



Organic Method for Eradication of Water Hyacinth Using Neem Seed Kernel-An Experimental Study

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Abstract: Water hyacinth (*Eichhornia crassipes*) invasion has been a most critical issue that almost every country is facing to protect their water bodies. Especially in India water hyacinth is not a native crop and there are no native invaders like sea cows in its water bodies and the threat caused is increasing tremendously. Water hyacinth ranks eight World's worst weed and ranks fourth in Mississippi's worst aggressive weed. Not a single method of eradication will stop the growth but an integrated approach should be adopted for the complete eradication. In our study we have experimented neem seed kernel as organic biocide for eradication of water hyacinth. Neem seed kernel contains azadirachtin as its chemical component which is toxic to water hyacinth. Neem seed kernels were subjected in the form of powder, solution and extract. The percentage mortality was determined along with waste water quality parameters in each case. It was found that application of neem seed extract has got highest efficiency of about 73% mortality and so neem seed extract along with other physical and biological methods of eradication will give significant eradication of water hyacinth.

Key Words: Azadirachtin, Biocide, Eradication, Neem seed kernel, Water Hyacinth.

1. Introduction

Water hyacinth is a native species of Amazon in Brazil and first identified in Francisco River in the year 1824. In India it was introduced in the year 1896 as an ornamental plant. Water hyacinth is susceptible to grow in tropical and sub-tropical climates and they could tolerate heavy frost condition [1]. Water hyacinth is a helophyte which grows well in water rich in macro nutrients specially in those water streams which is rich in nitrogen, phosphorus, potassium. Water hyacinth is killed under saline condition and so why they don't grow under brackish condition [2]. Water hyacinth is a floating mat on the water surface which reproduces by vegetative method. Height ranges from 3 ft. Leaves have the shape of rosettes, glossy green in color, flowers vary from blue violet or white. Seeds are usually long lived in water bodies.

1.1 Impacts

Growth of water hyacinth has got several disadvantages where the most noticeable defects are high loss of water by transpiration, health hazards by production of larvae, development of foul and septic smell, reduction in aquatic ecosystem, depletion of dissolved oxygen content of the water bodies which automatically reduces the self-purification capacity, clogging of water carrying pipes and intake structures.

1.2 Control measures

1.2.1 Physical methods

Physical or mechanical method of removal includes manual removal of the weeds or pulling through nets. Employing machines like weed harvesters, crusher

boats, and destruction boats. Advantage of physical method is there will not be any change in water quality and the disadvantage is costlier and harvesting should be done periodic.

1.2.2 Chemical methods

Application of chemicals like 2-4-D ACID [2] (carcinogenic in nature), Amitrole (hazardous to mankind), Diquat (Moderately hazardous), Paraquat (Hazardous), Azadirachtin (Extract from neem seed – Non-hazardous), Acetic acid, Rubbing alcohol was employed in various regions of the world but the greatest disadvantage is that it affects water quality to greater extent.

1.2.3 Biological methods

Water hyacinth weevils, two South American weevil beetles (*Neochetina eichhorniae* and *Neochetina bruchi*) and two water hyacinth moth species (*Niphograpta albiguttalis* and *Xubida infusella*) is employed as invader for water hyacinth and also by injecting mycoherbicides, *Alternaria Eichhornia*, *Fusarium chlamydosporum* [3,4].

1.3 Azadirachtin

Azadirachtin is found to be very effective for killing over 600 species of insects. Some trade names for products containing azadirachtin include Align, Azatin and Turplex. Along with Azadirachtin (0.3%) neem seed kernel also contains Nimbidin (1.2-1.6%), Nimbin (0.1%), Nimbinin (0.01%), Vepinin (0.15%). On an average, kernels contain between 2 and 3 mg of Azadirachtin per gram of kernel. Neem kernels have also got other mineral constituents like Calcium

0.2 – 0.4%, magnesium 0.29 – 0.46% and phosphorus content 0.24 – 0.38% and Oil is around 40% [5].

2. Experimental Study

2.1 Preparation of Powder

De-aflatoxinated seeds of Azadirachta indica are collected from market sun dried for about a day are powdered up to 60-120 mm mesh size and again oven dried for 24 hours.

2.2 Preparation of Solvent

Neem Kernel applied in the form of solvent is prepared by following method. Remove the outer seed coat and use only the kernel. If the seeds are fresh, 3 kg of kernel is sufficient. If the seeds are old, 5 kg is required. Here we have taken 3kg new kernels were taken separated Kernel was pounded and tied loosely in a cotton cloth and soaked in vessel containing 10 liters of water and then filtered.

