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Recycling Proposal for Removed Water Hyacinths into Eco Ganesha Idols and Economic Utilization of These Natural Resources at the Powai Lake, India

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Abstract: - **Eichhornia crassipes, Water Hyacinths is among the world's most noxious invasive weeds.**
Climatic and water conditions are the main determinant factors for the growth and expansion of water hyacinth. The weed has substantial negative impacts on the Powai lake (Mumbai India) hydrology, socioeconomics, and aquatic ecosystem causing it to shrink.
The lessons for management of Powai Lake water hyacinth are employing preventive and integrated management approaches. Reducing pollutant loads and nutrient enrichment through integrated watershed management is suggested to reduce the Powai Lake eutrophication.
The hyacinth has come to cover over half the 688-hectare, and along with the highly polluted silt settled on the lakebed is fast killing organisms.
Awareness about the water pollution caused by the immersion of Ganesh idols made out of Plaster of Paris, in natural water bodies such as lakes, rivers and the sea is growing and both municipalities and communities are changing their mindset towards biodegradable idols. There are extensive records and examples of clay, bamboo and straw being used in ancient Indian idols made out of naturally occurring clay (shaadu in Marathi) which dissolve within hours of immersion in water, whereas pop idols may take anywhere between several months to fully dissolve. In addition, when chemical paints are used to decorate the idols, these paints contain heavy metals such as mercury and lead, which seep into the water as the idol dissolves.
AIM
This paper will review the-
Issues, sustainable development of Lake Agro waste focusing on Environment, Economy.
-Use of recycling Water Hyacinths into Eco friendly Ganesha idols, Bio bricks and sustainable products/ fabric giving this agro waste economic value instead of being burnt in landfills emitting dangerous gases, after being transported usurping fuel and manpower.
- Collection and recycling of the water hyacinths to prevent shrinking of the Powai Lake.
- Saving the rich Biodiversity of Powai Lake and its fauna and flora.
- Pollution/ climate change mitigation by stakeholders
- Role of Community in the circular economy of water hyacinths (agro/ aquatic waste)
Conclusion
Every few years the government spends crores of rupees on cleaning the water body of water hyacinths only to leave it wasted at overloaded landfills. The Water Hyacinths at the Powai lake can be treated as aquatic Waste and be of economic value via eco-friendly bi-products, providing jobs in a post COVID-19 scenario and involving climate change mitigation outlining sustainable development of our water bodies.

I. INTRODUCTION

Water hyacinths at Powai Lake Mumbai have been choking the water body, causing serious ecological and economic problems. Removing these invasive species has proved futile since they come back almost immediately. It grows back within almost seven days due to pollution in the lake water. Researchers are trying to find economic uses so that these plants become a sustainable resource for income generation while promoting it's cleaning. Recycling Proposal for removed Water Hyacythns and economic utilization of these natural resources at Powai lake Mumbai India will promote sustainable development of waste recycling and circular economy. This paper proposes that harvesting these dried aquatic weed from hyacinth and converting them into bi product materials like eco Ganesha idols, bio bricks, mats, hand-bags, furniture items and textile decorations from its pulp in combination with other ingredients like clay, silt, straw and bamboo.

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Figure 1: Water Hyacythns
(Source: [2])

II. BACKGROUND OF THE STUDY

Water Hyacinth scientifically known as Eichhornia crassipes is found to exist in water bodies of tropical regions, especially in urban lakes. In this study a discussion would be held regarding the impact of Water hyacinth on Powai Lake situated in Mumbai. It is evident that this perennial marine species of plant creates certain menace in water management activities in the metropolitan area of Mumbai. This species is also identified to grow at a rapid pace inland water body. Moreover, existing sewage wastes also hasten this process and create vulnerable conditions for maintaining a normal aquatic life in the associated marine system [1]. Civic officers associated with the Brihanmumbai Municipal Corporation (BMC) found that 2.23 hectare of the Powai Lake is covered by this aquatic weed [2]. This thick layer intern results in sheathing the upper layer of the lake. As a result sun rays along with oxygen cannot enter to the deeper layer of this lake.

