour that ensues in physical and mental harm or it also denotes “taking pleasure in the sufferings of others” [2012]. ‘Torture’ means “great physical and mental suffering or anxiety” [2012]. So albeit these terms appear synonymous, torture is a more intense and prolonged form of suffering. So most of the plays manifest violence and cruelty, but few showcase the extreme form of torture.

ENGAGING WITH THE PLAYS

Espionage and Secret Agents : *The Birthday Party*, *The Dumb Waiter*

The play unveils several instances of violence and torture. The primary scene is that of Stanley who is living as a paying guest at the boarding house of Meg and Petey Boles. Two colleagues, Goldberg and Mccann, who are on the hunt for Stanley, succeed in locating him at the Boles’. The most striking scene of torture and violence is the interrogation of Stanley by Goldberg and Mccann. Goldberg and Mccann tortuously corner Stanley for ‘betraying’ the ‘organization’ and ultimately drive him insane until he is unable to consciously control his movements. They even get into a hammer and tong argument with Stanley kicking Goldberg, however they are restrained by Meg’s entry. In the end, Stanley falls unconscious and is smuggled out of the boarding house on the pretext of needing “special treatment” and Petey and Meg Boles are in no command of the situation. This scene resonates in the appalling espionage system of the Cold War era where in secret agents either assassinated or numbed the adversaries or whoever was charged for treachery.

What is intriguing to note is that all three members of the ‘organization’ are susceptible to violent behaviour. In the end the more powerful and the more cruel members succeed in subjugating the weaker force. Katarina Ivelja opines that these characters don’t control the organization, rather this organization “is part of a violent force beyond human influence in which they are merely its actors” [Ivelja K, 2014]. Further she adds that the presence of Goldberg and Mccann is necessary “only to manifest and escalate the violence from the emotional into the physical plain of existence” [Ivelja K, 2014]. This observation is quite sagacious because it delineates the emotional torture one endures when one knows that he/she is being threatened, and the ultimate physical pain when that threat comes true. So Stanley was cognizant that he was under threat, but when things took the form of physical violence, the turmoil and collapse of his sanity became inevitable.

The Dumb Waiter too encapsulates the working of an obnoxious organization with greater bluntness. By ‘bluntness’ I mean that the characters-Ben and Gus are seen possessing revolvers and seem to be awaiting top orders about their next target. They are discussing sordid details of

their commissions. One of them is of a girl which Gus describes as a “messy affair”. He even expresses an anxiety about who ‘clears up’ after they have executed the deed. The only instance of physical violence is evident when Ben, the senior partner, grabs Gus by the throat during an argument. Besides, violent incidents are highlighted through the newspaper headlines. Ben relates a gruesome accident of an old man who got crushed under a lorry, or of a child who killed a cat.

Albeit this play doesn’t showcase violence and torture as explicitly in *The Birthday Party*, the violence still can be gauged through the dialogues. In this case the violence is ‘between the lines’. The dialogues and language of the play instantly emanate a suspicion of their doings. For instance Gus’ comments such as, “I hope it won’t be a long job, this one.” “What time is he getting in touch?” Ben’s statements like, “How often do we do a job? Once a week?” To which Gus retorts, “You can’t move out of the house in case a call comes” [Pinter H, 2013]. These statements are ambiguous and enigmatic and you begin to fathom why the details aren’t lucidly mentioned. The very fact that Pinter is concealing it from us makes us deduce that this ‘job’ is too appalling to discuss.

All communication between the characters and their incognito boss transpires through the dumbwaiter (elevator). The boss demands items like cake, milk and crisps. But as readers we question whether these are just code names for weapons and illegal goods. The play ends abruptly with Ben pointing the revolver at Gus. So it was Ben who was awaiting the order to dismiss Gus.

Several critics regard these characters as professional killers who are assigned timely missions. The classic Indian term for their job is *supari*. Just like Stanley, Gus too becomes a victim of his gang. The appellation “dumb waiter” is a pun and can literally mean that the members of these secret organizations ought to be silent and follow orders unquestioningly. Ben becomes the silent assassin who has to ‘silently’ do away with Gus.

Hence, Stanley and Gus may be defined as victim-aggressors—they were the aggressors when they were a part of their organization, but the moment they leave the group or become a menace to the group itself, they themselves become the next target of that organization.

Dictatorship and sexual abuse: *One for the Road*

This play manifests all the trio themes of violence, cruelty and torture in a heart wrenching manner. It delineates a family who has been detained in prison by the military authorities. The figure in authority here is Nicolas and the family in question include Victor, Gila and their seven year old son, Nikky. The violence and tyranny aren’t staged, but is implied through the primary conversation between Victor and Nicolas.

It can be lucidly deciphered that Victor’s family is being tortured and beaten for flouting the dogma of the totalitarian regime. The dialogue that implies this is Nicolas’ statement to Victor, “I believe - the man who runs the country announced to the country: We are all patriots, we are as one, we all share a common heritage. Except you, apparently.” Further it is also implied that Gila is being raped by the soldiers and on one occasion Nikky spits on the soldiers in retaliation. The language

too is crude and filthy, particularly when Nicolas alludes to Gila. For instance, when he apprises Victor that she is being sexually assaulted: “Your wife and I had a very nice chat but I couldn’t help noticing she didn’t look her best. She’s probably menstruating. . . . I have rivals. Because everyone here has fallen in love with your wife” [Pinter H, 2013]. One can imagine the dismal plight of Victor who besides being beaten is subjected to the fact that his wife is being sexually abused. The cruelty of Nicolas is accentuated when he interrogates Victor while ravishing pegs of Whisky, which alludes to the title “one for the road”.

Merve Aydoğdu makes an Althusserian reading of the text and discusses the role of the Repressive State Apparatus in controlling society. Louis Althusser has introduced the concept of a State Superstructure for the proliferation of ideology. This structure entails twin wings. One refers to the Ideological State Apparatus (ISAs) and the other is Repressive State Apparatus (SA). ISAs and control citizens through the media of education, culture, literature and the arts, family and trade unions. The SA executes this via the police-army, government and prisons. The primary distinction between the two is that the “Repressive State Apparatus functions by violence whereas Ideological State Apparatuses function by ideology” [Aydoğdu M, 2014]. In this case it is the army that has tyrannized Victor’s family. Thus one notices the flagrant shades of fascism.

Race and Violence: *The Room*

This play may appear superficially peaceful, but the brutal violence transpires in the very last scene. It depicts the solitary life of a couple, Bert and Rose and their frequent conversations with their neighbours and landlord. The major chunk of the plot is driven by Rose’s dialogues while Bert maintains an ominous silence. Rose seems to be satisfied in her cocoon and resents travelling outdoors. However, in the climactic violent scene, a coloured man by the name of Riley enters their apartment and refers to Rose by a sobriquet, ‘Sal’. He persuades her to leave to which she refuses. When Bert enters after an errand, he bestially beats up and bruises Riley. This inconclusive end leaves the audience and readers baffled. It alters any conception that readers harboured about this seemingly peaceful couple.

Suha Fayadh opines that “Bert’s violence is revealed throughout the play, but his silence denotes hatred and cruelty.” She also ingeniously suggests that for Rose the ‘room’ is symbolic of a “mother’s womb wherein one resides safe and shielded. And thus, Riley’s “physical intrusion becomes a violent aggressive act as he threatens the security of the one inside the womb” [Fayadh S].

One may view this whole scene as a practice of racism. Bert could afford to take such a risky chance cognizant that as a white he would be granted the benefit of doubt. Rose’s obsession with staying indoors may be interpreted as a way of escaping the quotidian ruckus and violence of the *outside* world. And if we support this contention then the act of violence *indoors* seems very ironical!

Domestic violence and verbal abuse: *The Homecoming*

This play too is abound in violence, particularly verbal abuse. And it stages the tumultuous relationship between father and sons. The opening scene hits hard. The father-Max is ferreting for scissors and asks his son, Lenny's assistance, and Lenny belligerently blurts out, "Why don't you shut up, you daft prat?" Another string of words follows when Max is discussing his late wife and Lenny retorts:

"Lenny: Plug it, will you, you stupid sod, I'm trying to read the paper.

Max. Listen! I'll chop your spine off, you talk to me like that! You understand! Talking to your lousy filthy father like that!" [Pinter H, 2013].

Besides, Max also disparages his brother Sam hurling abuses such as "old grub", "maggot" or "cast-iron bunch of crap".

It appears that Max is taken for granted by his children that too being a widower. The least he expects in return is commiseration, patience and understanding. When he observes such ingratitude, his frustration erupts in verbal abuse. Aaron Beck too posits that, "When someone with an overblown sense of self-worth fears a threat to his self-esteem, a kind of reflexive hostility can result: "Stop the threat before it inflicts damage." Max too feels discounted and thus verbally retaliates in order to regain the upper hand, adds Beck.

Similarly Max threatens "to give the boot" to Sam if he ceases to pay his rent. This is atypical of western homes wherein siblings have to tender rent if they reside in the home of their relative. Given the war torn situation and financial encumbrances, Max greatly relies on his brother's rent. And Bakhtiar Hama posits that it is this inter-dependence that holds Sam and Max together. The former requires the shelter while the latter depends on the rent. [Hama B, 2020].

Conclusion

Violence, cruelty, torture and verbal abuse are prevalent in Pinter's plays and may be a reflection of past and contemporary events of the twentieth and twenty-first centuries. If we survey the events of the post war period, we will cognize that the most inglorious fall-out of the Second World War was the Cold War and its formidable espionage. Plays like *The Birthday Party*, *The Dumb Waiter* showcase the operations of these enigmatic secret organizations. *One for the Road* may be read from a fascist perspective reflecting the horror and torture of fascist regimes of Joseph Mussolini and Adolf Hitler. Even today, violence and torture are reflected in the wars between Ukraine-Russia or Israel and Iran/Palestine. The violence against women is also reminiscent of the violence and sexual abuse faced by women of Manipur during the ethnic tensions that erupted in 2023 in Manipur, India. *The Room* is a poignant rendition of racism and takes us to a flashback of the George Floyd murder case that transpired in Minneapolis, U.S.A. in 2020. *The Homecoming* allows a peek into a dysfunctional household. The plotline of these plays may appear bizarre, but

are not cut-off from reality thus making Pinter's excoriation of society and authority inescapable.

Acknowledgements

I extend my gratitude to the Management and the Research and Development Cell of St. Xavier's College for fostering curiosity and research skills in budding teachers. This initiative serves as the first step towards undertaking research and writing papers. In a special way I am grateful to Dr. Prema Rocha and the Department of English for always mentoring me in all my endeavours.

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Formulation and Evaluation of Herbal Lipbalm and Herbal Lotion

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Abstract: Herbal cosmetics are defined as the beauty products which possess desirable physiological activity such as healing, soothing appearance, enhancing and conditioning properties because of herbal ingredients. Cosmetics play an important role and are used everyday by both men and women for beautifying and altering the appearance of the skin. Synthetic colouring agents used in cosmetics have been found to produce carcinogenic effects. The usage of herbal cosmetics has been increased to many folds in personal care system and there is a great demand for the herbal cosmetics. Nowadays consumers are well aware about the product benefits and their side effects. The main objective of the present study was to formulate and evaluate herbal lip balm and herbal lotion. Evaluation parameters consist of dye test, stability studies, homogeneity, appearance, pH, colour etc. Various plant materials were used such as bixa, (*Bixa orellana*), beetroot (*Beta vulgaris*), *Aloe vera*, butterfly pea (*Clitoria ternatea*) etc. Different natural ingredients were also used such as beeswax, paraffin wax, rose water, coconut oil etc. The use of bio active ingredients in cosmetics influence biological functions of skin and provide nutrients necessary for healthy skin or hair. It can be concluded from the present study that the herbal (organic) lip balm and herbal lotion can be a better option as it is safe to use and without any side effects. There is tremendous scope to launch numerous herbal cosmetics using appropriate bioactive ingredients with suitable fatty oil, essential oils, proteins and additives.

Keywords: Herbal cosmetics, lip balm, lotion, bioactive, natural ingredients.

1. Introduction

Cosmetics plays a significant role in today's lifestyle. Herbal cosmetics are defined as the beauty products made with herbal ingredients and possess desirable physiological activity such as healing, soothing appearance, enhancing and conditioning properties. Herbal Cosmetics, referred as Products, are formulated, using various permissible cosmetic ingredients to form the base in which one or more herbal ingredients are added to provide defined cosmetic benefits only (Joshi et al., 2015). Herbal cosmetics are the modern trend in the field of beauty and fashion. These products are becoming more popular as most women prefer natural products over synthetic to enhance their beauty as these products supply the body with nutrients, enhance health and provide satisfaction. They are also free from chemicals and have relatively less side-effects as compared to the synthetic cosmetics (Joshi et al., 2015).

Herbal cosmetics like herbal conditioner, herbal soaps, herbal face wash, herbal shampoo, are more frequently used and preferred by people. The best thing of the herbal cosmetics is that it is purely made using herbs and shrubs. The natural content in the herbs does not have any reactions on the human body but rather enhance the body with supplements and other required minerals (Bijauliya et al., 2017).

Herbs include crude plant material, such as leaves, flowers, fruit, seeds, stems, wood, bark, roots, rhizomes or other plant parts, which may be used fresh, dried or powdered. Herbal materials include, in addition to herbs, fresh juices, gums, fixed oils, essential oils, resins and dry powders of herbs. These materials may be processed by various methods such as steaming, roasting or stir baking with honey, alcoholic beverages or other materials (Bijauliya et al., 2017).

