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NON-PROLIFERATION OF WATER HYACINTH AND WATER PURIFICATION

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Abstract - *Water hyacinth [Eichhornia crassipes] is an obtrusive oceanic weed that has spread in tropical districts, attacking freshwater streams, lessening biodiversity and disintegrating water quality. Its fast expansion causes waterborne infections, consumption of oxygen levels, rearing of mosquitoes and choking of local species. Different physical, chemical and natural strategies are being utilized to control water hyacinth. Anyway cost, length, poisonousness, resurgence and water contamination stay a bottle neck. Integrated controls are accounted for to be the best decision to kill of water hyacinth. Eutrophication and other ecological elements advance the expansion of the plant. This undertaking centers by consolidating the planning of Floating tile and spraying arrangement. Floating tiles are made utilizing natural parts like rice husk, guar gum powder, Azadirachtin, Neem leaf powder and Mexican mint powder. Spraying arrangement is done utilizing parts like citrus extract from lemon and acetic acid from white vinegar. Water hyacinth remnants serve as organic fertilizer for agriculture. This outcomes in long haul concealment and detoxification. The second period of undertaking centers around removal of turbidity of water utilizing Moringa oleifera seed kernel powder.*

Key Words: **Azadirachtin, Eutrophication, Guar gum powder, Mexican mint powder, Water hyacinth**

1.INTRODUCTION

One of the serious issues in water collections of the jungles and sub-jungles is the drifting sea-going weed 'water hyacinth' or *Eichhornia crassipes*, which is considered to have started from the Amazon and has spread rapidly in different tropical and sub-tropical nations of Latin America and the Caribbean, Africa, Southeast Asia and the Pacific. This infamous macrophyte has spread freshwater streams like lakes, streams, streams, lakes and wetlands, dislodging local species, diminishing biodiversity and breaking down water quality. As far as its immediate effect on humankind, it upsets human exercises, goes about as a favorable place for illness vectors and keeps being a vermin in the oceanic climate. Among the momentary control estimates there are physical (mechanical and manual) removal and chemical control.

This multitude of techniques have specific requirements, and conditions, including level of pervasion, and the attributes of plagued locales ought to be known prior to executing them.

1.1 Physical Control

Manual removal requires an enormous workforce, and Government of the developing world don't necessarily in all cases possess the ability to pay for this activity. Manual removal may likewise be of help in mild regions where the weed stand is low. For this situation expulsion of the weed turns into a significant preventive measure. In any case, in exceptionally pervaded regions, manual evacuation doesn't appear to be an in fact powerful or monetarily practical technique. Mechanical removal is more powerful in exceptionally pervaded regions, yet here certain collectors would be required in addition to fuel and support expenses of the hardware. Without powerful monetary helping to allow the acquisition of the apparatus and supply of fuel it is dubious whether mechanical removal will be broadly executed in many emerging nations.

1.2 Chemical Control

Chemical control is the other choice. General assessment all around the world is against the utilization of herbicides in water bodies, as it will dirty water bodies and may bioconcentrate, bioaccumulate and biomagnify in the oceanic food web, possibly wiping out non-target life forms however the utilization of herbicides is by all accounts undeniable in specific conditions and, in the event that they are utilized appropriately and with alert, natural issues can be stayed away from. Notwithstanding the natural worries, another requirement is the need to buy basic showering gear to be mounted in a boat to apply the herbicide. Among the herbicides glyphosate is the most secure for use in water, yet cost of utilization would be restrictive in certain nations. The herbicide 2,4-D is by all accounts ok for fish, is quickly degradable in the climate and a lot less expensive than glyphosate. Uses of any of these herbicides ought to be made in unambiguous swarmed locales, yet never in generally speaking application to the entire pervaded region to stay away from a consumption of water oxygen because of quick fuse into the water of the obliterated water hyacinth mass.

1.3 Biological Control

It is notable that natural control is one of the best strategies to control water hyacinth. The most famous bioagents have been the weevils *Neochetina spp*., yet little has been finished with *Sameodes albiguttalis*. In many cases where the bioagents were to be introduced difficulties were faced because not every institution working with these bioagents is able to provide sufficient number of the insects and sometimes the distance is too great to bring the insects into the country.