Due to lack of oxygen, normal biological life aquatic animals such as crocodiles and others in the Powai lake is being disrupted significantly. Therefore, the civic body associated with the hydraulic department adopts suitable strategies to overcome such challenges in a significant manner. They found that de-slitting of Powai Lake is not possible as it can harm the normal nutritional value of the lake along with causing disturbance to the aquatic animals. However, spreading of this invasive weed is occurring at a faster rate on the lake surface that 50% of the lake is occupied by Water Hyacinth [3]. Methods such as physical removal, chemical and biological control are not only harmful to the fish but lethal for crocodile habitats in the lake.

Figure 2: Spread of water hyacinths in Powai Lake
(Source: [3])

The economic utilization of these bio resources of aquatic weeds by economically feasible techniques like the concept of eradication through utilization is proposed here. The leaves, stems of the water hyacinths can be made into pulp and recycled into bi products. Techniques can be adopted by Municipality trying to clean the lake body and adopt cleaning on a larger scale involving local stakeholders, where there will be incentives, employment, products and economic benefits. It is also found to have high nitrogen content and in combination with cow dung it can be used for biogas production. Its enormous biomass production rate, its high tolerance to pollution, and its heavy metal and nutrient absorption capacities qualify it for use in wastewater treatment ponds.

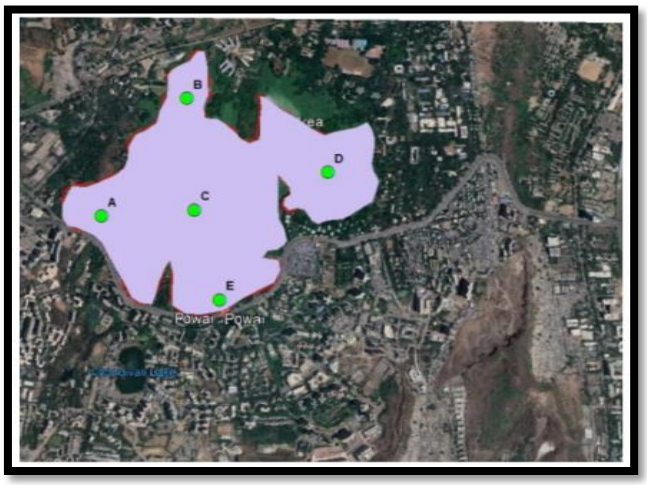

Figure 3: Map of Powai Lake
(Source: [4])

The pulp from water hyacinths can be added with clay/silt and converted into Eco Ganesha idols, bio bricks which have a significant range of usage in good sustainable purposes, it would contribute to an effective utilization of this aquatic weed along with maintaining an eco-friendly infrastructure in the city post testing the tenacity and strength of these idols and bio bricks. Bio bricks made with the water hyacinths of Powai Lake can be used for garden walls and hedging purposes before higher research and technology is applied by the government to recycle water hyacinths as bio bricks for housing or other sustainable building materials.

Research aims and objectives

Main aim of this research is to evaluate different factors associated with recycling of Water Hyacinths to develop Eco Ganesha idols, bio bricks, and bi products and prevent shrinkage of Powai Lake from the encroaching water hyacinths in Mumbai in an effective way.

Objectives:

- To recognize the dependency of countries on their exports of natural resources.
- To compare the analysis of two stock prices in the last five years.
- To evaluate the effects of the COVID19 pandemic on the real estate market of Pune city.

Hypothesis

H1 (Alternative hypothesis): Due to the pandemic situation the stock prices of SBI and Kotak Mahindra Bank Ltd have been reduced.

H0 (Null Hypothesis): The pandemic situation did not affect the stock prices of SBI and Kotak Mahindra bank Ltd.

III. LITERATURE REVIEW

In the contemporary era increasing rate of environmental pollution is a major concern for business units to adopt adequate strategies for incorporating renewable sources of energy. In accordance with [4], are significant to ensure a reducing rate of environmental pollution. Biomass is considered as effective sources of renewable energy that ensure accumulation of alternative energy. According to the perspective of [5], water hyacinths are an effective source of alternative energy that can be accumulated by means of catalytic pyrolysis. Cement is used as a catalyst to produce bio-bricks from Water hyacinths. It is an invasive weed found in aquatic environments that also leads to endanger movement of aquatic animals and boats. It is evident that Water hyacinth is available in fresh water bodies and utilized as biomass and brick powder. On the other hand, as argued by [6], Water Hyacinths are considered as animal manure. Hence, it is used as biogas digesters in developing countries.