Lips are a part of the human body that is very thin as compared to face skin, even though it consists of three to four layers of the skin. Lips are susceptible to inflammation, swelling and other disorders, therefore, lips must be moisturized with lip product such as Lip balm. Lip balms are formulations applied onto the lips to prevent drying and protection against adverse environmental factors (Telange -Patil et al., 2022). Lips do not have any oil glands therefore it is important to provide extra moisture and protection throughout the day. Products that are used to protect lips rather than decorate them are known as lip balms. They form an adherent, flexible, moisture resistant film of oily substances over the lips. Conventional lip balm often contains petroleum, synthetic waxes, alumina, paraben, hydrogenated oils and artificial fragrances and colours which are toxic. Often the lip balm is eaten by the user, thus it becomes major issue for health (Vinodkumar et al., 2019).

There are four main components as key ingredients for formulation of natural lip balm. Basically, waxes are used as base to give a more stable structure and make it easier to form desirable shape of lip balm. Oils are required to blend waxes properly, so that they provide a suitable film on the applied lip skin to protect and moisturize the lip. Colouring agents or dyes are mainly used to impart a distinctive appearance to the products (Hapiz et al., 2018). Herbal lip balms consisting of natural materials like almond oil, bees wax, shea butter, vitamin E, beet root etc. offers a natural way to maintain and promote healthy lips.

The skin is the body's largest organ, which protects the body from germs and regulates body temperature. Nerves in the skin are sensitive to heat and cold. Normal skin is neither too dry nor too oily. Sensitive skin, dry skin, oily skin is more prone to react to stimuli than normal skin, hence sunscreen agents are used for external application only. Sunscreen lotion is used as photo protecting agents against UV rays. When applied topically it protects the treated area from sunburn. The sunscreen depends on ability to protect against UV induced sunburn and their chemo-preventive activity. Excessive solar ultraviolet radiation is responsible for various skin damages such as sunburn, skin pigmentation, premature aging and photo carcinogenesis. Sunscreen should contain antioxidant agent in addition to sunblock agent to be effective for prevention of photoaging

and skin cancer. Plants due to their antioxidant potential are used in sunscreen formulation for prevention of skin damage due to solar radiation (Tangadkar et al., 2022).

The present work was done to formulate and evaluate herbal lipbalm and herbal lotion by using easily available natural ingredients for protection of lips and skin.

2. Materials and Methods

Procurement of materials:

The different plant species like *Bixa*, butterfly pea and Aloe leaves were collected from Pomburpa and Mapusa respectively. Beetroot, Ginger, Coconut oil, lemon, from Mapusa market and other ingredients like beeswax, vitamin E capsules, nutmeg oil, rose water were procured from Hindu Pharmacy, Panjim, Goa.

Herbal Lip balm:

Preparation of Extracts:

20 gms of Bixa seeds (*Bixa orellana*) (Fig. 1), were taken in a mixer and 8ml of water was added to it and ground coarsely. The liquid was strained using a muslin cloth and the extract was obtained.

20 gms of beetroot (*Beta vulgaris*) (Fig. 2), pieces were taken in a mixer and 8ml of water was added to it and ground coarsely. The liquid was strained using a muslin cloth and the extract was obtained. Lemon was cut and squeezed and the juice was strained using a muslin cloth. 10gms of ginger was taken cut into pieces, 4 ml of water was added to it and ground. The liquid was strained using a muslin cloth and the ginger extract was obtained.



Figure 1. Bixa seeds.



Figure 2. Beetroot.

Formulation of Herbal lipbalm from Bixa and Beetroot.

6 gms of beeswax was taken in a beaker and was heated in a boiling water bath. 7 mL of coconut oil, 1 mL of the lemon juice and 0.5 mL of ginger extract was added. To this, 5mL of the extract from Bixa seeds was added. Essential oils and vitamin E capsules were added drop wise with continuous stirring. 2 drops of nutmeg oil were added for preservation. The mixture was transferred from the water bath into a container and stored under refrigeration. The same procedure was followed with beetroot extract.

Herbal Lotion

Preparation of Extract:

A dozen flower petals of butterfly pea (*Clitoria ternatea*) (Fig. 3) were taken in a cup of boiling water and boiled for 15 minutes. The liquid was strained and the petals were discarded. The deep blue colour of the extract was obtained. Aloe gel was extracted from the Aloe leaves by making a slit and by scooping out the gel.

Formulation of Lotion:

2 mL of flower extract was taken in a beaker. 20 gms of aloe gel, 4 mL of rose water, 4mL of coconut oil and vitamin E capsules was added. The contents were mixed till a smooth consistency was obtained.

Evaluation test for Herbal Lip Balm from Bixa (A) and Beetroot (B):

Organoleptic characteristics: The prepared lip balm was tested for characters like colour, appearance and odour (Vinodkumar et al., 2019).



Figure 3. Butterfly pea plant.

Effectiveness Test on Paper: Lip balm was tested by applying a little of it on white paper. It was used to determine the colour and effectiveness of the colour obtained (Hapiz et al., 2018).

Test for Spreadability:

This was tested by applying the product (at room temperature) repeatedly on glass slide to observe the uniformity in the formation of the protective layer and determine if the product is fragmented, deformed or broken during application. The criteria used for spreadability is as follows;

G-Good: Uniform, no fragmentation, perfect application, without deformation of the lip balm.

I- Intermediate: Uniform, few fragments, appropriate application, little deformation of the lip balm.

B-Bad: Not uniform, many fragments, difficult/inappropriate application, intense deformation of the lip balm (Chaudhari et al, 2022).

pH Test: Lip balm from the refrigerator was taken out and melted on a petridish. The pH paper was dipped and the colour was compared with the pH scale reading (Hapiz et al., 2018).

Skin Irritation Test: It was done by applying the lip balm on skin for 10 minutes (Hapiz et al., 2018).

Evaluation tests for Herbal Lotion:

pH Test: 0.5gm of sample was mixed in 50 ml of water The pH paper was dipped and the colour was compared with the pH scale reading (Hapiz et al., 2018).

Homogeneity: Formulation was tested for appearance and visual touch.

Appearance: Colour, pearliness and roughness were observed.

Removal of Formulation: Sample was applied and tested how easily it was washed away.

Irritancy Test: It was applied on the skin to check if any side effects were seen.

Dye Test: To determine the type of emulsion 1 gm of lotion was taken and to it scarlet red dye (Sudan IV) was added. The contents were mixed and a smear was prepared on the slide. The cover slip was placed and observed under the microscope. If the disperse globules appeared red and the ground was colorless the lotion is O/W (oil in water) type and in vice-versa it is W/O (water in oil) type (Mawazi et al, 2022).

Stability Test: The lotion was tested at room temperature and at high temperature if melting took place. The sample was kept at room temperature (30 °C) and examined after several days. For high temperature, small amount of sample was taken in a beaker and heated in a water bath to 40 °C temperature and results were noted.



Figure 4. Herbal Lipbalm A and B.



Figure 5. Herbal Lotion.

3. Results and Discussion:

Two Herbal lipbalms were prepared one with with bixa seeds giving orange colour (A) and with beetroot giving pinkish red colour (B) (Fig. 4). The herbal lotion prepared was pale blue in colour (Fig. 5). All the evaluation tests were done the results were recorded in a form of table.

The herbal cosmetic products i.e., Herbal lip balms and Herbal lotion prepared and evaluated were found to be good and could be used safely. The herbal cosmetic products were named as

‘Botanique’.

The primary purpose of lip balm is to provide an occlusive layer on the lip surface to seal moisture in the lips and protect them from external exposure. Dry air, cold temperature, and wind all have a drying effect on skin by drawing moisture away from the body (Chaudhari et al, 2022). Herbal lip balm nourishes the lips, hydrates and protect the lips affected by the dryness. It can also be a better option for treatment of various lip issues such as chapped or cracked lips.

Both the lipbalms from Bixa and Beetroot evaluated for organoleptic characteristics like colour, odour, and appearance showed good results (Table 1).

Table 1. Evaluation of Herbal Lip Balm.

PARAMETERS	OBSERVATIONS	
	Bixa Lip Balm (A)	Beetroot Lip Balm (B)
Colour	Orange	Pinkish red
Appearance	Smooth	Smooth
Odour	Pleasant	Pleasant
Spreadability test	Good	Good
Effectiveness	Good	Good
Skin irritation test	No Irritation	No Irritation
pH test	7.0	7.0

The colour test on paper with beetroot was pinkish red and with bixa was orange (Fig. 6). No colour change was observed in lip balm, even after two months of preparation and storage in refrigerator. The colour of the herbal lipbalm exhibited appropriate appearance regardless of storage conditions. No irritation was seen when applied on the skin for more than ten minutes. The lipbalms showed good spreadability and hence could be easily applied on the lips (Fig. 7a & 7b). The test for pH was neutral for both the lipbalms (Fig. 8).



Figure 6. Colour test on paper for Lipbalm A and B.

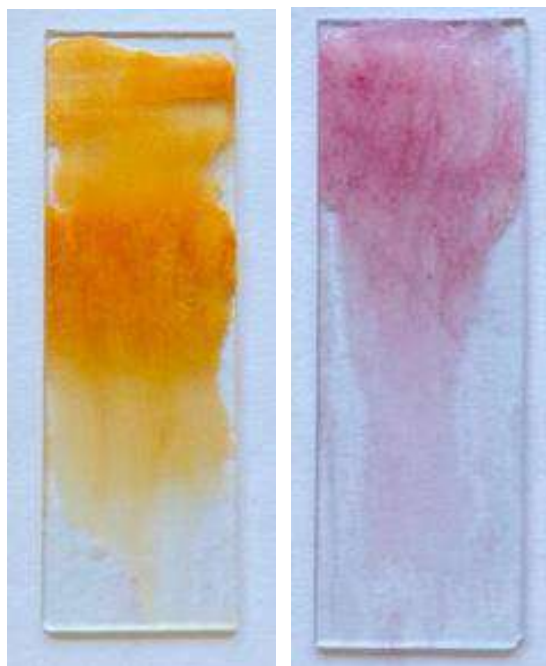


Figure 7 (a). Spreadability test for Lipbalm A and (b) Spreadability test for Lipbalm B.

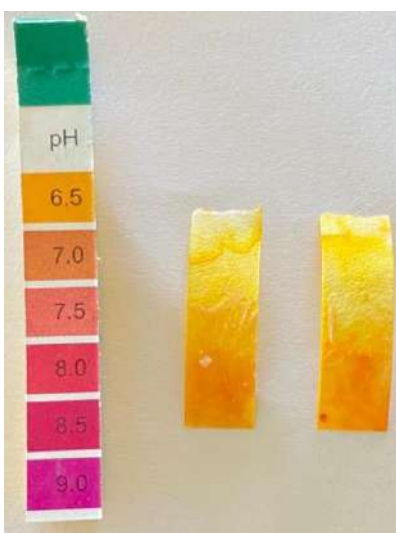


Figure 8. test for pH for lipbalm.

To be effective in preventing sunburn and other skin damage, a sunscreen product should have a wide range of absorbance. During the storage and handling of cosmetic formulation spreadability and viscosity are the prime parameter which affects the formulation acceptability (Vasant et al., 2021). The formulated herbal lotion obtained was pale blue in colour with a pleasant odour (Table 2). When formulation was kept for long time, no change in colour was observed. It was uniform and smooth and hence easy to apply on the skin. The formulated herbal lotion exhibited no redness, inflammation and irritation. The pH of the lotion was 6.5 (Fig. 9). The lotion was oil in water

emulsion type (O/W) (Fig.10) and lotion was easily removed by washing with tap water. It was stable even at high temperature.

Table 2: Evaluation of Herbal Lotion.

PARAMETERS	OBSERVATIONS FOR HERBAL LOTION
Colour	Pale blue
Odour	Pleasant
Spreadability	Uniform and Smooth
pH	6.5
Irritancy test	No Irritation
Dye test	Oil in water emulsion (O/W)
Stability test	No melting at high temperature



Figure 9. Test for pH for lotion.

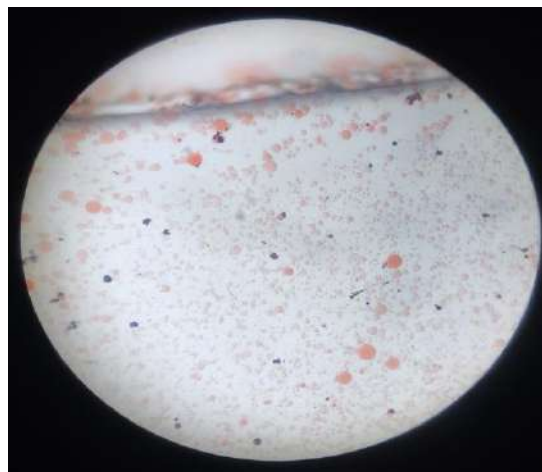


Figure 10. Dye test for lotion.

4. Conclusion

In today's scenario, people are more health conscious and thus herbal cosmetic demand is increasing day by day as they are environment friendly and safe to use. There is common belief that chemical based cosmetics are harmful to the skin which increase the awareness among consumers for herbal products. Herbal cosmetics are prepared, using one or more herbal ingredients to treat different skin ailments and for the beautification. This work done showed that herbal lip balm and lotion made from plant materials and natural ingredients can be easily prepared and can be used safely. Herbal lip balm is also a better option for treatment of various lip problems. The herbal lotion prepared can also be used as a sunscreen lotion as it has Butterfly pea flower

extract which has an antioxidant as well as sun protecting factor. There is tremendous scope to launch simple herbal formulation techniques using natural ingredients.