2. MATERIALS

Following materials were used in the making of Floating Tiles

1. **Mexican mint powder** – has allelopathic properties that inhibit water hyacinth growth
2. **Guar gum powder** – used as a binder
3. **Neem leaf powder**-has Anti-fungal and anti-bacterial properties
4. **Coconut husk** -Enhancing structural integrity , water resistance and contribute to slowing down of decomposition
5. **Rice husk**-Provide buoyancy and structure to tiles.
6. **Azadirachtin** - Extract of neem seed kernal , Effective in killing water hyacinth

Following materials were used in the making of Spray that retard the growth of leaves by causing dehydration

1. **Synthetic Vinegar (Acetic acid)**
2. **Lemon (Citrus Extract)**

Following materials were used for turbidity removal

1. ***Moringa olifera* seed powder**-Act as natural coagulant & also have antimicrobial properties
2. **Alum**- A universal coagulant and flocculant

3. METHODOLOGY

3.1 Cultivation of Water Hyacinth

Fig -1: Water Hyacinth

A reasonable area was picked for putting of water tank. Adequate daylight and appropriate ventilation is expected for the development of water hyacinth. Tank was loaded up with water and the plants were gradually put on water equitably disseminated across the water as shown in Fig 1. Subsequent to setting up the tank, appropriate consideration must be taken to forestall different bugs and reptiles entering the tank. The water hyacinth is then permitted to fill in its new living space.

3.2 Making of Floating Tiles

The most common way of making Floating tiles included a few stages for trial and error and enhancement. At first, guar gum was blended in with water to frame a thick arrangement, filling in as the base. Mexican mint powder and rice husk were then integrated into this blend manually, guaranteeing even dispersion. In the principal set of tile tests, fluctuating proportions of Mexican mint (20g, 30g, 40g) were blended in with the composite and manipulated completely to accomplish homogeneity. The point was to decide the ideal amount of Mexican mint that caused most extreme withering of leaves when submerged in water. The composite was then formed into tiles utilizing a 200mmx100mmx50mm shape and left to dry in daylight for 48 hours.

In the second set of tiles, different ratios of Azadirachtin (10ml, 20ml, 30ml) were added while maintaining the optimal Mexican mint ratio from the first set as shown in Fig 2. The aim was decide the quantity of Azadirachtin that caused complete dead of roots. The number of days required for the most significant root extermination was noted for each ratio and the tile was made as said in the previous case.

Fig -2: Floating tile

Fig -3: Floating tile in artificial pond

3.3 Preparation of Spraying solution

Additionally, experiments were conducted to explore the effects of varying ratios of acetic acid from synthetic vinegar to citrus extract from lemon (1:1, 1:2, 2:1) as shown in Fig 4. on leaf browning. This involved spraying the mixture on the leaves twice a day during bright sunny days and recording the days until browning occurred. The objective was to identify the ratio that induced sudden browning of leaves.

Fig -4: Spraying solution

Throughout the experiments, weight analysis was performed to assess the impact of different components and ratios on the final properties of the composite tiles. By systematically adjusting variables and observing outcomes, the study aimed to optimize the formulation for both wilting and root extermination, as well as to understand the effects of acetic acid and citrus extract on leaf browning. Based on the findings, a final tile was crafted with the optimal amounts of Azadirachtin and Mexican mint powder, alongside the determined optimum ratio of acetic acid to citrus extract. This meticulous process aimed at achieving the most effective composite tile formulation for desired properties. Water hyacinth remnants serve as organic fertilizer for agriculture.

3.4 Removal of Turbidity of water

Fig -5: Jar Test Apparatus

Alum and Moringa seed powder were separately added in consecutive increments to 500ml water samples. For alum, 0.5-2.5ml amounts were added, stirred at 40rpm for 1min, then 20rpm for 30min, followed by 30min settling in Jar Test Apparatus. Moringa seed powder (0.5-2.5ml) was added, stirred vigorously for 1min at 40rpm, then 20rpm for 30min, with subsequent sedimentation. After an hour, supernatant water was filtered through mesh cloth, and turbidity measured using a turbidimeter.

