RESEARCHERID
THOMSON REUTERS

[NCRAES-2019]

ISSN 2348 – 8034
Impact Factor- 5.070

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

WATER HYACINTH REMOVAL MACHINE

Shrikrushna U. Gaikwad*[1], Dattatrya R. Gade[2], Atul A. Rodage[3], Shubham C. Patil[4] & Prof. Promod G. Rahate[5]

*[1,2,3,4&5]Department of Mechanical Engineering, Bharati Vidyapeeth's College of Engineering, Lavale, Pune-412 115

ABSTRACT

In many countries throughout the world struggling with massive amounts of water hyacinths affects in the country's fresh water recourses and created problems associated with navigation, national security, irrigation and drainage, water supply, hydro-electricity and fishing. There are several methods available for removing hyacinth from the water source. like chemical deposition, Mechanical removal by using various harvester machine , Manual extraction by conventional equipment's etc. Among all of them most effective method for water hyacinth removal is chemical deposition, but there will be chances of contamination of water. So, for overcoming that issue, we are designing removal of hyacinth by using Mechanical Mechanism. The aim of the proposed research work is to remove the hyacinth produced over water bodies by using a boat mounted pedal operated mechanical mechanism requiring zero electricity. Due to hyacinth the oxygen content in water bodies decreases and thereby reducing the quality of water, Breeding ground for pests and vectors. So removal of hyacinth is an essential process to maintain the equilibrium of aquatic ecosystem. In this project we are designed and manufactured water hyacinth remover prototype in which we designed shaft, roller chain conveyor, bearing, J-type cutters, design & analysis of main frame.

Keywords: *Water hyacinth, Mechanical mechanism, Water resources.*

I. INTRODUCTION

The water hyacinth (Eichhornia crassipes) is a floating plant. Recognized as one of the top 10 worst weeds in the world, it is characterized by rapid growth rates, extensive dispersal capabilities, large and rapid reproductive output and broad environmental tolerance. This invasive nuisance often jams rivers and lakes with uncounted thousands of tons of floating plant matter. A healthy acre of water hyacinths can weigh up to 200 tons! "Eichhornia crassipes grows in all types of freshwater. Water hyacinth is a floating water weed with a fibrous root system and dark green rounded leaves up 3 to 5 cm in diameter. The leaf stalks are swollen into spongy, bulbous structures. Water hyacinths the most predominant, persistent and troublesome aquatic within the world and has posed ecological and economic problems in several countries. Many studies have been conducted to evaluate utilization of water hyacinth and removal of water hyacinth vegetation. The major problems of water hyacinth its affect the countries fresh water recourses. Water hyacinth is considered a serious and one of the most noxious aquatic pests in many parts of the world. Its rapid growth has clogged major waterways and created problems associated with navigation, national security, irrigation and drainage, water supply, hydroelectricity and fishing in many countries Because Of its devastating effects on aquatic ecology and 'man, It's called "green devil" or "Bengal tenor" in India, "Florida devil" in America.

1.1 Problem statement

This proposed research work aims towards the removing of hyacinth from the river or any other water resources.

Some general problem found in surveys are stated below:
i) Destruction Of Biodiversity
Today, biological alien invasions are a major driver of biodiversity loss worldwide. Water hyacinth is challenging the ecological stability of freshwater water bodies, out-competing all other species growing in the vicinity, posing a threat to aquatic biodiversity.

ii) Oxygen depletion and reduced water quality
Large water hyacinth mats prevent the transfer of oxygen from the air to the water surface, or decrease oxygen production by other plants and algae. When the plant dies and sinks to the bottom the decomposing biomass depletes oxygen content in the water body. Dissolved oxygen levels can reach dangerously low concentrations for fish that are sensitive to such changes. Death and decay of water hyacinth vegetation in large masses deteriorates water quality and the quantity of potable water, and increases treatment costs for drinking water.

iii) Breeding ground for pests and vectors
Floating mats of water hyacinth support organisms that are detrimental to human health. The ability of its mass of fibrous, free-floating roots and semi-submerged leaves and stems to decrease water currents increases breeding habitat for the malaria causing anopheles mosquito as evidenced in Lake.

iv) Blockage of waterways hampering agriculture, fisheries, recreation and hydropower Water hyacinth often clogs waterways due to its rapid reproduction and propagation rate. The dense mats disrupt socioeconomic and subsistence activities (ship and boat navigation, restricted access to water for recreation, fisheries, and tourism).

v) Physical Problems – "Water hyacinth mats clog waterways, making boating, fishing and almost all other water activities impossible. Water flow through water hyacinth mats is greatly diminished, an acre of water hyacinth can weigh more than 200 tons; infestations can be many acres in size."

vi) Ecological Impacts – "Water hyacinth mats degrade water quality by blocking photosynthesis, which greatly reduces oxygen levels in the water. This creates a cascading effect by reducing other underwater life such as fish and other plants. Water hyacinth also reduces biological diversity, impacts native submersed plants, alters immersed plant communities by pushing away and crushing them, and also alter animal communities by blocking access to the water and/or eliminating plants the animals depend on for shelter and nesting."