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Exfoliation of Graphite Powder to Graphene Oxide and Fe-doped Graphene Oxide and its applications in D-Glucose Sensors

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Abstract: A wide range of applications of exfoliated Graphite powder have been investigated using D-Glucose in recent studies. In this study Graphene oxide was successfully synthesized using Hummer's method. Further Graphene oxide was adorned with iron oxide nanoparticles to form reduced Fe-doped Graphene oxide (r-FeGO). Synthesized Graphene and its derivatives was characterized using X-ray diffraction (XRD), UV-Visible spectroscopy and Scanning electron microscopy (SEM) which confirmed the formation of synthesized material. The sensitivity of these derivatives was studied using different concentration of D-glucose solution. The r-FeGO showed highest sensitivity as compared to other materials.

Keywords: Graphene oxide, Fe-doped Graphene oxide, D-glucose, Sensitivity

1. Introduction

The graphene is a two-dimensional form of hexagonally ordered carbon atoms with a special honeycomb structure made of carbon atoms that have undergone sp^2 hybridization. Because of its numerous applications in various fields and its special qualities such as its zero-gap band structure, high electron mobility, high thermal and electrical conductivity, high specific surface area, and chemical tunability graphene is seen as a material for the future. Due to its huge theoretical specific surface area (about $2630 \text{ m}^2/\text{g}$), it is the perfect adsorbent for removing pollutants from the environment. The innovative techniques for separating graphene include chemical vapor deposition (CVD), in which graphene is chemically produced on a metal substrate, mechanical exfoliation, and layer-peeling off graphite using adhesive tape. Moreover, doping graphene and its derivatives with heteroatoms like transition metals and alkali metals changes the electronic and chemical properties of graphene, making it most suitable for the confines of affordable sensors with realworld applications. GO is a derivative of graphene, obtained through the oxidation and exfoliation of graphite. It consists of a single layer of carbon atoms arranged in a hexagonal lattice, similar to graphene, but with additional oxygen-containing functional groups attached to its basal plane and edges. These functional groups, such as epoxide, carbonyl, carboxyl, and hydroxyl, give GO its unique chemical and physical properties. One of the defining characteristics of GO is its hydrophilicity, which is attributed to the abundance of oxygen functional groups. This property allows GO to readily disperse in water and other polar solvents, unlike pristine graphene, which is

hydrophobic. The presence of oxygen groups also imparts solubility in various organic solvents, making GO versatile for solution processing techniques in material fabrication. GO exhibits tunable electronic properties depending on the degree of oxidation and the distribution of functional groups. The thickness of GO layers typically ranges from a few to tens of nanometres, with an average thickness of around 1.1 ± 0.2 nm for individual layers. In the field of sensors, GO's high surface area and ability to interact with analytes through functional groups make it ideal for gas sensors, biosensors, and chemical sensors. Its biocompatibility and ability to support cell growth also make it promising for applications in tissue engineering, drug delivery systems, and biomedical imaging. GO's unique combination of properties and versatility make it a highly promising material for various technological advancements and applications across multiple industries.

r-FeGO represents a specialized variant of graphene oxide that has been intentionally modified with iron (Fe) atoms. This doping process involves incorporating Fe atoms into the GO lattice, which can significantly alter its properties and functionalities. r-FeGO exhibits a unique combination of characteristics derived from both GO and the integrated iron dopants. The presence of iron atoms introduces magnetic behavior to the GO structure, making r-FeGO useful in various applications such as magnetic separation, magnetic sensors, and magnetic resonance imaging (MRI) contrast agents. Furthermore, r-FeGO retains the advantageous properties of GO, such as its large surface area, chemical reactivity, and biocompatibility. These characteristics make r-FeGO suitable for diverse applications, including catalysis, sensing, environmental remediation, and biomedical technologies. r-FeGO is synthesized through various methods, including chemical vapor deposition, hydrothermal synthesis, and chemical reduction of GO in the presence of iron precursors. The doping level, distribution of Fe atoms, and resulting properties of r-FeGO can be controlled through precise synthesis techniques. The ideal sensor is able to detect minute changes in its surrounding environment. Due to the planar and consistent arrangement of atoms in a graphene sheet, every atom within the sheet is exposed to the surrounding environment. In recent years, an enormous number of sensors and biosensors based on graphene and its related materials have been accounted for: (a) clinical applications like detection of glucose, cholesterol, H₂O₂, dopamine, ascorbic acid and uric acids; (b) environmental applications, for instance, for detection of heavy metal ions and pesticides; and (c) food sciences, for instance, for detection of erythromycin, tryptamine, and many more. Heteroatom-doped graphene materials have attracted great attention of mainstream researchers because of their enhanced physicochemical, optical, electromagnetic and structural properties, when contrasted with undoped graphene. The doping of heteroatoms in the graphene structure is known to enhance the wettability of graphene materials. Graphene derivatives doped with heteroatoms are highly promising materials for applications such as energy storage, fuel cells, electrocatalysis, sensing etc.

Specific capacitance is a critical measure for sensors, representing the capacitance per unit area of the electrode material, such as graphene oxide (GO) in glucose sensors. It directly influences the sensor's charge storage ability, impacting sensitivity and response time. In electrochemical sensors,

a higher specific capacitance improves performance by enhancing detection accuracy and responsiveness. This capability is vital across various applications, including environmental monitoring, healthcare diagnostics, and industrial process control, where precise measurement and adaptability are essential for safety and efficiency.

Glucose is a main component in blood to provide energy. The naturally occurring form of glucose is D-glucose. Glucose sensors with graphene-based enzymatic as well as nonenzymatic detection are of tremendous importance. The enzymatic glucose sensors are quite sensitive and selective whereas non-enzymatic sensors have attracted a lot of attention due to their stability, reliability and sensitivity. The comparison of graphene-based sensors and graphene-less ones has revealed that graphene-based sensors are better in all aspects such as sensitivity, detection limit and many more.

2. Experimental Work

2.1. Synthesis of Graphene Oxide

Graphene oxide (GO) was synthesized using Hummers' method. 6.0 g of graphite powder was dissolved in 140 mL of concentrated sulfuric acid (H_2SO_4). To this mixture, 18 g of potassium permanganate (KMnO_4) were gradually added, initiating an exothermic reaction. The mixture was then agitated for approximately 30 minutes at 50°C to ensure thorough oxidation of the graphite. Further 300 mL of deionized water were added to the reaction mixture, and it was stirred for 20 minutes at 90°C to further facilitate the oxidation process. Subsequently, 1000 mL of deionized water were introduced, and 30 mL of hydrogen peroxide (H_2O_2) were added dropwise. Stirring continued until the color of the solution changed from dark brown to a yellowish hue, indicating the completion of the oxidation reaction. The suspension was then acidified with a 1:10 hydrochloric acid (HCL). The resulting precipitate was separated by centrifugation and washed several times with distilled water until the pH 7. Finally, the precipitate was dried at 80°C for 24 hours.

2.3. Synthesis of reduced Fe-doped Graphene Oxide

0.30 g of graphene oxide (GO) was sonicated in 400 mL of deionized water to homogeneous suspension. This suspension was then transferred to a round-bottom flask. Further an aqueous solution was prepared by dissolving 0.66 g of ferric chloride hexahydrate ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$) and 0.76 g of ferrous sulfate heptahydrate ($\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$) in 10 mL of deionized water. This iron salt solution was added to the GO suspension. The mixture was heated to 80°C with constant stirring to facilitate the reaction. Further the pH was adjusted to 10 using 30% ammonia, and the mixture was stirred and maintained at 80°C for 30 minutes. Subsequently, 2.0 g of trisodium citrate was introduced while raising the temperature to 95°C , resulting in a black-colored suspension. The precipitate obtained was centrifuged several times. Finally, the obtained product was dried at 60°C .

3. Results and Discussion

3.1. X-Ray Diffraction Measurements

X-ray diffraction (XRD) was used to examine the crystal phase and to investigate the interlayer spacing for Graphite powder, GO and r-FeGO. The X-ray diffraction (XRD) pattern in figure 3.1(a) shows the peak which was obtained at $2\theta=26.63^\circ$ having interlayer spacing of 0.39 nm. The crystallite size was found to be 22.80 nm. The intense peak obtained at $2\theta=26.63^\circ$ having (002) plane confirms the pure form of graphite. On the other hand, in figure 3.1(b) 2θ value was observed at $2\theta=11.49^\circ$. The crystallite size was found to be 7.00 nm. It has been noticed that diffraction peak of pure graphite was found to be at $2\theta=26.63^\circ$. The disappearance of peak at 26.63° having (001) plane confirms that the compound is completely oxidised after treatment of oxidation and exfoliation of graphite result in the formation of oxygenated functionalities. The above crystallite size were obtained using Debye Scherrer's formula.

From X-ray diffraction pattern figure 3.1(c) it shows no sharp and narrow peak. This amorphous XRD pattern confirmed the presence of Fe nanoparticles in the samples. The characteristic peaks are not detected possibly because of the existence of iron compound that overwhelm the weak carbon peaks.

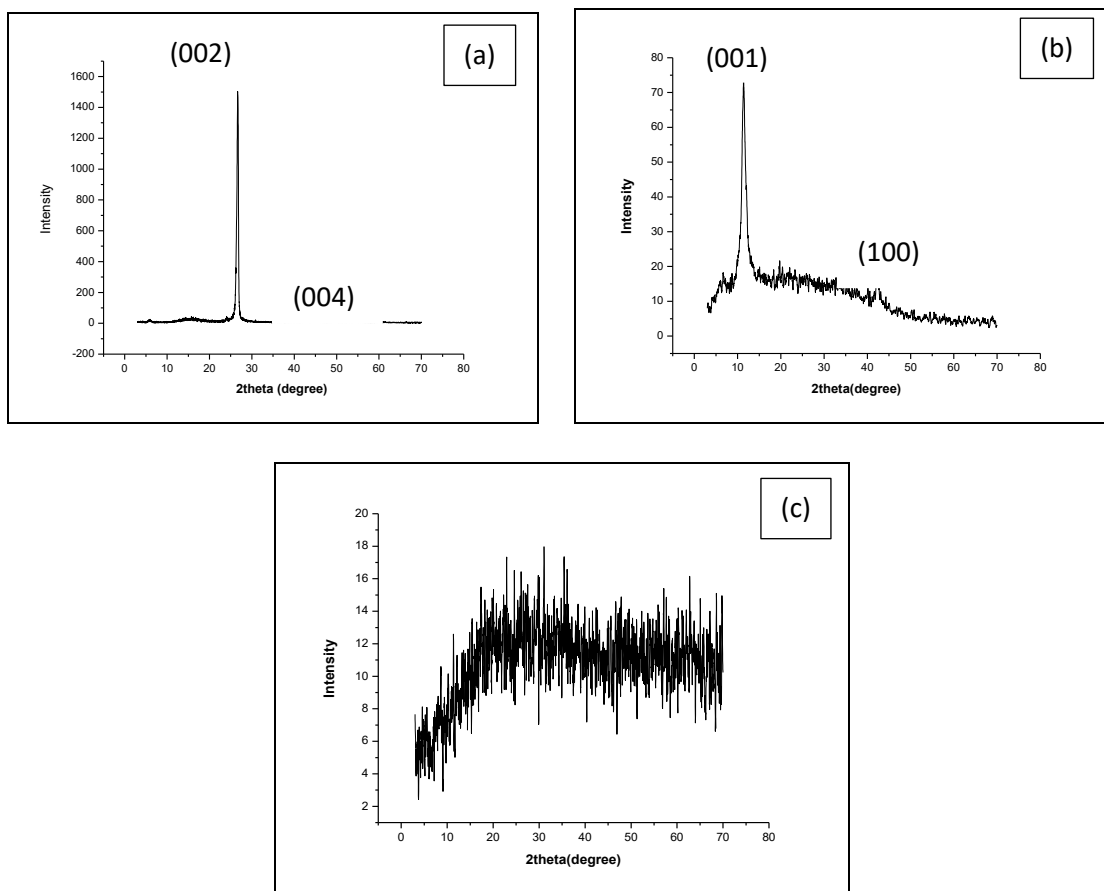


Figure 3.1. X-Ray Diffraction pattern of (a) Graphite powder (b) GO (c) r-FeGO.

3.2. UV-visible Spectroscopy

UV-visible spectroscopy was used to measure the absorption and reflectance of radiation in the UV spectra range. Figure 3.2 (a) displays the UV-visible spectrum of Graphite powder which shows no remarkable absorption peaks due to stack layer of graphene only composed of graphitic carbon. Whereas in figure 3.2 (b) spectra of GO shows that the GO structure is more ordered due to the presence of the carbon rings at the base plane of the structure. The degree of the conjugation can be determined from the λ_{\max} value. If there are more $\pi \rightarrow \pi^*$ transition the less energy needs to be used for electronic transition which has higher λ_{\max} . The λ_{\max} of the prepared GO is 238 nm which is almost similar to the reported value. The observed shoulder at around 300 nm suggests the presence of $n \rightarrow \pi^*$ transitions in carbonyl rings. This confirmed the formation of GO.