This material is also utilized as an optional feedstock to ensure smooth shipping activities in several water bodies. In the views of [7], bio bricks with density 1920 kg/m3 can be generated from water hyacinths. This specimen is also considered having a comparable strength that results in developing bio bricks. It is also evident that this aquatic plant is found in different species. Water hyacinths Agrostone is a superior species of bagasse and grass that leads to build concrete bricks of the same thickness. Amid the increasing rate of pollution, it is significant to utilize recyclable bricks for maintaining an ecological balance in the contemporary society. It is also identified that this species is vulnerable in terms of environmental issues. Hence, development of biodegradable bricks is significant to protect this species from threatening issues.

Apart from that there are several implications of Water Hyacinths for ensuring stable environmental parameters in the society. As mentioned by [8], these species are found in tropical areas along with being used to make organic fertilizers. However, it is dependent on the nutritional aspects of a plant along with its capacity to develop biodegradable products. These species are also found to absorb several polluting agents such as lead, mercury and other harmful pollutants. Moreover, it also results in absorption of carcinogenic materials that exist in heavy concentrations in the environment. Therefore, bricks made from these biodegradable elements lead to protect any building from environmental impacts such as leaching towards underground. Hence, it also ensures protection from short circuiting due to utilization of such bricks made up from biomass products.

It leads to an increase in the rate of microbial pollution as increasing utilization of these products result in protecting such species from menace. As mentioned by [9], water hyacinths are taken under surveillance for ensuring a superior utilization of this species in aquatic environments. Therefore, it leads to a decreasing amount of environmental degradation by increasing the rate of utilization to produce biodegradable bricks.

Theoretical underpinning

Triple Bottom Line Theory

It refers to three major concerns of a business unit that are involved with people, profit and planet. In accordance with [10], it is essential for modern business units to utilise renewable sources of energy for ensuring a sustainable economic development. Transformation of Water hyacinths into bio bricks ensures an appropriate utilization of these invasive weeds into eco-friendly materials. Hence, it contributes to decrease the level of environmental degradation by both the means of accumulation of such

perennial plants from the water body and development of other biodegradable products from it. Apart from that, the enterprise involved in this regard can also perform sustainable economic practices and earn a desired level of profitable income through selling of such bio bricks in the market.

Suitable strategic implementation is also needed in this regard for attaining a sustainable economic development. On the contrary, as argued by [11], adequate technological advancement is required to transform a harmful element for particular useful purposes. In the case of transformation of the discussing plant into specific environment friendly material certain technological parameters are necessary such as chemical treatment, compactification, semi-decomposition and others. Hence, a suitable financial investment for technological enhancement is needed in this regard for developing bio products from such weeds in modern society.

Literature gap

It is found that previous researchers focused on studying different sources of renewable energy more than this invasive weed. However, other sources are potential to produce eco-friendly products that reduce menace to global climate. From that perspective utilization of water hyacinths also contributes to produce eco-friendly materials along with protecting the water body from unnecessary clogging. Therefore, this aspect is also needed to be discussed in a significant manner for exploring such issues in context to recent environmental concerns.

IV. METHODOLOGY

Research paradigm

This research has been conducted based on a positivism philosophy, as it helps to collect suitable information from a wide range of observations regarding the research objectives. This philosophy is significant for a researcher to gather factual data from several relevant contents [12]. Additionally, a descriptive design along with an inductive approach is adopted to conduct a systematic analysis of the situation regarding transformation of water hyacinths into bio bricks. As mentioned by [13], descriptive design is significant for conducting a systematic qualitative data analysis by investigating associated research variables. Inclusion of inductive approach results in evaluating specific sets of observations collected from secondary sources to meet research objectives in a significant manner [14]. By adopting the above mentioned research methods an authentic set of data have been collected by the researcher to address major issues related to the research topic.