3.5 Laboratory tests

Following water quality tests were carried out before and after placing of tile:

1. pH
2. Biological Oxygen Demand (BOD)
3. Chemical Oxygen Demand (COD)
4. Nitrate
5. Nitrite
6. Phosphate

4. RESULTS AND DISCUSSIONS

4.1 Analysis of Fresh weights and dry weights of water hyacinth

1. By changing the quantity of Mexican mint powder in the tile, the following weight analysis were analyzed.

Table -1: Quantity of Mexican mint

	Sample 1	Sample 2	Sample 3
Quantity of Mexican mint powder (in g)	20	30	40
No. of days for wilting of leaves	16	13	11

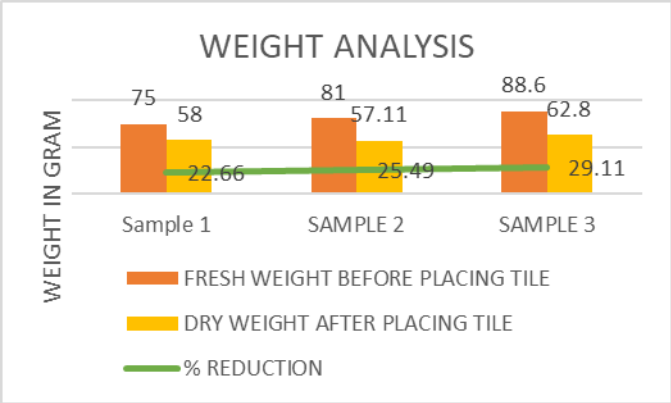

Chart -1: Weight analysis of water hyacinth using tile having Mexican mint

From the above results from sample 3, it is clear that 40g Mexican mint proved to be effective in reducing the fresh weight of the plant by 29.11%.

2. By changing the quantity of Azadirachtin in the tile, the following weight analysis were analyzed.

Table -2: Quantity of Azadirachtin

	Sample 1	Sample 2	Sample 3
Quantity of Azadirachtin (in ml)	10	20	30
No. of days for extermination of roots	11	8	6

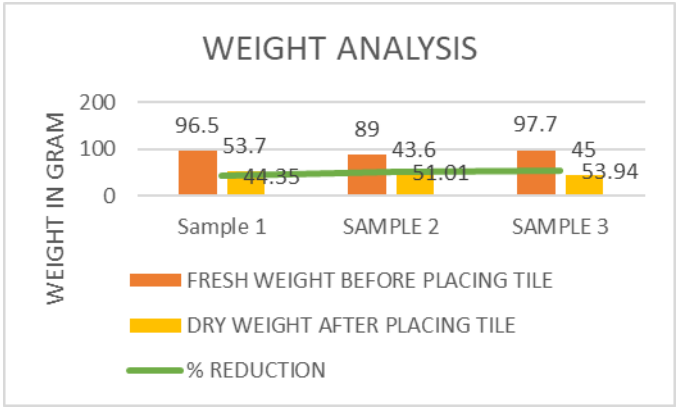

Chart -2: Weight analysis of water hyacinth using tile having Azadirachtin

From the above results, it was evident that from sample 3, 30ml of Azadirachtin was effective in reducing the fresh weight by 53.94%.

3. By changing the quantity of Acetic acid and Citrus Extract (A:C) in spray and weight analysis were done:

Table-3: Ratio of Acetic acid and Citrus extract

	Sample 1	Sample 2	Sample 3
Ratio of Acetic acid & Citrus extract(A:C)	1:2	1:1	2:1
No. of days for browning of leaves	4	3	2

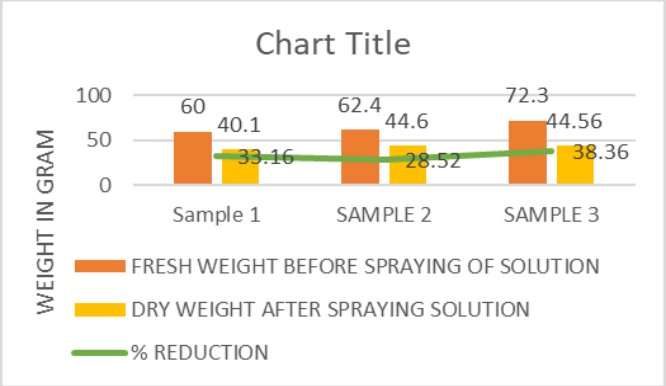

Chart -3: Weight analysis using Spraying solution

From the above results, it was noted that sample 3 having 2:1 (A:C) gave better results in reducing the fresh weight by 38.36%.