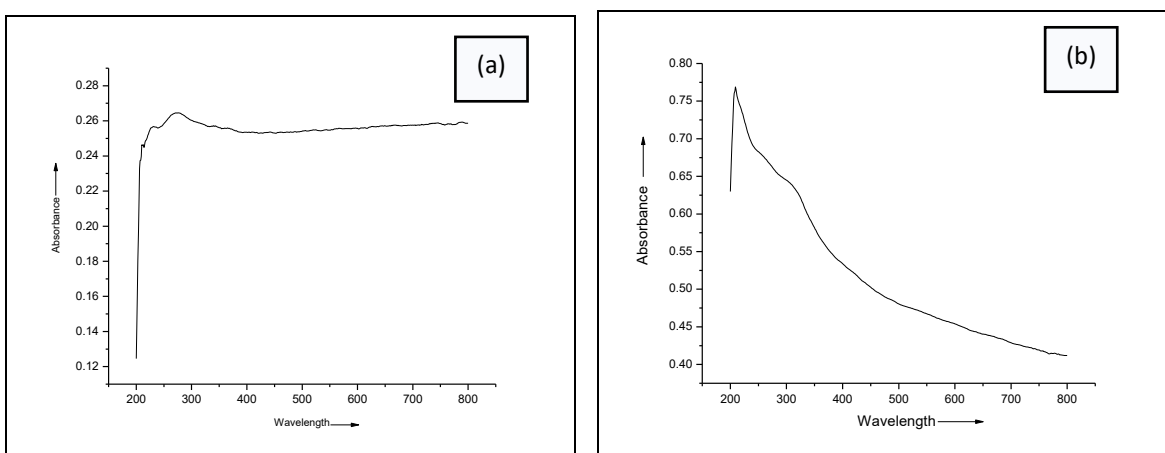


Figure 3.2 UV-Visible spectra of (a) Graphite powder (b) GO recorded in aqueous solution in the range of 200-800 nm.

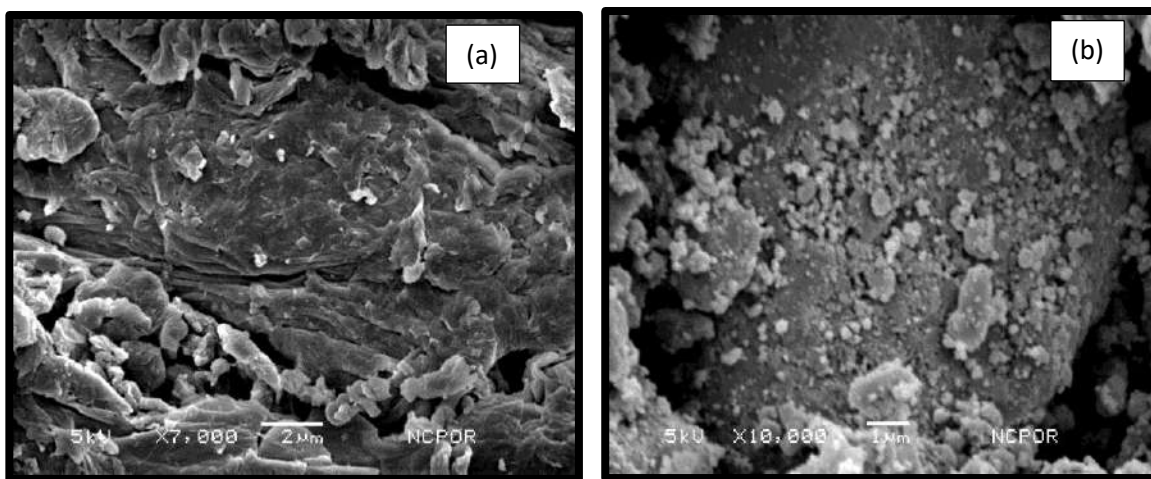


Figure 3.3 SEM image of (a) GO (b) r-FeGO.

3.3. Scanning Electron Microscopy

Scanning electron microscopy was used to analyze the morphology and composition of the structure. Figure 3.3 (a) shows the SEM image which displays the structural and morphological characteristics of GO. The image depicts GO as a disordered solid composed of closely associated, thin and overlapping sheets, forming wrinkled and layered structures. These characteristics are attributed to interactions between oxygen containing functional groups, promoting efficient adsorption due to exposed surfaces on the crumpled GO sheets. Figure 3.3 (b) shows the SEM image which shows the morphology of rGO-iron oxide depicts crumpled wave like graphene sheets and presence of iron atoms inside the graphene sheets.

3.4. Electrochemical Measurements

3.4.1 Cyclic voltammetry (CV)

The cyclic voltammogram was recorded using D-glucose as an electrolyte having 0.1, 0.2, 0.3 and 0.4 M concentration. The three electrode setup was used where Platinum wire (Counter electrode), Ag/AgCl (Reference electrode) and Glassy carbon as working electrode. The CV was recorded at 10, 30 and 50 mV/s having potential window of -0.2 to 1.4 V. Using the Anodic current of different concentration at 10, 30 and 50 mV/s. Anodic Current (A) v/s Concentration (M) was plotted where slope obtained depicts the sensitivity of material at 10, 30 and 50 mV/s.

Table 1. Shows sensitivity for Graphite, GO and r-FeGO at different scan rate.

Scan Rate(mV/s)	Sensitivity		
	Graphite	Graphene oxide	r-FeGO
10	1E-06	1E-06	4E-06
30	2E-06	2E-06	5E-06
50	2E-06	3E-06	6E-06
Average Sensitivity	1.667E-06	2E-06	5E-06

Table 1. shows that as the scan rate increased, the sensitivity of the materials also increased, likely due to a larger surface area. Graphite powder had an average sensitivity of 1.667E-06 A/M, serving as a baseline. Graphene oxide (GO) exhibited a higher average sensitivity of 2E-06 A/M compared to graphite powder, suggesting that GO was more responsive to D-glucose due to its enhanced electrochemical properties. However, reduced iron-doped graphene oxide (r-FeGO) demonstrated the highest average sensitivity at 5E-06 A/M, indicating that the combination of reduction and iron doping significantly boosted its sensitivity. Consequently, r-FeGO showed the highest sensitivity among the tested materials, making it the most effective for applications involving D-glucose detection.

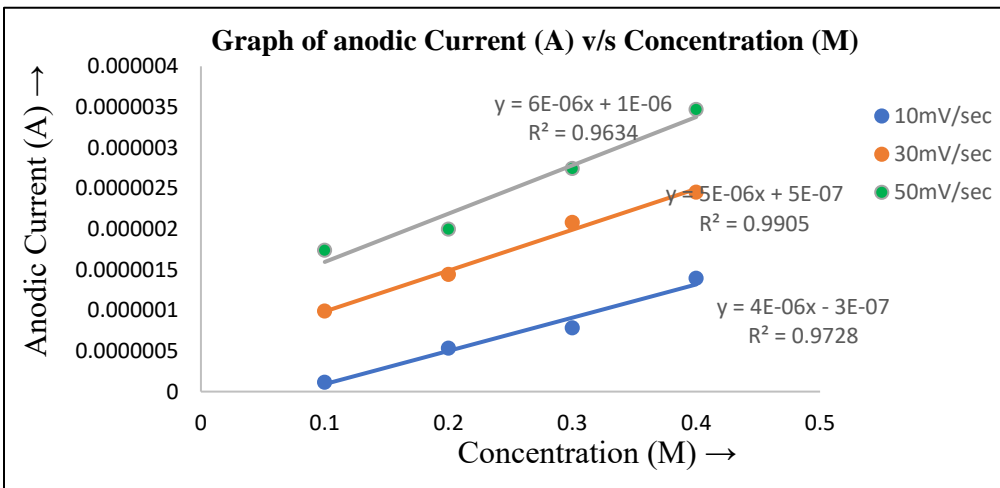
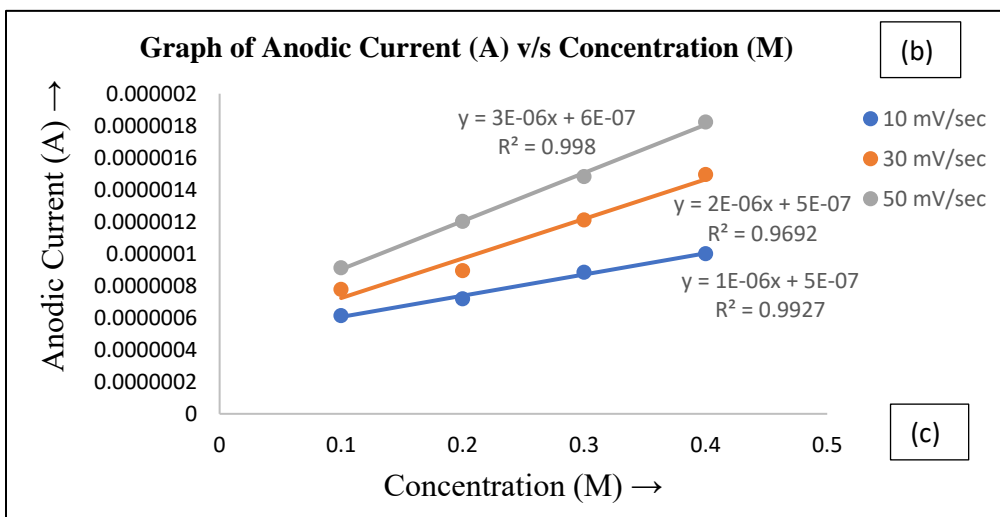
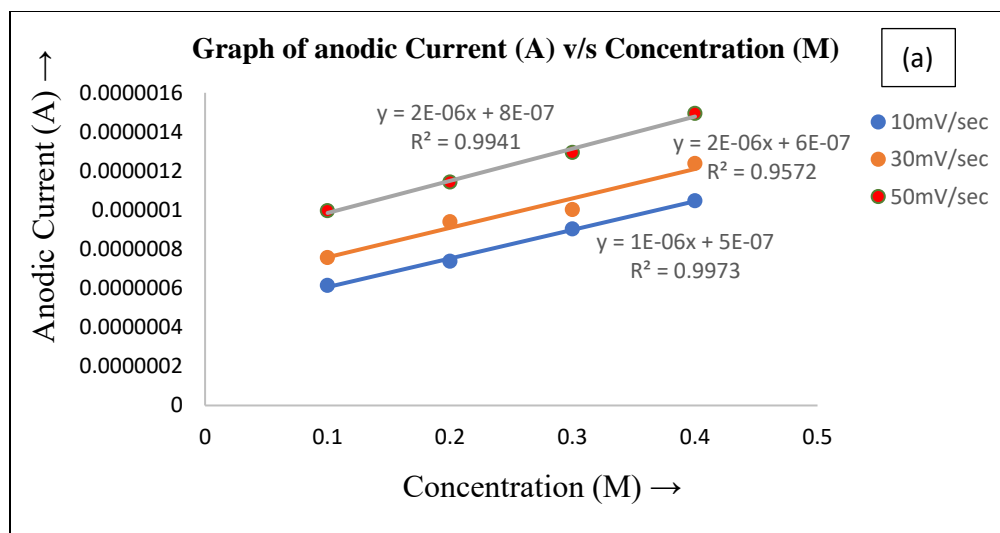


Figure 3.4.1 Current (A) v/s concentration (M) plot at 10, 30 and 50 mV/s using different concentrations of D-glucose of (a) Graphite powder (b) GO (c) r-FeGO.

4. Conclusion

In this study GO was synthesized from pure graphite powder using Hummer's method. Reduced Fe-doped graphene oxide was synthesized by using GO as a matrix. The synthesized compounds was characterized by UV-visible spectroscopy which proved that Graphite powder showed no remarkable absorption peaks due to stack layer of graphene whereas GO proved that the GO structure is more ordered due to the presence of the carbon rings at the base plane of the structure. From XRD plot the peak obtained at $2\theta = 11.46^\circ$ having (001) confirmed the formation of GO, whereas for r-FeGO no sharp and narrow peak was observed this amorphous pattern confirmed the presence of Fe nanoparticles in the samples. SEM images displayed the structural and morphological characteristics of GO and r-FeGO. The Sensitivity in D-Glucose was compared for exfoliated forms of graphite where better sensitivity was observed for r-FeGO which confirms that presence of Fe can increase the detection limit.

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Exploring Statistical Tools for Social Science Research

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Abstract: Application of statistical tools in social science research enhances the credibility, accuracy, and generalizability of research findings. From designing surveys and analyzing complex datasets to understanding causal relationships and forecasting future trends, statistical methods are vital for addressing the diverse and intricate problems within social sciences. The present study is to explore various tools which are available to social researchers. Significance of descriptive statistics, inferential statistics, methods of bivariate and multivariate techniques etc. are discussed in this paper. A detailed account of factor analysis and multiple regression analysis is also given for the perusal of the researcher. As social phenomena become increasingly complex, the role of statistics will continue to expand, providing researchers with robust tools to generate meaningful insights that can impact public policy and contribute to social progress.

Keywords: Regression, Multicollinearity, Eigenvalues, ANOVA, Correlation matrix

Introduction

Statistics is an essential tool in social science research, helping researchers collect, analyze, interpret, and present data to uncover trends, patterns, and relationships in social phenomena. From psychology and sociology to economics and political science, statistical methods enable researchers to make data-driven decisions and develop theories grounded in empirical evidence.

The present study illustrates the various applications of statistics in social science research and how it enhances the rigor and credibility of research findings. An attempt is done here to outline the essential role that statistics play in enabling social scientists to analyze and interpret complex social data with precision and clarity.

Materials and Methods

Some of the broad areas in statistics with various statistical methods that can be explored are being discussed below.