Method of data collection

A secondary research method is adopted in this study for collecting information from relevant scholarly articles, peer reviewed journals, newspaper articles and suitable websites available on the online platform. Based on that collected set of data and information a suitable thematic analysis is performed in this study. As stated by [15], secondary methods of data collection are significant as it can be conducted in a cost-effective and time efficient way. Moreover, amid the pandemic situation it is viable to adopt this data collection technique for gathering relevant information from published resources on the digital platform.

Ethical considerations in this regard have been maintained by texting all the author's names along with including all the articles in the reference list. Selection of recent articles and journals containing key issues related to the research topic also ensures reliability assets of the entire research activity. Supplementary Field survey which is defined as collection and gathering of information at the local level by conducting primary surveys at the Powai Lake was also conducted over the years.

V. FINDINGS AND DATA ANALYSIS

Thematic analysis

Resource utilization of Water hyacinths -

Modern world faces difficulties in respect of scarcity of conventional energy resources across the globe. In this regard, transformation of several natural resources into appropriate useful components is necessary to develop eco-friendly items. Water hyacinths are significant in this regard as it serves as effective sources of raw materials to develop biodegradable products. As mentioned by [16], the concept of transforming waste into a treasure is useful to utilize biochemical features of water hyacinths. As this plant can absorb solar energy at a rapid rate it can be used to extract renewable energy from this weed effectively. It is useful to produce high energy yielding bio bricks through the process of carbonization and semi decomposition. It is observed that water hyacinth is useful to price several eco-friendly components such as biogas, aerobic compost and components for suitable engineering applications [17]. It also contributes to developing biofuel briquettes. Therefore, suitable industrial applications are associated with water hyacinth in the modern period.

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Figure 4: Water hyacinths
(Source: [15])

Potential strategies to overcome challenges regarding transformation of Water hyacinths into bio bricks

Challenges in this regard include an appropriate understanding of ecological characteristics of this plant. Along with that analysis of growth parameters of its biomass is required to estimate the time to harvest an appropriate quantity of water hyacinth to develop a large scale of production of bio bricks. According to [18], inadequate strategic implementation regarding engineering application of this plant can impart adverse impact such as blockage in water bodies, disruption in irrigation and water supply system. Apart from that, delay in harvesting of this plant can also result in decomposition of its parts in the water body. It also leads to an increasing rate of eutrophication of the lake water.

Therefore, suitable strategies such as mechanical harvesting and manual salvage are implemented for harvesting water hyacinths in a time effective manner [19]. Manual salvage is associated with labours and mechanical harvesting includes a highly efficient machine driven technique to ensure clearing of a large water body within a short period. In addition to that an effective method of drying and dehydration of plants is significant to reduce the moisture content from water hyacinths prior to introducing it for developing bio bricks. Mechanical dehydration process is significant in the case of Powai Lake as a huge amount of water hyacinths are collected from there.

Environment management tools to ensure an effective utilization of Water hyacinth as economic resource of renewable energy

Water hyacinths are found to be grown in warm water bodies having a neutral pH level. As stated by [20], at a temperature range above 400 C and below 100 C further growths of water hyacinths can be inhibited in a significant manner. Apart from that a low range of moisture content in air also prohibits normal growth of this plant in the aquatic environment. These ecological parameters are required to be understood by associated personnel to prevent further growth of this weed in the Powai Lake. Seven species of this plant is found globally that consists of pendant roots that are long, rhizomes, stolones, leaves and clusters of fruits. Thus, appropriate knowledge in this regard is essential for making Eco Ganesha idols, fibers, baskets and bio bricks from this plant.

It is evident that Powai Lake in Mumbai is not supplying water to the municipal area or supporting irrigation purposes. As stated by [21], an effective aquaculture management is required for preventing damage to the water quality of Powai Lake. Increasing rate of water hyacinths in this damages the desired quality of its water along with creating disturbances for maintaining normal aquatic ecosystems. Therefore suitable management strategies are required to be taken by the municipal authority for tackling such situations in a scientific way.