4. Weight analysis of water hyacinth plant using Floating tile and Spraying

Table-4: No. of days for degradation of plant

	Sample 1	Sample 2	Sample 3
No. of days for complete degradation	3	3	4

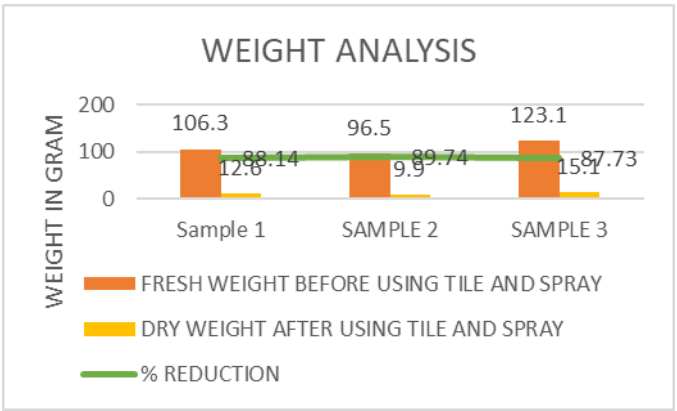

Chart -4: Weight analysis using tile and spray

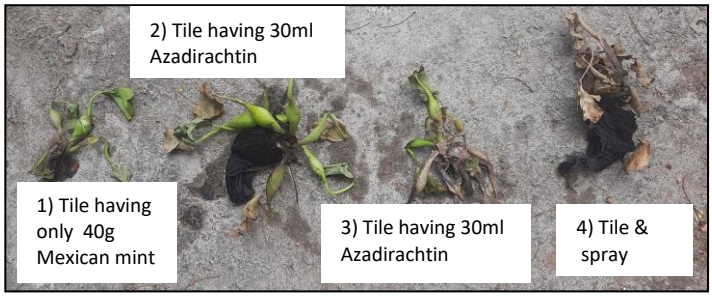

Fig -6: Water hyacinth plants

From the above results, it was noted that all three samples showed greater reduction in fresh weight by using tile and spray. The average percentage reduction is 88.53% at about 3 days.

4.2 Water Quality Test Results

1. Before placing of Floating tile:

Table -8: Water quality parameters

S No.	Parameter	Unit	Results
1	pH		7.3
2	BOD	mg/l	6.4
3	COD	mg/l	69
4	Nitrate	mg/l	6.9
5	Nitrite	mg/l	0.01
6	Phosphate	mg/l	0.14

2. After placing of Floating tile:

Table -9: Water quality parameters

S No.	Parameter	Unit	Results
1	pH		6.5
2	BOD	mg/l	0.6
3	COD	mg/l	11
4	Nitrate	mg/l	3.7
5	Nitrite	mg/l	0.1
6	Phosphate	mg/l	1

From the above results we can conclude that pH has slightly increased from 7.3 to 6.5. This can be due to spraying of solution containing citrus extract and vinegar. However, the pH of water is still within the permissible limit of 6.5-8.5. BOD and COD has drastically decreased from 6.4 to 0.6 and 69 to 11 respectively. Permissible limit of BOD is less than 5mg/L and COD is less than 250mg/L. When BOD is low, the dissolved oxygen present in the water body is high. This indicates that the water is less polluted by organic matter. Low COD indicates that lesser amounts of pollutants present in the water and increased availability of Dissolved Oxygen. Nitrate reduced is also within the permissible limits of maximum of 50mg/L as per WHO (2017). Permissible limit of Nitrite is 3mg/L and the values obtained is also less than the threshold according to WHO. Maximum value of phosphate is 1mg/L. Slight increase in value of phosphate can be due to decomposition of organic matter in the floating tile.