1. Descriptive Statistics

Descriptive statistics are used to summarize and describe the main features of a dataset. This includes organizing data in a way that is easy to understand and interpret. Social scientists often

use descriptive statistics to:

- i. **Summarize Survey Results:** Social scientists commonly conduct surveys, and descriptive statistics help them present data on central tendencies (mean, median, mode) and variability (range, standard deviation) of variables like income, education levels, or political preferences.
- ii. **Visualizing Data:** Researchers use graphs, tables, and charts to provide a visual summary of the data. For example, a histogram might show the distribution of age among participants in a study on public health.
- iii. **Comparing Groups:** Descriptive statistics can compare groups on various variables. For instance, comparing average income levels between different demographics or regions.

2. Inferential Statistics

Inferential statistics allow researchers to make predictions or inferences about a population based on a sample. This is crucial in social sciences where researchers cannot study entire populations but rely on smaller samples to draw conclusions. Key applications include:

- i. **Hypothesis Testing:** Social scientists test hypotheses about relationships or differences between variables. For example, researchers might test whether there is a significant difference in job satisfaction levels between men and women in a given industry.
- ii. **Estimation:** Inferential statistics, such as confidence intervals, are used to estimate population parameters based on sample data. For example, a political scientist might estimate the proportion of voters who support a candidate based on survey data.
- iii. **Regression Analysis:** Regression is used to determine relationships between variables. In social sciences, it can explain how one or more independent variables (e.g., education level, age) influence a dependent variable (e.g., income level). This helps to understand the underlying dynamics of social issues.
- iv. **Correlation Analysis :** Correlation analysis is used to compute the degree of association between two variables. If the variables are directly proportional , then the correlation will be positive and if they are inversely proportional , then the correlation will be negative. However the coefficient of correlation ranges from -1 to + 1 only. For example , the correlation between height and weight of students may be positive while the correlation between price and demand for a product may be negative.

3. Multivariate Analysis: Multivariate analysis involves examining multiple variables simultaneously to understand complex relationships between them. This is particularly useful in

social sciences where phenomena are often influenced by numerous interconnected factors. Common techniques include:

Factor Analysis: Social scientists use factor analysis to identify underlying variables, or "factors," that explain the pattern of correlations within a set of observed variables. For example, psychologists may use this method to identify underlying personality traits.

Cluster Analysis: Cluster analysis is used to group individuals or entities that share similar characteristics. This technique can be applied to classify different socioeconomic groups based on income, education, and lifestyle factors.

Multivariate Regression: This technique extends regular regression to involve multiple predictors, helping social scientists understand how different variables together influence a particular outcome. For example, how education, work experience, and location collectively affect wages.

4. Survey Design and Analysis

Surveys are one of the most common data collection tools in social sciences, and statistical methods play a key role in both the design and analysis of surveys:

Sampling Techniques: Social scientists use statistics to design appropriate sampling techniques (e.g., random sampling, stratified sampling) to ensure that the sample is representative of the larger population, reducing biases.

Reliability and Validity Testing: Researchers apply statistical techniques like Cronbach's alpha to measure the internal consistency of a survey, ensuring the reliability of the responses. Validity tests ensure that the survey measures what it intends to measure.

Data Weighting: In survey research, especially in national surveys, statisticians often apply weights to the data to account for oversampling or undersampling certain groups, allowing more accurate population-level conclusions.

5. Causal Inference

Understanding cause-and-effect relationships is a major goal in social sciences, and statistics provide the tools to identify and measure these causal relationships:

Experimental Designs: In experimental research, statistics help determine whether a treatment or intervention (e.g., a new educational program) has a significant effect on an outcome (e.g., student performance). Statistical significance tests like t-tests or ANOVA are often used to assess the effect.

Quasi-Experimental Designs: When random assignment is not possible, social scientists use quasi-experimental designs to infer causal relationships by comparing treatment and control groups

before and after an intervention.

Propensity Score Matching (PSM): PSM is used to control for selection bias in observational studies by matching individuals with similar characteristics across treatment and control groups. For instance, it can be used to assess the effect of a social policy on employment rates by matching participants with non-participants on similar characteristics.

6. Time Series Analysis

In social science research, time series analysis is used to analyze data that is collected over time. This type of analysis helps in identifying trends, cycles, and seasonal variations in data:

Economic Forecasting: Economists use time series analysis to forecast economic indicators such as GDP, unemployment rates, or inflation trends. It helps policymakers anticipate and respond to changes in the economy.

Behavioral Trends: Sociologists and psychologists may analyze trends in behavior over time, such as shifts in public opinion, crime rates, or health outcomes.

Policy Impact Assessment: Time series analysis can assess the long-term impact of social policies or interventions by tracking relevant variables before and after implementation.

7. Social Network Analysis (SNA)

Social Network Analysis (SNA) is a statistical technique used to study the structure of relationships between entities, such as individuals, organizations, or countries. It has the following applications.

Understanding Social Structures: SNA helps researchers examine how individuals or groups are connected through social networks, allowing an understanding of how information flows or how influence is distributed.

Mapping Influence: Political scientists use SNA to map networks of political influence, identifying key actors, decision-makers, and their relationships within political systems.

Organizational Behavior: In organizational studies, SNA is used to understand communication patterns within companies and to identify potential areas for improving collaboration and efficiency.

8. Cluster Analysis

Cluster analysis is used to group individuals or entities that share similar characteristics. This technique can be applied to classify different socio economic groups based on income, education, and lifestyle factors.

9. Qualitative Data Quantification

While social sciences often rely on qualitative data (e.g., interviews, observations), statistical techniques can be applied to quantify this data by the following methods.

Content Analysis: Content analysis involves coding qualitative data into categories that can be statistically analyzed. For example, researchers might quantify the number of times a specific theme appears in interviews about political participation.

Sentiment Analysis: This is used to quantify the sentiment (positive, negative, neutral) expressed in qualitative data like open-ended survey responses or social media posts.

Results and Discussion

Having discussed various methods and statistical techniques in social science research, now let us study in detail about two important multivariate tools a) Factor Analysis and b) Multiple Regression

(a) Factor Analysis

The goal of factor analysis is to simplify data by identifying structures or patterns that explain the variation in a dataset. Factor analysis is particularly useful in fields like psychology, social sciences, and marketing, where many variables may be correlated with one another. By identifying patterns in complex data sets, factor analysis helps streamline research and provide deeper insights into latent variables driving observed outcomes.

Key Concepts in Factor Analysis:

1. **Observed Variables:** These are the measured variables in your dataset.
2. **Factors (Latent Variables):** Unobserved variables that are inferred from the observed variables. These represent the underlying structure that explains the correlation between the observed variables.
3. **Factor Loadings:** Coefficients that explain the relationship between observed variables and the latent factors. A higher loading indicates a stronger association between a variable and the factor.
4. **Communality:** The proportion of each observed variable's variance that is explained by the factors.
5. **Eigenvalues :** A measure of how much variance is explained by each factor. Factors with higher eigenvalues explain more variance.

6. Rotation: A technique used to make the output of factor analysis easier to interpret by adjusting the factor loadings. The most common types are varimax (orthogonal) and oblimin (oblique) rotations.

Types of Factor Analysis:

1. Exploratory Factor Analysis (EFA): Used when you don't have prior knowledge about the structure of the factors.
2. The goal is to explore the underlying structure and determine how many factors exist in the data.
3. Confirmatory Factor Analysis (CFA):
4. Used when you have a preconceived theory or hypothesis about the number and nature of the factors. It tests whether the data fits a specific factor structure.
5. One should be familiar with the data before selecting the correct type of factor analysis including the total number of independent variables, number of dependent variables etc. Computer software can be used to compute the correlation matrix.

Steps in Conducting Factor Analysis:

1. Formulate the Research Question: Define the problem and determine which variables you want to include in the analysis. Ensure that factor analysis is appropriate by confirming correlations between variables (using a correlation matrix).
2. Check Assumptions: Adequate sample size: Larger sample sizes are generally needed for factor analysis. A common guideline is to have at least 5-10 observations per variable.
3. Normality: Factor analysis works best when variables are normally distributed.
4. Multicollinearity: High correlations between variables are needed, but excessive multicollinearity should be avoided. Use Bartlett's Test of Sphericity and Kaiser-Meyer-Olkin (KMO) Test to ensure that factor analysis is appropriate.
5. Extracting Factors: Principal Component Analysis (PCA): A commonly used method for extracting factors by transforming the original variables into a set of uncorrelated components.
6. Maximum Likelihood: Another method used for factor extraction, particularly when working with normally distributed data.

7. Determine the Number of Factors: Eigenvalues : Retain factors with eigenvalues greater than 1.
8. Scree Plot: A graph that shows the eigenvalues for each factor. You can retain the number of factors before the "elbow" in the plot. Cumulative Variance: Retain factors that together explain a significant portion of the variance, typically aiming for around 70-80%.
9. Rotation: Apply rotation to make the factor loadings easier to interpret. Varimax (Orthogonal Rotation): Assumes that factors are uncorrelated and simplifies the factor structure. Oblimin (Oblique Rotation): Allows for correlated factors and is more flexible in representing real-world scenarios.
10. Interpretation of Factors: Look at the factor loadings to see which variables are highly correlated with each factor. Variables that load highly on the same factor are believed to measure the same underlying construct. Name or label the factors based on the group of variables that load on them.
11. Assess Model Fit (for CFA): Use model fit indices like Chi-Square, RMSEA (Root Mean Square Error of Approximation), CFI (Comparative Fit Index), and TLI (Tucker-Lewis Index) to determine how well the model fits the data.

Example of Factor Analysis:

Suppose you conduct a survey measuring different aspects of job satisfaction, such as work-life balance, salary, management, job security, and career development. Factor analysis can help you reduce these variables into a smaller set of factors like:

Job Benefits: Grouping variables such as salary and job security.

Work Environment: Grouping variables like management and work-life balance.

Applications of Factor Analysis:

Psychometrics: Identifying underlying personality traits, attitudes, or intelligence factors.

Marketing: Reducing customer preferences into broader dimensions (e.g., product features).

Finance: Identifying common factors driving stock returns or economic indicators.

Social Sciences: Exploring hidden structures in survey data, such as attitudes or beliefs.

Limitations of Factor Analysis:

There is subjectivity in deciding the number of factors and interpreting the factors. It is sensitive

to sample size and requires careful validation when applying the results to a broader population.

(b) Multiple Regression

Multiple regression analysis is a statistical technique used to examine the relationship between one dependent (outcome) variable and two or more independent (predictor) variables. It allows researchers or analysts to determine how changes in the independent variables influence the dependent variable, while controlling for the effects of other variables in the model.

Key Concepts in Multiple Regression:

1. **Dependent Variable (Y):** The outcome variable you're trying to predict or explain.
2. **Independent Variables (X_1, X_2, \dots, X_n):** The variables that you believe have an influence on the dependent variable.
3. **Coefficients ($\beta_1, \beta_2, \dots, \beta_n$):** These represent the strength and direction of the relationship between each independent variable and the dependent variable.
4. **Intercept (β_0):** The value of the dependent variable when all independent variables are zero.
5. **Error Term (ϵ):** Represents the unmeasured factors that influence the dependent variable.

A Multiple Regression Model

The general form of a multiple regression model is:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \epsilon$$

Steps in Conducting Multiple Regression:

1. Formulate the Hypothesis:
2. Identify the dependent variable and the independent variables.
3. Check the assumptions of Multiple Regression models

Linearity: The relationship between the dependent and independent variables is linear.

Independence: Observations should be independent of each other.

Homoscedasticity: The variance of errors is consistent across all levels of the independent variables.

Normality of Residuals: The errors (residuals) should be normally distributed.

Multicollinearity: Independent variables should not be too highly correlated with each other.

4. Model Fitting:

Use software like Excel, SPSS, R, Python, or others to fit the model to the data and estimate the coefficients for the independent variables.

5. Model Evaluation:

R-square (R^2): Represents the proportion of variance in the dependent variable that is explained by the independent variables.

Adjusted R-square: A modified version of R^2 that adjusts for the number of predictors in the model.

F-statistic: Tests the overall significance of the model.

P-values for coefficients: Assess whether each independent variable is statistically significant.

Standard Error: The precision of the coefficients' estimates.

6. Model Diagnostics:

Check for multicollinearity using Variance Inflation Factor (VIF).

Plot residuals to assess homoscedasticity and normality.

Identify any potential outliers or influential points.

An example of a Multiple Regression Model

Suppose you want to predict a student's exam score (Y) based on the number of study hours (X_1), previous academic performance (X_2), and class attendance (X_3). The regression model would be:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$$

Types of Multiple Regression Models:

1. Linear Regression: The relationship between dependent and independent variables is linear.
2. Polynomial Regression: Used when the relationship between variables is nonlinear but can be modeled using polynomial terms.
3. Logistic Regression: When the dependent variable is binary (0 or 1).

4. Ridge and Lasso Regression: Used when multicollinearity is an issue or for variable selection, adding penalty terms to the regression model.
5. Each of the above models has its specific use cases depending on the nature of the data and the research question being addressed.

Conclusions

Most of the statistical techniques have been discussed in this paper. As there are various statistical tools available, the selection of the most appropriate tool by the researcher is of paramount importance. Therefore the researcher has to decide the techniques only after collection of data and looking at the complex structure of the data. The number and significance of decision variables should be clearly defined. Multiple regression and factor analysis are very strong methods in social science research. However, a layman can take the help of statistical softwares for the technical analysis, at the same time interpretation of the findings should match with the objectives of the research. Research methodology also may be strictly followed.