Vii) Economic Impacts – "In Florida, millions of dollars a year used to spend on water hyacinth control; finally getting the plant under "maintenance control" has greatly reduced that expenditure." Therefore, while searching for a related problem with common philosophy, it is very important to extract or remove this floating mats of water hyacinth. The mechanical hyacinth remover using Cutter and conveyor belt is one of the best option for removing this mat.

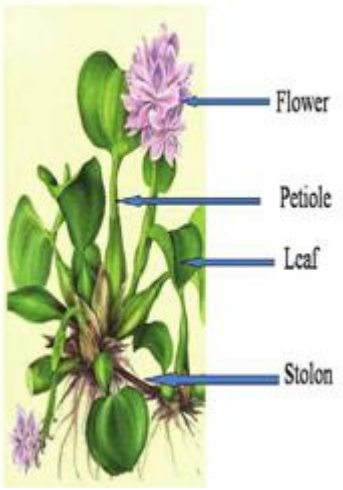

Fig no.01 Water hyacinth

ISSN 2348 – 8034
Impact Factor- 5.070

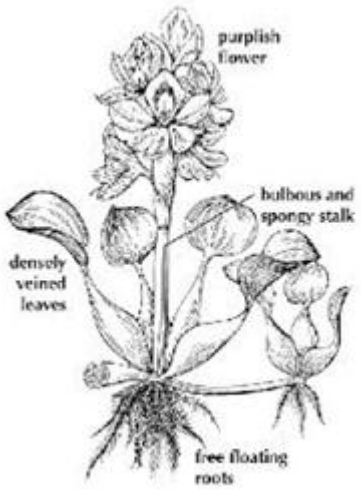

Fig .no.02 Water hyacinth

1.2 Objectives

After an extensive study of the subject under focus and collecting information from the related researchers, peers and users, the current research project envisages the following as its primary objectives.

- To identify and address current environmental problems of poor and developing nations
- To Minimize contamination of water in ponds, rivers, lakes etc. by using the mechanical removal, as per their functionality and usability concerns.
- To develop a methodological model during concept design phase to transform designed values for implementing the prototype of mechanical harvester.
- To investigate the current evaluation process and to find the problem behind its implication
- To automate the concept design phase with a case study considering hyacinth remover
- To reduce toxicity of water by removing hyacinth plant to safeguard the aquatic life.
- To improve aqueous environment by using mechanical fastenings and material handling equipment.

II. CONSTRUCTION AND WORKING

Construction

1) Frame: frame is made up mild steel of 25 mm × 25mm hollow box Section bar of rigid structure. Main frame is constructed in rectangular structure and used as support Structure. Length of the frame is 5 ft. and width 3.5 ft. and back side of frame attached pedal and seat arrangement.

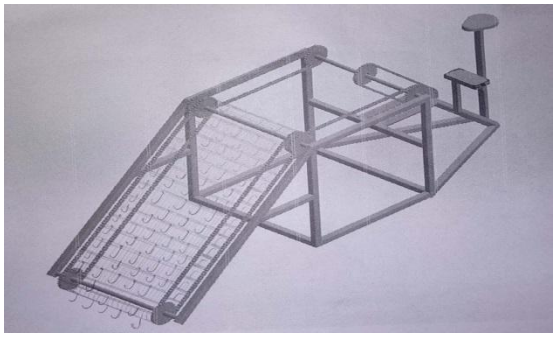

Fig. cad model

2) Chain conveyor : It is made up of sprocket (Cast iron) and roller chain (Alloy steel) as per ASME standard. Roller chain is welded with the net as shown in fig. The J-type cutters are mounted on this roller chain. We used four sprocket and two roller chain for front side conveyor.

3) Rotating shaft: It is made up of mild steel and use for guiding smooth rotation of hole mounted assembly. We use three shaft in this mechanical mechanism.