4.3 Analysis Of Flocculation And Coagulation Process

Table 10: Comparison of turbidity using Alum and Moringa seed powder

Dosage (in ml)	Turbidity in NTU (Alum)	Turbidity in NTU (Moringa seed powder)
0.5	31	26
1	24	15
1.5	11	19
2	19	25
2.5	23	29

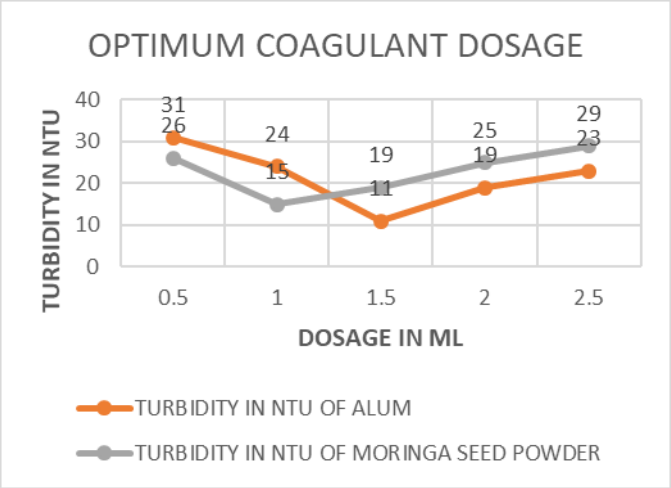

Chart -5: Optimum coagulant graph of Alum vs Moringa seed powder

Turbidity removal efficiency of alum was around 75% and Moringa seeds was around 68%. Alum showed greater reduction in turbidity as compared to Moringa seed powder. Alum has its own side effects to health in human beings as compared to moringa which is a natural coagulant.

5. CONCLUSIONS

- Water hyacinth is still the major floating water weed in the world despite nearly 100 years of attempts to control it.
- Water hyacinth negatively effects ecosystem services and the ecological conditions of aquatic environments and result in water pollution.
- Our work shows the implementation of the integrated approach towards water hyacinth to prevent proliferation and purification of contaminated water to fresh water.

- By creating floating tile and spraying solution, growth of water hyacinth has been reduced to 88.53% within 3 days.
- Alum is a universal coagulant and it shows greater turbidity removal efficiency but it has its own side effects in human health. Thus we used natural coagulant Moringa seed powder.
- Water hyacinth remnants serve as an organic fertilizer for agriculture.

REFERENCES

[1] Abinaya S, S Chandran, Karthiga Devi M And Mano Bharathi E, (2017) Organic Method for Eradication of Water Hyacinth Using Neem Seed Kernel, International Journal of Earth Sciences and Engineering, , P.P. 166-169.

[2] Adekitan Aa,Oyewumi Jo, Dada Vo, Layi-Adigun Bo,Raheem I, (2023) Use of Neem Leaf, Pawpaw Seed and Moringa Seed as Natural Coagulants for Surface Water Treatment, Journal for Applied Science and Environmental Management Vol.27 (7) 1347 - 1352

[3] Fadoua Karouach, Amine Ezzarial, Mulugeta Kibret, (2021) A Comprehensive Evaluation of the Existing Approaches for Controlling and Managing the Proliferation of Water Hyacinth (Eichhornia crassipes), Frontiers Environmental Science Vol.9.

[4] I. Gnanavel and R.M. Kathiresan, Allelopathic potential of Coleus on water hyacinth, (2013) Indian Journal of Weed Science 45(1): 71–72,

[5] Nilanjana Das,Nupur Ojha, Sanjeeb Kumar Mandal, (2021) Wastewater treatment using plant-derived bioflocculants: green chemistry approach for safe environment, Water Sciemce Technology , 83 (8): 1797–1812

[6] Tarek Abd El-Ghafar El-Shahawy, Chemicals with a natural reference for controlling water hyacinth, Eichhornia crassipes, (2015) Journal Of Plant Protection Research Vol. 55, No. 3