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पॅन्तातेव्कांतली पितृसत्ता आनी मातृसत्ता: सिमॉन द ब्यूवॉयरच्या 'द सेकंड सेक्स' ह्या पुस्तका वांगडा तुलनात्मक विश्लेशण

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सारांश: ह्या सोदलेखांत पॅन्तातेव्कांतली (पवित्र पुस्तकांतलीं पयलीं पांच पुस्तकां) पितृसत्ताक आनी मातृसत्ता हांची गतिशिलताय सिमॉन द ब्यूवॉराच्या 'द सेकंड सेक्स' ह्या पुस्तकांत सादर केल्ल्या नारीवादी सिध्दांतां कडेन जुळोवन अभ्यास केला. पॅन्तातेव्कांतल्या बायलांच्यो भुमिका, दर्जो आनी प्रतिनिधीत्व हांची तपासणी करून तांची तुळा ब्यूवॉरान बायलांच्या जुलुमांचेर आनी समाजांतल्या पितृसत्ताक संरचनेचेर टिका केल्या. ह्या सोदवावरांत पॅन्तातेव्कांत आशिल्लो लिंगभेद उजवाडाक हाडपाचो प्रयत्न जाला.

मुखेल उतरां: पितृसत्ताक, मातृसत्ता, पॅन्तातेव्क, सिमॉन द ब्यूवॉयर, 'द सेकंड सेक्स'.

1. सुरवेचीं उतरां

उत्पत्ती, सुटका, लेवीशास्त्र, लोकगणटी आनी दुसरी समुर्त पवित्र पुस्तकांतल्या ह्या पयल्या पांच पुस्तकांक पॅन्तातेव्क अशें म्हणटात. पॅन्तातेव्कांत ज्यू, क्रिस्तांव आनी इस्लामी परंपरेची बुन्याद आस्पावल्या. पितृसत्ताक नेमांक लागून चलपी संवसार तातूंत सादर केला. दादल्याचें वर्चस्व आनी बायलांचें अधीनताय हे परत परत येवपी विशय तातूंत दिसतात. सिमॉन द ब्यूवॉयरच्या 'द सेकंड सेक्स' ह्या पुस्तकांत ह्या विशयांचें विश्लेशण करपा खातीर एक विमर्शीक चौकटी दिल्या, कारण तातूंत बायलांचो जुलूम इतिहासीक, समाजीक आनी मानसीक यंत्रणेचोआस्पाव आसा. पॅन्तातेव्कांतलें कथन आनी कायदे पितृसत्ताक मुल्यांचें प्रतिबिंब आनी बळगें कशें करतात आनी ब्यूवॉयराच्या अंतर्दृष्टींतल्यान ह्या पुस्तकांचो परिणाम समजून घेवपाक कशे मदत जावंक शकतात हाचो अभ्यास ह्या सोदलेखांत जाला.

2. पॅन्तातेव्कांतली पितृसत्ताक रचणूक

2.1. उत्पत्ती: रचना आनी पातक

उत्पत्तींत रचनेच्या कथनांनी लिंगसंबंदांचेर परिणाम करपी श्रेणीबध्द क्रम स्थापन केला. आदांवाची बर काडून देवान तातूंत मास घालून बायल रचली अशें उत्पत्तीच्या पुस्तकांत मेळटा (उत्पत्ती 2:21-23). ही बायल-रचनेची खबर, बायल दादल्याचेर अवलंबन आसा आनी तिका दुय्यम दर्जो फावला असो अर्थ लायला.

देवान मनशाक हुकूम घाल्लो, "तुमी त्या रुकाचें फळ खावचें न्हय" (उत्पत्ती 3:3). येवेन आदावांक तें फळ खावंक

दिलें. देवाचो हुकूम मोडून पातकाची सुरवात जाली. अश्या वेळार देवान म्हणलें, “... तुजी वंदावण तुका घोवा वाटेन ओडटली आनी तो तुजे वयर अधिकार चलयतलो” (उत्पत्ती 3:16). हातुंतल्यान बायलेक कमी लेखून दादल्याचो बायलेचेर कशे तरेचो अधिकार आसा तें स्पश्ट जाता.

ब्यूवॉयर अशा प्रसंगां विशीं चिंतन करून म्हणटा, “बायलेची कूड दादल्या भशेनूच, पूण तिचे कूडीक तसो सम्मान मेळना” (Beauvoir 46). हें पवित्र पुस्तकांतले रचने आनी पातकाच्या चित्रणा कडेन जुळटा अशें ब्यूवॉयराचें मत आसा. बायलेक दुय्यम स्थान आनी दादल्या पसून निर्माण जाल्ली अशी कल्पना रेखांकीत जाल्ली दिसता.

उत्पत्तींत रचना आनी पातक कथांक बायलांच्या अधीनतायेक न्याय दिवपा खातीर वापरिल्लें ‘भिरांकूळ कथन’ अशें पवित्र पुस्तकाची अभ्यासक फिलीस ट्रायबल म्हणटा (Trible 110). एलिझाबेथ ए. जॉन्सन हाणें मूळ ग्रंथांत कल्पिल्ली भागीदारी आनी परस्परतायेचेर भर दिवन पितृसत्ताकतेचो आदार दिवपा खातीर उत्पत्ती कथांचो चुकीचो अर्थ लायला अशें मत मांडलां (Johnson 25). पातकाचें मूळ बायलांक अधीनताय मान्य करपी पितृसत्ताक मिथक आसा असो विचार नारीवादी समिक्षक जुडिथ फेटरलीन व्यक्त केला (Fetterley 78).

2.2. सुटका: पितृसत्ताक समाजांतली बायल

सुटकेच्या पुस्तकांत पितृसत्ताक संदर्भांतल्यान बायलांक हिणसायल्यात पूण म्हत्वाचीय भुमिका निबयल्या तें उजवाडाक आयलां. जोकेबेद, मिरियम, जिपोरा सारकिल्ल्या बायलांचो म्हत्वाचो वांटो आसतना, तांची कथा चड करून मोयजेस आनी आरन सारकिल्या दादल्या नायकांच्या व्यापक कथना खाला चेपून उरता तें जाणवता. सुटकेच्या पुस्तकांत सादर केल्ले कायदे पितृसत्ताक नेमांक खास करून लग्न, मालमत्ता आनी शुध्दताये संबंदीत नेमांक अदीक बळगें दितात (देखीक, सुटका 21:7-11).

सुटकेच्या पुस्तकांत बायलांची भुमिका समर्थनशील आनी उण्या मोलाची अशें ब्यूवॉयर हाणें केल्लें विश्लेशण स्पश्ट जाता. मिरियम आनी जिपोरा सारकिल्या बायलांची मर्यादीत आनी गौण भुमिका नियाळून ब्यूवॉयर बरयता, “तिचीं पाखां कापून उडयतात आनी मागीर तिका उडपाक कळना म्हूण दोश दितात” (Beauvoir 64).

सुटकेच्या पुस्तकांतल्या बायलांक दुय्यम स्थान आसून लेगीत बहुआयामी भुमिका आशिल्लीं कुटुंबीक आनी समाजीक संरचना सांबाळपाक गरजेचीं आशिल्लीं अशें पवित्र पुस्तकाची अभ्यासक कॅरल मेयर्स हांणी उजवाडाक हाडलां (Meyers 47). देवशास्त्र अभ्यासक वॉल्टर ब्रुगेमन हाणें नोंद केलां की सुटकेचें पुस्तक जरी पितृसत्ताक आसले तरी सोडवणेच्या इतिहासांत बायलांक म्हत्वाची भुमिका दाखयल्या (Brueggemann 85). सुटकेचें पुस्तक बायलांच्या कथांचो उपेग दादल्या केंद्रीत कथानकांक फुडें व्हरपाक करता, दादल्यांच्या अधिकाराक बळगें दिता आनी बायलांचें म्हत्व कुशीक काडटा अशें समिक्षक मिके बाल म्हणटा (Bal 34).

2.3. लेवीशास्त्र, लोकगणटी आनी दुसरी समुर्त: पितृसत्ताक नेमाचें संहिताबध्दीकरण

लेवीशास्त्र, लोकगणटी आनी दुसरी समुर्त ह्या पुस्तकांनी कायदेशीर संहितेंत बायलांची वागणूक आनी दर्जो नियंत्रीत करपी पितृसत्ताक पद्दत संहिताबद्ध केल्या. हे कायदे शुध्दताय, लैंगीक आचरण, वारसो, कुटुंबीक भुमिका ह्या सारक्या प्रस्नांचेर भर दितात, जाका लागून चड करून बायलांक दादल्यां परस अधीनस्थ स्थितींत दवरतात. देखीक-

लेवीशास्त्राच्या बाराव्या प्रकरणांत बाळंतपण जाले उपरांत बायलां खातीर शुध्दीकरण प्रक्रियेचो तपशील दिला, तातूंत बायलांच्या जैवीक कार्या कडेन संबंदीत आशिल्ले अशुध्दीचेर भर दिला.

ब्यूवॉयर अशा मतांचेर टिका करता, “तिचो पुराय इतिहास दादल्यांनी बरयला” (Beauvoir 141) असो दावो करून, इतिहासीक नदरेन धर्मीक कायदे आनी चालीरितींचो उपेग बायलांक नियंत्रणांत दवरपा खातीर आनी आपल्या शेकातळा हाडपा खातीर कसो केला हाचेर नदर मारता.

पवित्र पुस्तकाचो जाणार फ्रायमर-केन्स्की पॅन्तातेव्कांत आशिल्ल्या कायद्यांतल्या पितृसत्ताक नेमांक (लोकगणटी 27:1-11) मान्यताय दिता पूण तातूंतल्यान बायलांक वारसा सारके हक्क मेळटात अशें नोंद करता (Frymer-Kensky 112). देवशास्त्री जॉन गोल्डनगेकाक ह्या कायद्यांत न्याय मेळपाची शक्यताय दिसता, तातूंत बायलां सारकिल्ल्या दुबळ्या गटांक संरक्षण दिवपाची शक्यताय आसा अशें म्हणटा (Goldingay 94). हे कायदे बायलांक दादल्याचें वर्चस्व तिगोवन दवरपा खातीर जुलूम करतात अशें समिक्षक मॅरी डाली हाणें आपलें मत व्यक्त केलां (Daly 63).

3. मातृसत्ताक घटक आनी बायलांचें कृत्य

सर्वव्यापी पितृसत्ताक चौकटी आसून लेगीत पॅन्तातेव्कांत बायलांचें कृत्य मातृसत्ताक घटकांचेर भर दिवपी कथानकां आसात. सारा, रेबेका, लिआ, रेशल ह्या मातृसत्ताकांची कथा पितृसत्ताक संदर्भा भितर आपलें प्रवर्धन आनी स्वयंशासन दाखयतना दिसतात. ह्यो बायलो अदींमदीं पितृसत्ताक आनी मातृसत्ताकाच्या द्विपदी विरोधाक आव्हान दिवन सुक्ष्म आनी विध्वंसक पद्दतीन सत्तेक मार्गदर्शन आनी वाटाघाटी करतात.

आब्राहामान हागार आनी इस्मायल हांकां भायर काडचीं असो सारा आग्रो करून तिचो प्रभाव दाखयता (उत्पत्ती 21:10). तेच प्रमाण जाकोबाक इजाकाचो आशिर्वाद मेळचो हाची खात्री करपाची रिबेकाची भुमिका (उत्पत्ती 27) तिचें कृत्य आनी रणनिती विचार दाखयता.

ब्यूवॉयर बायलांच्या कृत्याच्या अशा प्रसंगांक मान्यताय दितना नोंद करता, “दादल्या कडेन तुळा करतना बायल निर्धारित आनी वेगळायल्ली आसता. दादल्याचे तुळेन तिचें म्हत्व कमी जावन तिका गौण स्थान प्राप्त जाल्लें आसा तें दिसता” (Beauvoir 6). मातृसत्ताक ह्यो कथा बायलांच्या आदर्शीकृत भुमिका आनी तांच्या समाजांतल्या तांच्या प्रत्यक्ष प्रभावा मदलो तणाव दाखयतात.

4. ‘द सेकंड सेक्स’ आनी पवित्र पुस्तकांतली पितृसत्ता

सिमॉन द ब्यूवॉयराच्या ‘द सेकंड सेक्स’ ह्या पुस्तकांतल्या विश्लेशणा वरवीं एक दुर्बिणी नदर मेळटा, जाचे वरवीं आमी पॅन्तातेव्कांतल्या पितृसत्ताक संरचनेची विमर्शीक नदरेन तपासणी करूं येता. इतिहासीक नदरेन बायलांक “दुय्यम” स्थान दिलां अशें ब्यूवॉयर म्हणटा. हें स्थान पॅन्तातेव्कांतल्या कथांनी चड करून बळकट जाता. बायलांचो जुलूम कायम दवरपी समाजीक आनी धर्मीक संस्थांचेर ती टिका करता. तातूंतल्या जायत्या संस्थांचीं मुळां पवित्र पुस्तकांत मेळटात.

5. ब्यूवॉयराची “निरंतर स्त्रीलिंग” संकल्पना

ब्यूवॉयराची “निरंतर स्त्रीलिंग” ही संकल्पना- बायलेची तुळा दादल्या करून तिका अधोरेकीत केल्या आनी नेमकी

भूमिका मर्यादीत केल्या. ही अशे तरेची संकल्पना पॅन्तातेव्कांतल्या लिंग रचनां कडेन प्रतिध्वनीत जाता. बायलांक मुखेलपणान बायल, आवय आनी धूव अशें चित्रण केल्ल्यान पवित्र पुस्तकांत पदार्थवादी (essentialist) नदर दिसून येता अशें ब्यूवॉयरान आपलें मत मांडलां.