Before spraying, soap solution at 10 ml/L was added in order to make the solvent stick to the surface of the leaf .This concentration of the extract can be increased or decreased depending on the intensity of pest attack by dilution with water.

2.3 Collection of Water Sample

Water sample and saplings of water hyacinth plant was collected from Avaniyapuram town panchayat is located to the south of Madurai city. Water sample collected were raw sewage and treated sewage from avaniyapuram waste water treatment plant. (Lat: 9° 56' 20.7348'' N, Long: 78° 7' 18.1884'' E)

2.4 Determination of Optimum ppm

Determination of optimum ppm for the death of the plant, Standardization of ppm: Calculated by using standard dilution formula C1V1=C2V2. Azadirachtin brought in market available as NEEM GOLD with 1500 ppm and 3000 ppm. They were diluted with acetone to bring out to the standard ppm. Condition of plant after four days shows that dead of plants started to occur at 1500 ppm and it shows increased death at ppm greater than 1500ppm say 2000,2500,3000 ppm .At 3000 ppm it was found to have complete eradication of plant samples within a day and so 1500 ppm was adopted to carry out future studies.



Figure 1 shows the Condition of water hyacinth after four days of contact period

2.5 Determination of % of Mortality

$$\text{Per cent hyacinth mortality} = \frac{\text{Number of Dead hyacinth}}{\text{Total number of treated hyacinth}} * 100$$

$$\text{Abbott's corrected Mortality} = \frac{(\% \text{ mortality in treatment}) - (\% \text{ mortality in control})}{100 - \% \text{ mortality in control}} * 100$$

Table 1: Percentage Mortality in Raw Sewage

Parameters	powder	Solvent	Extract
Number of saplings treated	40	40	40
Number of death saplings	13	18	29
Percentage mortality	32.5	45	72.5
Abbott's corrected mortality	32.5	45	72.5

Table 2: Percentage mortality in treated sewage

Parameters	Powder	solvent	Extract
Number of saplings treated	40	40	40
Number of death saplings	9	14	21
Percentage mortality (%)	22.5	35	52.5
Abbott's corrected mortality	22.5	35	52.5

3. Results and discussion

Determination of waste water quality parameters in raw sewage before and after application.

Table 3: Waste water quality parameters of raw sewage

Parameters	Initial	Final treated		Sewage
	Values of Raw Sewage	Powder	Solvent	
COD (mg/L)	540	623	578	562
TDS (ppm)	915	1081	942.5	937
Conductivity (Ms)	1.856	2.579	3.272	1.887
Chlorides (mg/L)	250.275	242.34	136.5	116.2
Sulphates (mg/L)	51.487	56.78	49.83	46.39

Table 3 implies that change in waste water quality is greater in case of using neem kernel powder as such and change in quality is comparatively low while

using extract of about 1500 ppm and there reduction in values for chlorides and sulphates that indicates the reduction of nutrients which is necessary for the growth of plants. Determination of water quality parameters in treated sewage before and after application of neem kernel.

Table 4: Treated sewage parameters

Parameters	Initial	Final Raw Sewage Values		
	Values Of Raw Sewage	Powder	Solvent	Extract
COD (mg/L)	88	92.2	91.5	87.6
TDS (ppm)	223.3	248	233.9	231
Conductivity (Ms)	0.405	0.567	0.432	0.447
Chlorides (mg/L)	122.3	124	122.8	122.4
Sulphates (mg/L)	11.98	13.23	10.28	8.72

Table 5: Comparison of various biological methods adopted for eradication –leaves









Sl No	Biological method adopted	Condition of leaf
1	Neochetina Eichhornia and N. bruchi (Coleoptera: Curculionidae)[7]	
2	Insects and weevils[8]	
3.	The water hyacinth planthopper (Megamalus scutellaris)	
4	The water hyacinth grasshopper Cronos aquarium [9]	
5	Neem kernel powder	

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indicates the reduction of nutrients which is necessary for the growth of plants.

Table 6: Comparison of various biological methods adopted for eradication– petioles, roots

Sl No	Biological method adopted	Condition of petiole	Condition of roots
1	Insects and weevils[8]		N.A
2	Neem kernel powder		

4. Conclusions

Neem seed kernel application completely kills the leaves first which is the reproductive organ of the plant and hence neem seed extract can be used for the small scale eradications like ponds, pools, lakes etc., where as in large scale eradication it can be used one among the method along with other mechanical methods to get higher efficiency of removal ,Further eradicated water hyacinth can be used for water treatment purposes, poultry, making of paper, furniture's, Generation of bio-gas etc., Since neem seeds are available larger in India ,it will be also an ideal and economic solution for the complete eradication of water hyacinth in water bodies of India.

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