4) Pedal:- The back side of the assembly pedal is used to give transmission power manually for this mechanism. Thare are five sprocket and three chains used to give power upto roller chain conveyor.
5) Bearing: we select four footstep ball bearing for support and rotation of shaft.

Working
A mechanical water hyacinth machine used for a variety of tasks, including aquatic plant cutting, and this plants collecting and trash removal in rivers, lakes, bays, and harbors. Mechanical mechanism are designed to cut, collect and unload Hyacinth and debris using a J-type cutters, guide, and Roller chain conveyor system on ship, its small prototype so it has adjustable to the small appropriate cutting height, up to 0.5 feet below the surface of the water. Cutter bars(guide) cut, and collect material and bring it aboard the vessel using the Roller chain conveyor; when the conveyor has reached capacity, cut material is transported to a disposal site(ship) although the conveyor continuously operate so no matter quantity of the hyacinth it can transfer also small amount of Hyacinth and offloaded using the conveyor. This machanism are typically driven by manually Pedal operation provide powers to a J-type cutter bars and the Roller chain conveyor system . Mechanical Mechanism provides good control of floating Hyacinth.

Mechanical design:

1. shaft:

Material	Material Grade	Tensile Strength	Yield strength
Ms brite	EN3B	560 Mpa	440 Mpa

No. of shaft = 3 , (length = 1100mm and dia.20 mm each)
2. Center distance between two sprocket (a) = 500mm
Reeling drum speed to maintain same pipe reeling velocity of pipe on it,i $=Z_2/Z_1 = N_1/N_2$
Reeling drum speed or driven sprocket speed (N_2) = 70.71 rpm

Selected chain specifications

ISO chain number	Pitch 'p' mm	Roller diameter 'Dr' mm	Width 'b' mm	Breaking load N
081	12.7	7.75	3.30	8000

The number of chain links

$$L_n = 2\left(\frac{a}{p}\right)+\left(\frac{Z1+Z2}{2}\right) + \left(\frac{Z2-Z1}{2\pi}\right)^2 \times \left(\frac{p}{a}\right) = 111.175 \text{ links} = 112 \text{ link}$$

The corrected centre distance $X = \left[L_n - \left(\frac{Z1+Z2}{2}\right)\right] = \left[111 - \left(\frac{44+18}{2}\right)\right] = 80$

$$a = \frac{p}{4}\left[X + \sqrt{X^2 - 8\left(\frac{Z2-Z1}{2\pi}\right)^2}\right] = 505.2669 \text{ mm}$$

Length of chain $L = L_n \times p = 111 \times 12.7 = 1409.7$ mm

ISSN 2348 – 8034
Impact Factor- 5.070

III. CONCLUSION

In this paper we concluded the mechanical water hyacinth removing machine is most effective, efficient, economical compare to other method. One person can easy to operate from start to finish entire operation on machine. It is versatile to pulls, cut, and skims weeds in shallow water. It can be used as multipurpose to gathers floating debris and algae. It improves the operational stability. It has 95% effective weed pulling. Due to mechanical control effective contaminated water resources management are done. Therefore now it's the perfect time to making such machine and save our, lake, cannels, rivers.

IV. ACKNOWLEDGEMENTS

We would like to express our sincere gratitude to the Hon. Principal Prof. Dr. R. N. Patil sir, Head of Department Prof. S. R. Patil sir, and all the professors and lab incharge. They all give us moral support and proper guidance to do this project. Also we are very thankful to our Project Guide Prof. P. G. Rahate sir for the valuable support and guidance during this work.

REFERENCES

1. *Brenzy O, Mehta I, Sharma RK, Studies on evapotranspiration of some aquatic weeds. Weed Science, 1973.*
2. *Abbasi SA. Renewable energy from aquatic biomass. In: processing of the International Congress on Renewable Energy Source. CSIE, Madrid. 1987, 60-69.*
3. *Devendra Kumar, R.K. Mandloi "Analysis & Prospects of Modification in Belt Conveyors - A Review" IJERA Vol. 3, Issue 1, January -February 2013, pp.581-587.*
4. *VINOD M. BANSODE, ABHAY A. UTPAT "Fatigue Life Prediction of A Butt Weld Joint In A Drum Pulley Assembly Using Non-Linear Static Structural Analysis" Dept. of Mechanical Engineering, College of Engineering, Pandharpur, India.*
5. *Kathalyn S. Tung 'The Effectiveness of Mechanical Control of Water Hyacinth (Eichhornia crassipes)'*
6. *Ratchanon Keawmanee 'Water Hyacinth - The Green Potential.' (5-15-2015).*