“बायल जल्मतांच बायल नासता, पूण ती बायल जाता” (Beauvoir 267) ह्या तिच्या उतरांनी ब्यूवॉयर लिंगीक भूमिका समाजीक बांदावळीचेर भर दिता, जें पॅन्तातेव्कांतल्या बायलां खातीर थारायिल्ल्या भूमिका आनी वागणुकींनी प्रतिबिंबीत जाता.

6. बायलेचें मिथक

संस्कृतीक कथांनी स्त्रीत्वाची आदर्शीकृत पूण अधीनस्थ प्रतिमा कशी तयार जाता तें आनी पॅन्तातेव्कांतल्या बायलांचें चित्रण समांतर आसा अशी बायलेच्या मिथकाचेर भासाभास ब्यूवॉयरान केल्या. सद्गुणी बायल, आज्ञाधारक धूव, आत्मत्यागी आवय हे आदर्श पितृसत्ताक मुल्यांक बळगें दितात.

ब्यूवॉयर ह्या मिथकाचेर टिका करून म्हणटा, “संवसाराचें प्रतिनिधित्व, संवसारा भशेनूच, तें दादल्याचें कर्तृत्व; ते आपले नदरेंतल्यान ताचें वर्णन करतात, अशें करतना ते परम सत्या कडेन गोंदळतात” (Beauvoir 143). पॅन्तातेव्कांतल्या बायलांचे चित्रीत पितृसत्ता संदर्भात केल्ली ही ब्यूवॉयराची टिका जुस्ताजुस्त आसा.

7. निश्कर्श

पॅन्तातेव्कांतल्या पितृसत्ताक आनी मातृसत्ताक घटकांक सिमॉन द ब्यूवॉराच्या ‘द सेकंड सेक्स’ ह्या पुस्तकांतल्या विमर्शीक अंतर्दृष्टी वांगडा जोडून ह्या सोदलेखांत पवित्र पुस्तकांतल्या कथांचो लिंगीक संबंदांचेर जावपी परिणामाचेर भर दिला. पॅन्तातेव्क मुखेलपणान पितृसत्ताक संरचनेचें प्रतिबिंबीत करता आनी ताका बळगें दिता, जाल्यार बायलांचें कृत्य आनी मातृसत्ताक प्रभाव हांच्या प्रसंगांतल्यान लिंग गतीविज्ञानाची बारीकसाणीन नदर मेळटा. ब्यूवॉयराच्या वावरांतल्यान ह्यो गुंतागुंत आनी बायलांच्या जुलूमाचीं इतिहासीक मुळां समजून घेवपा खातीर एक मोलादीक चौकट फावो जाता.

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सारांश: शास्त्रीय वा संस्कृत रंगमाची, पारंपरीक वा लोकरंगमाची आनी आधुनीक रंगमाची अश्या तीन तरांनी भारतीय रंगमाची विभागूक येता. भारतीय रंगमाचयेच्या मुळाचो सोद घेतना लोकरंगमाची ही अदीक प्राचीन म्हणपाचें समजता. भारतीय रंगमाचयेची बुन्याद आशिल्ली ही लोकरंगमाची संक्रमण अवस्थेंतल्यान गेल्ल्यान आयज जेन्ना लोकरंगमाचयेच्या विकासाच्या अवस्थेविशीं विचार जाता तेन्ना ह्या लोकरंगमाचयेर सादर जावपी नाट्यांच्या प्रयोगात्मक स्वरूपा वांगडा ताच्या सादरीकरणाचो उद्देश लेगीत विचारांत घेवचो पडटा. प्रस्तूत बरपांत लोकरंगमाचयेचें मूळ स्वरूप स्पश्ट करपा वांगडाच काळांतरान वेगवेगळ्या कारणांत लागून धर्मीक विधीचो भाग म्हण लोकजिणेत प्रचलीत आशिल्ल्या नाट्याचें स्वरूप बदल गेलें आनी विधी – विधीनाट्य – नाट्यात्मविधी – लोकनाट्य हे तरेन ताची उदरगत जायत गेली. ह्या संदर्भांत गोंयच्याय लोकरंगमाचयेर प्रचलीत आशिल्ल्या नाट्यांचोय विचार हांगां जाल्लो आसा.

सारभूत उतरां: रंगमाची, लोकरंगमाची, विधीनाट्य, लोकनाट्य

विशयाची वळख:

लोककला लोकजिणेचो आविश्कार आसता. लोककथा, लोकगीत, लोकसंगीत, नाच, चित्र, नाट्य, शिल्प, आदी सारक्या कलांचो तातूंत आसपाव आसता. हीं सगलीं लोकसमुहाचे अभिव्यक्तीचीं साधनां. लोकसमुहाच्या आविश्कारातल्यान निर्माण जाल्लीं आनी लोकअभिव्यक्तीचें प्रभावी माध्यम आशिल्ल्या हेर कलां मदली एक कला म्हणल्यार नाट्य. नाच हें नाट्य कलेचें मूळ. आदीम अवस्थेंतल्या मनशाच्या अभिव्यक्तीचें तें मुळावें साधन. मनशाच्या आदीम अवस्थेचो विचार करीत सुरवेक सैमशक्तीक ताणें देवत्वाचो दर्जो दिलो आनी त्या उपरांत आपणें देवत्व फावो करून दिल्ल्या गजालींक मुर्त रूप दिलें. तांचेवयल्या विस्वास, श्रध्देतल्यान समज, धारणा, आचार, प्रथा, विधी, रिती, परंपरा तयार जाल्यो. आपणें देवत्वाचो दर्जो दिल्ल्या गजालीची स्तूती केल्यार तीं प्रसन्न जाता हे धारणेतल्यान नाच, गायन, संगीतातल्यान तांची स्तूती करपाचो ताणें यत्न केलो आनी काळांतरान तातूंत अभिनयाची भर पडून नाट्यात्म विधी निर्माण जावन तांचे सादरीकरणाचे परंपरेक लागून लोकरंगमाचयेचो जल्म जालो. आधुनीक भारतीय रंगमाचयेक ह्याच लोकरंगमाचयेकडल्यान प्रेरणा मेळल्या. प्रस्तूत अभ्यासात भारतीय आदीम लोकरंगमाचयेन काळांतरान आपलें रूप कशें बदल्लें हाचें विवेचन करपाचो यत्न केला.

नाट्यकलेचो उगम:

भारतीय रंगमाची ही खूब पोरणी आनी आदीम. लोकरंगमाची हें तिचें मूळ. हांगां 'लोक' म्हणल्यार सर्वसामान्य लोक

वा परंपरागत जीण जगपी मनीस कुळाचो पंगड आनी “त्या लोकांच्या जिवितांत जें परंपरेन नाट्यरूप चलत आयिल्लें आसता, जे रंगमंचीय नाट्यप्रकार लोकांनी, लोकां खातीर आनी लोकआश्रयान सांबाळून दवरिल्ले आसात ताचो आसपाव ‘लोकरंगमाची’ ह्या संज्ञेत जाता”(भवाळकर 8).

लोकरंगमाचयेचें दायज आशिल्ली ही भारतीय रंगमाची इतली पोरणी की “सिंधू सभ्यातायेत लेगीत तरेकवार नाट्यप्रकार प्रचलीत आशिल्ल्याचे पुरावे मेळल्यात. तातूंत लौकीक अर्थाचीं, कळसुत्री, कठपुतळी बावल्यांची नाटकां आशिल्लीं” (फळदेसाय 158). भारतांत नाट्य कलेची वळख घडोवपी पयलो आनी म्हत्वाचो ‘नाट्यशास्त्र’ हो ग्रंथ भरतमुनीन क्रिस्तपूर्व 400 ते 100 च्या अदमासाक बरयलो. ह्या ग्रंथात मांडिल्ल्या नाट्यसिध्दांताच्या, नाट्य तत्वांच्या आदारान मुखार भारतांत नाटकां तयार जालीं पूण ताच्याय आदीं भारतात पारंपारीक लोकनाट्यांची शेंकड्यांनी वर्सांची नाट्य परंपरा आशिल्ली. त्या लोकरंगमाचयेचें स्वरूप कशें आशिल्लें हें सांगप आयज कठीण पूण “आयज लेगीत भारतांतल्या साबार आदिवासी जमातीं मदीं रूढ आशिल्ल्या लोकनृत्यां आनी लोकनाट्यां मेळटात तांच्या आदारान ह्या बाबतींतली कल्पना करूं येता”(शिंदे 146). हाचोच अर्थ लोकरंगमाचयेच्या आदीम आनी पोरण्या अश्या ह्या दायजातल्यान भारतीय रंगमाचयेक आपलें रूप फावो जालां.

भारतीय नाट्य कलेच्या प्रवासाचो सोद घेतना नाट्य कलेच्या प्राथमीक पांवड्यावेल्या अवस्थेचो विचार करप गरजेचें. आदीम काळांत अभिनयाचें प्रकटीकरण नृत्यातल्यान जातालें. भारतीय भासांतलें ‘नाटक’, ‘नाट्य’ आनी ‘नट’ हे शब्द लेगीत संस्कृत ‘नृत्’ म्हणल्यार ‘नाचपी’ ह्या धातू सावन तयार जाल्यात. ह्या बाबतींत भारतीय नाट्य कलेच्या मुळाचो विचार केल्यार भारतीय नाट्य कलेचें मूळ नाचातच आशिल्ल्याचें स्पश्ट जाता.

लोकरंगमाचयेचें दायज आशिल्ल्या आदीम अश्या ह्या “नाट्यकलेचो उगम धर्मीकतेतल्यान जाला” (शिंदे 146) अशें मत चडश्या अभ्यासकांनी मांडिल्लें आसां. पाश्च्यात्य रंगमाचयेचो लेगीत हाका आडवाद ना. “भारतांत ऋग्वेद काळांत लेगीत नाट्यसंवादाचे खेळ एक सुफलीकरण विधी म्हण करताले” (फळदेसाय 158). आदीम काळांतलो मनीस रानवट जिवीत जगतालो. ताचें पुराय जिवीत सैमाचे आदारून आशिल्लें. सैमांत जावपी तरेकवार बदल, ताणें घेतिल्लें आक्रमक रूप मनशान पळयलें तेन्ना हें सगलें कशें घडटा हें ताका खबर नाशिल्ल्यान ताका हें अजापूच दिसलें आसूंक जाय. ह्यो सगल्यो गजाली घडपा फाटलें कारणूय सोदपाचो यत्न ताणें निश्चीतूच केलो पूण ताची जाप ताका मेळूंक ना तेन्ना ह्यो शक्ती अद्भूत, अलौकीक, अमानवी आसात अशें ताका कळ्ळें. “मनशाक दिलासो दिवपी ती एक भावनीक शक्त आशिल्ली” (भवाळकर). अश्या ह्या अद्भूत, अलौकीक, अमानवी शक्तींक अभ्यासकांनी ‘यातुशक्ती’ म्हणील्लें आसां. हो शक्ती कांय बऱ्यो जाल्यार कांय विध्वंसक आशिल्ल्यान तांचेर ताणें श्रध्दा दवरली. ही यातुश्रध्दा आशिल्ली. बऱ्या शक्तीनी आपल्याचेर प्रसन्न जावंचें, तांणी आपली राखण करची आनी वायट शक्तींचो बादिकार आपल्याक जावंचो न्हय, तिच्या वायट शक्ते सावन राखण मेळची म्हण तंत्र – मंत्र सारक्यो विद्या उपकाराक हाडल्यो. ही ‘यातुविद्या’ आशिल्ली. “ह्या यातुविद्येचो आदार घेवन ज्यो विधी उपकाराक हाडल्यो तांकां ‘यातुविधी’ म्हणटात. आदीम मनशान यातुशक्ती म्हण मानिल्ल्यो ह्यो शक्ती खरें म्हणल्यार सैमशक्ती आशिल्ल्यो” (शिंदे 147). मनीस कुळयेच्या विकासांत मनशाक सैमातल्या पंचमहाभुतांच्या शक्तीची कल्पना आयली तेन्ना सैमाक नियंत्रीत करपी ही शक्ती यातुशक्ती न्हय पूण सैमशक्ती आसा हें कळ्ळें तशें ल्हव ल्हव यातुशक्ती वचून इश्वरशक्तेची जाणीव जावन तातुंतल्यान देवदैवतांची, मुर्तीची उपासना करपाची कल्पना जल्माक येवन यातुश्रध्देची सुवात धर्मश्रध्देन घेतली (भवाळकर 10). ह्या वांगडाच मरून गेल्ले पुर्वजांची प्रतिकात्मक रुपान पुजा आदिमांनी केली आनी ताचेंच रुपांतर मुखार ग्रामदैवतांत, कुलदैवतांत

जालें. ग्रामदैवतांची भौशीक पांवड्याचेर जाल्यार कुलदैवतांची कुटुंबीक पांवड्यार पुजा -प्रार्थनेचो भाग म्हण विधी जावंक लागल्यो आनी तांकां धर्मीक म्हत्व फावो जालें. तांकां पाळो दिवप होच त्या लोकांचो 'लोकधर्म' आसता. हातुंतल्यान जीण जगपाची सैमीक रीत तयार जाता तिका 'लोकसंस्कृती' अशें म्हणटात. लोकरंगभुमी ही हे लोकसंस्कृतीचोच आविश्कार. हो आविश्कार लोकसंस्कृतीन कसो केलो? खंयच्या अवस्थांतल्यान वचून लोकरंगभुयेची उदरगत जाली हाचो मुखार विचार जातलो.