VI. DISCUSSION

It is found that an appropriate technique of harvesting and drying is required to conduct the development of Eco Ganesha idols, Fibers, bags, bio bricks from water hyacinths at a faster rate. As mentioned by [22], suitable development processes are involved with production of bio bricks from water hyacinths in scientific laboratories. These processes are such as accumulation of water hyacinths, blending of molasses, compacting and drying of the final bio bricks component. It is evident that a high temperature is required at the time of fabricating bio bricks from water hyacinths. Standard procedures to develop bio bricks need to be followed by associated experts [23]. Collected samples of water hyacinths are first cut into desired shapes and sizes.

After that water is added to it to make slurry and then a homogeneous mixture is produced by means of mechanical mixer. Then this mixture is poured into molds and a wooden block is used for ramming these blocks to produce compact bricks. It is then put into a separate place for one or two days for drying the mound [24]. After getting dried side walls of the mould are broken and the brick blocks are only put to be air dried for fifteen to twenty days. Such a long period of air drying is required to attain a desired level of strength of these compact bio bricks made up from water hyacinths. Similarly Eco Ganesha idols can also be molded.

Figure 5: Different set of bio bricks developed from Water hyacinths

(Source: [25])

These bio bricks are best suited for low cost fencing walls, housings and required to be used along with metallic or wooden load bearing structures. Advantages of these bricks are found to deliver excellent insulation to both heat and sound [25]. Moreover, it also provides adequate benefits to maintain the desired level of humidity of the building. Hence, these kinds of bio bricks are suitable for making heat resistant buildings in India.

VII. CONCLUSION AND RECOMMENDATIONS

Above analysis shows that appropriate scientific steps are required to be taken by the municipal authority in Mumbai to convert a huge quantity of water hyacinths into recycled materials for Eco friendly Ganesha idols and bio bricks. Several parameters are required to be understood by the associated personnel for ensuring appropriate utilization of this plant to develop eco-friendly products such as bio bricks. Suggestions to have the processing plant situated close to the lake as water hyacinth is 95% water, being close to the source would reduce transport costs.

A good number of studies have emerged for the potential use and conversion of water hyacinth into value-added products, suggesting a positive aspect of the weed. Transforming these ecological issues into opportunities for wealth from waste and harvesting water hyacinth through physical and mechanical means by collecting its biomass can be resourceful, manageable, feasible, and profitable not only for the government and locals but Lake Biodiversity Maharashtra tourism.

This study has mainly discussed the procedure of developing bio products and bio bricks from this plant to resolve increasing issues regarding rapid rate of spreading of water hyacinths in the aquatic ecosystem of Powai Lake. Therefore, it is significant to implement suitable steps to convert the harmful species into essential eco-friendly components. Such an approach also contributes to maintaining a sustainable and pollution free environment in the country. Along with that reduction of these harmful plants from the lake leads to revive the normal aquatic ecosystem in that region. However, certain parameters are found to be taken under major consideration to ensure suitable utilization of this plant to make bio bricks. These aspects are identified as appropriate knowledge regarding ecological aspects of this plant to ensure an appropriate estimation of time in developing bio bricks. Therefore, it is suggested to incorporate suitable technologically advanced measures to fasten the process of producing bio bricks from water hyacinths.

It is recommended to give the contract to groups for circular economy, recycling, or a technology based organization for conducting suitable waste treatment in the region close to the lakes. Moreover, it would also ensure prevention regarding further spread of this plant in the lake by taking suitable precautionary steps. Technological adaptation is also significant to ensure mass production of bio bricks from water hyacinths that ensures both development of ecofriendly products and maintaining a normal aquatic ecology at Powai Lake. Small scale paper making industry has been successful depending on the weed in several countries like Philippines, Indonesia, India and others. It can be used to prepare fiber board and bituminized board for general purpose and low cost roof materials. The plant parts, like the stems are possible resource for the manufacture of ropes and yarn following drying and treatment with sodium metabisulphite.

The plant parts are also utilized -for the preparation of basket and both ropes and baskets can be used as decorating articles. Since nitrogen and phosphorus are mostly accumulated in the roots, it could be a potential source of organic fertilizer. Scientists reported that WH has been utilized as livestock feed, bio-fertilizer, sewage purifier and biogas production, paper and fiber, and dried hyacinth can be used as animal feed for cows, pigs, goats, etc. (CWSCB, 1982). The main objective is to minimize toxic which affect aquatic ecosystem/fish population and cost of implementing control strategies.

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