भारतीय लोकरंगमाचयेच्या उदरगतीचे पांवडे:

“आचार हें धर्माचें मूळ. विधी हें ह्या आचारांचें मुखेल आंग. एखादें देवकार्य करप ही विधीची भुमिका आसता” (भागवत 50). दुर्गा भागवत हांच्या ह्या वयल्या मताचो विचार केलो तर लोकजिणेंत विधीक आशिल्लें अन्यसादारण म्हत्व समजता. लोकमनांत दैवतांविशीं उपाट श्रध्दा आसता. ह्या श्रध्देच्या उपासनेचो भाग म्हण ह्यो विधी करतात आनी परंपरेतल्यान एके पिळगे कडल्यान दुसरे पिळगे मेरेन त्यो पावतात.

“देवदैवतांच्या ह्यो उपासनाविधी एका थारायिल्ल्या तिथीक करपाची रीत आसता. गांवाच्या देवदैवतांक प्रसन्न करून घेवचें, तांचें रागणें गांवाचेर पडचें न्हय ह्या उद्देशान लोकसमुहातलो लोक विधाचो भाग कश्यो पुजा, जात्रा, उत्सव मनयतात, जाल्यार कुटुंबीक पांवड्यार कुलाचार म्हण घरांत शुभकार्या वेळार विधी करतात. थळाव्या दैवतांच्या सामर्थ्याच्या, चरित्राच्या व्हडविकायेची स्तूती गद्य – पद्य निवेदनातल्यान करतात. गीत, संगीत, नाचा वांगडाच अभिनयाच्या स्वरुपांत दैवतकथा, पुराणकथा हांचेर आदारिल्ले प्रसंग सादर जातात” (शिंदे 150). संगीत, नाच, गायन, अभिनय हांची साथ ह्या सादरीकरणाक फावो जाल्ल्यान तांचें सादरीकरण करपी उपासका सांगाता आयकुवपी भक्तांचोय तातूंत सहभाग आसता. देवदैवतांच्या उपासनेच्यो ह्यो विधी धर्मीक सेवेच्या उद्देशान करतात. विधी रुपान केल्ल्या ह्या सादरीकरणांत कांय प्रमाणांत नाट्यत्मकता आसता तरी ह्या विधीक मात नाट्य म्हणपाक येना.

विधीनाट्य:

देवदैवतांच्या सामर्थ्याच्या, चरित्राच्या व्हडविकायेची स्तूती करताना तें सादर करपी उपासक तातूंत सारके गुल्ल जावन वतात. आपल्या सादरीकरणातल्यान ते त्या दैवतांचें फकत सवंग रंगयना पूण तांचें रूप, अवतार घेतात. गीत, संगीत, नृत्य आनी आपल्या कुडिच्या हालचालीतल्यान आपल्या मुखार बशिल्ल्या प्रेक्षकांक ते भक्तींत गुल्ल करतात. हे उपासक देवदैवतांची आख्याना सांगतात, आख्यानातल्यो घटना, प्रसंग सादर करतात. तांच्या त्या सादरीकरणातल्यान नाट्यविश्कार जाता. तांच्या त्या सादरीकरणातल्यान “विध्यात्मकता आनी नाट्यात्मकता ह्या दोनूय गजाली एकाच वेळार थंय व्यक्त जातात. म्हणल्यार विधी म्हण उपासकांनी सादर केल्ल्या त्या गजालींनी विधी वांगडा नाट्यूय भरसता. अशे तरेन विधीक नाट्याचें रूप आयिल्ल्यान त्या सादरीकरणाक ‘विधीनाट्य’ म्हणप जाता” (शिंदे 150).

धर्मीक श्रध्देचो भाग म्हण लोकजिणेंत लोकदैवतांच्या उत्सवांच्या निमतान विधीचो भाग म्हण परंपरेन हीं विधीनाट्यां

सादर करतात. हेर विधीं वांगडा देवदैवतांच्या उपासनेचो भाग म्हण हीं विधीनाट्यां करपाची रीत आसता. तांचें सादरीकरण करुंक ना तर गांवच्या दैवताचें रागणें पडटलें ही भिरांत लोकमनांत आसता. जे उपासक ह्या नाट्यप्रयोगांत वांटेकार जातात तेवूय हें नाट्यांचें सादरीकरण म्हणल्यार एक उपासनाविधी मानून ज्या निमतान व्रत, उपास पाळटात. तातूंत वांटो घेवपी कलाकार थारायिल्ल्या जातीतलें, जामातीतले आसतात. ती सादर करपाचो मान फकत त्या जाती – जमातीतल्या घराण्यां कडेन आसता. ह्या विधीनाट्यांचें सादरीकरण करप हें आपलें धर्मीक कर्तव्य, सेवा मानून तातूंत वांटेकार जातात.

लोकनाट्यः

विधीनाट्यात नाट्य रूपान विधी सादर करतात. म्हत्वाचें म्हणल्यार विधी, भक्ती आनी नाट्य ह्यो तिनूय गजालींचो आसपाव विधीनाट्यांत आसता. यातुश्रध्देतल्या यातुनाट्याची सुवात हांगां विधीनाट्य घेता. “विधीनाट्य ही लोकनाट्याची पुर्वअवस्था. लोकनाट्यांची सगलीं लक्षणां, घटक विधीनाट्यांत आसतात” (भवाळकर 48).

काळ, थळ आनी परिस्थिती प्रमाण समाजजिणेंत बदल घडटात. विज्ञानाच्या मळावेली प्रगती, तर्कनिश्ठा, आदींक लागून विधी, रिती, परंपरा, समज, धारणा हांचें म्हत्व, देवदैवतांवेली श्रध्दा कांय प्रमाणांत उणीं जाता. तरीय विज्ञानाच्या आदारान मनीस जिणेकडेन संबंदीत सगल्या प्रस्नांच्यो जापो मेळप शक्य आसना. अशे परिस्थितींत लोकमनांतली श्रध्दा, धारणा, विस्वास, समज, आदी तिगून उरता. हाका लागून यातुश्रध्देतल्यान, धर्मश्रध्देतल्यान, विधी- परंपरेतल्यान निर्माण जावपी नाट्यरुपांय तिगून उरतात. काळांतरान “विधीनाट्यांतले विधीचो भाग शेणलो तरीय तांतुतली नाट्यत्मकता लोकांक जाय कशी दिसता. तांकां तातुंतल्यान मेळपी कलेचो आनंद शेणून वचना. तातुंतल्यान तांचें मनोरंजन जाता, नैतीक शिकवण मेळटा, प्रबोधन जाता. हें सगलें काळाभायलें जायना तो मेरेन हीं नाट्यरुपां तिगून उरतात” (शिंदे 151). म्हत्वाचें म्हणल्यार विधीनाट्यांतलें नाट्य उणें जायना पूण त्या नाट्यविशकारांत विधी, श्रध्देक गौण स्वरूप फावो जावन विधीनाट्याक ‘लोकनाट्याचें’ स्वरूप फावो जाता.

जायते फावट विधीनाट्य सादर करपी उपासकांक आपणें सादर केल्लें लोकांक आवडटा अशें दिसता आनी तांकां तें अदीक आवडल्यार अदीक प्रतिसाद मेळटलो हाची जाणीव तांकां जाता. तेन्नाय विधीनाट्यातली नाट्यात्मकता, तातुंतली रंजकता वाडटा पूण भक्ती, श्रध्दा उणीं जाता आनी विधीनाट्याक लोकनाट्याचें स्वरूप फावो जावंक लागता.

वयर उल्लेख जाल्ल्या वेगवेगळ्या कारणांक लागून “विधीनाट्य पुरायपणान विधिमुक्त जाता आनी विधीनाट्याक लोकनाट्याचें स्वरूप फावो जाता. अश्या विधिमुक्त नाट्यरुपाक ‘लोकनाट्या’ अशें म्हणटात” (शिंदे 152) पूण पुरायपणान विधिमुक्त मात साप्प उणीं लोकनाट्यां जातात. तर वयल्या विवेचनातल्यान विधी – विधीनाट्य – नाट्यविधी – लोकनाट्य हे लोकरंगभुंयेच्या उदरगतीचे पांवडे आसतात हें स्पश्ट जाता. हांकां ‘प्रयोगरुप लोककला’ (performing folk art) अशेंय म्हणटात.

सरसकटपणान प्रयोगरुप लोककलांत लोकनाट्या वांगडा विधीनाट्याक लेगीत ‘लोकनाट्य’ म्हणटात. ह्या प्रयोगरुप लोककलांत विधीनाट्यां वांगडा विधीमुक्त लोकनाट्यांचोय आसपाव करतात पूण ह्या दोनूय नाट्यां भितरली पात्रांची येवजण, प्रसंगाची माळ, गायना सयत दर एका पात्राचे नृत्य गितमय संवाद हे विधीनाट्याचे मुळावे घटक. हातुंतल्यान

दोनूय नाट्याचे प्रकार वेगळे म्हणपाचें कळटात. हांगां एक म्हत्वाची गजाल ह्या दोनूय नाट्यांक वेगळायता ती म्हणल्यार विधीनाट्य धर्मीक सेवेतल्यान जाल्यार लोकनाट्या हीं विधीमुक्त आसतात आनी कांय जायते फावट तीं मनोरंजनाच्या उद्देशानूच सादर करतात.

वयर विधीनाट्य आनी लोकनाट्य ह्या दोनूय नाट्यांच्या केल्ल्या विवेचनातल्यान गोंयच्या वेगवेगळ्या लोकसमुहांनी प्रचलीत आशिल्ल्या नाट्यांचो विचार करून तीं विधीनाट्य कांय लोकनाट्यां हें समजून घेवंक येता. गोंयांत गांवच्या जात्रा, उत्सवां निमतान जागोर करपाची परंपरा आसा. हो जागोर ह्या प्रदेशांतल्या वेगवेगळ्या जातीं मदीं आनी भुगोलीक वाठारा प्रमाण थोड्या भोव फरकान सादर जाता. हातुंतलो पेरणी जमातीन वर्सावळीचो विधी म्हण सादर केल्ल्या जागराक विधीनाट्य म्हणपाक येता जाल्यार गावडा जागोर, क्रिस्तांव गावडा जागोर, शिवोलेचो हिंदू – क्रिस्तांव समाजान एकठांय येवन केल्लो शिवोलेचो जागर हीं पारंपारीक लोकनाट्यां कशीं सादर जातात. गांवच्या देवळाच्या वर्सुकी उत्सवां निमतान जावपी कालो पारंपारीक नाट्य म्हण सादर जाता. गोंयच्या सत्तरी वाठारांतल्या कांय गांवांनी आयजूय सादर जावपी रणमालें थंयचो कुळवाडी समाज “शेतां हाणूक वच्चे आदी दैवतांचो आशिर्वाद मागपाक , वंशावळ वाडची म्हण लग्नाच्या माटवांत आनी अन्न देवता प्रसन्न जावची म्हण ‘रणमालें’ हे विधानाट्य खेळयतात” (गांवकार 53-54). ह्याच सत्तरी वाठारांतल्याच कुळवाडी समाजात शिगम्या उत्सवाच्या सातव्या दिसा ‘भरणूल’ हें विधीनाट्य सादर करतात जाल्यार साश्ट वाठारांतलो क्रिस्तांव गावडा, कुणबी समाज कार्नीवालाच्या उत्सवा निमतान ‘खेळ’ वा ‘फेळ’ वा ‘जमनीवेलो खेळ’ हें पारंपारीक लोकनाट्य सादर करता.

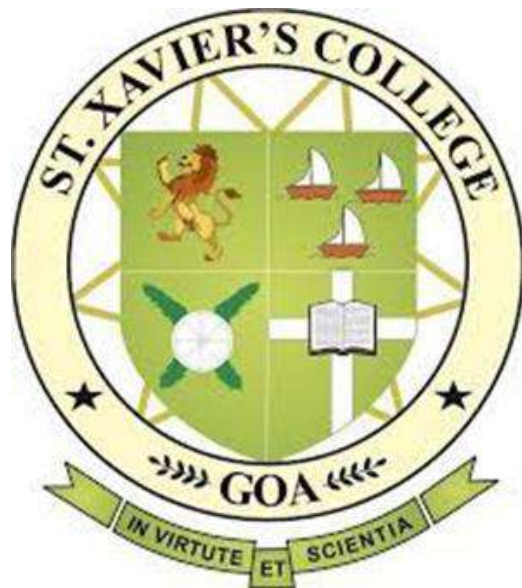
निश्कर्श:

भारतीय लोकरंगमाची ही खूब आदीम आनी पोरणी. ह्या संदर्भांत आदीवासी समाजांत आयज लेगीत सादर जावपी लोकनृत्यां आनी लोकनाट्यांच्या बाबतींतली कल्पना करूं येता. भारतीय लोकरंगभुयेचो उगम धर्मीकतेतल्यान जाला. लोकजिणेंत यातुश्रद्धेंत यातुविधीक मानतात. नाट्यरूपातलें सादरीकरण यातुविधी म्हण जाता. काळांतरान यातुश्रद्धेची सुवात धर्मश्रद्धेन घेतली आनी धर्मीक विधीचो भाग कशीं विधीनाट्यां सादर जावंक लागली. आधुनीक काळांत श्रद्धा, विधी हांचें म्हत्व उणें जावन विधीनाट्यांतले श्रद्धेचो, विधीचो भाग कांय प्रमाणात गळून पडून विधीनाट्याक लोकनाट्याचें स्वरूप फावो जालें. यातुनाट्य, विधीनाट्य, नाट्यविधी आनी लोकनाट्य ह्या अवस्थेतल्यान भारतीय लोकरंगभुमी वचून आयचे आधुनीक रंगमाचयेच्या विकासाक तिणें प्रेरणा दिल्या.

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