



Fabrication of Water Hyacinth Shredder

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Abstract

Water hyacinth has posted a unique national problem in Thailand. Each plant can propagate up to 10 tons within 1 month. Every year, vast amount of water hyacinth clogs water flow in the rivers. Individual plant is heavy and takes a lot of spaces. Reduce size of the plant will increase transportation load. This shredder using 2 blades rotate toward each other at different speed create shearing effect. Shredding machine can run continuously with less noise. One horsepower motor can cut water hyacinth down to the size of less than 10 cm. at 22% of fresh water hyacinth loading weight. Two horsepower motor (220 V) and three horsepower motor (380 V) can cut water hyacinth to less than 10 cm at 55% and 66.2% respectively. Two horsepower motor (220 V) was preferred since it is convenience for household usage

Keywords: Water hyacinth, Shredder, Size reduction

1 Introduction

Water hyacinth (*Eichhornia crassipes*) is a native fresh water plant of Amazon basin in South America. It became wide spread over the world due to its attractive flowers. The plant grows well in tropical and sub-tropical climate; therefore, it grows over the entire world's continents included America, Africa, Europe, Asia, Australia and New Zealand (Dango et al., 2007). It is considered the worst fresh water aquatic weed in the world. The rapid spread into the new area due to its particular reproduction in both sexual (seed) and asexual (budding). Floating freely and anchor in mud, it can form thick matt that can block flowing of water.

There are four main methods to eliminate water hyacinth. The cutting boat provides fast chopping of water hyacinth into pieces but without proper collection may promote more dispersion. Manually dragging was labor intensive suitable for small area. Herbicide using Glyphosate may harm environment and posted health issue for both men and animals. Biological control using weevils and fungi is effective but, in some case, takes too long to out grown of water hyacinth. In Thailand, natural herb extracted was experimented by College of Educational and Innovation Research, KMITL in 2017. The result is quite effective, water hyacinth was diminished within 4 weeks (personal observation). However, rotted matt was left in the water and labor cleanup is needed.

This study purposes a machine for size reduction of water hyacinth after it is removed from the water. The expected size after cutting is less than 10 cm. Water hyacinth of this size can be pressed to release

water and can be tightly packed. Therefore, there will be more payload and less cost for transportation

2 Materials and Methods

2.1 Fabrication of shredder

The shredder has two shafts equipped with 6 blades. The distance between each blade is 10 cm. The shafts rotated at different speed in opposite direction created shearing effect. Water hyacinth brunch will be thrown through a hopper for shredding.

2.2 Experiments

Preliminary study found that the average shear force on the water hyacinth stem was 48.66 Newton. With 12 blades total force needed for shredding was 584 Newton.

Experiment 1. Find appropriate rotation speed.

3 phase motor of 3 hp and an inverter was used to find speed and efficiency for shredding. Frequency of 30, 40 and 50 Hz. were set as rotation cutting speed to find percent of less than 10 cm length. Rotational speed found will be used to calculate size of the motor hp needed.

Experiment 2. Find shredding efficiency between 3 phase 3 hp, 1 phase 2 hp and 1 phase 1 hp motor. 10 kg of water hyacinth and 5 replications used for each test.

Experiment 3. Find of loading rate. 100 kg of water hyacinth used for 3 motors. Time of complete shredding was recorded. There are 5 replications for each motor tested. Average and standard deviation were reported.

can be used. However, most machine is identified as "multi-purpose" which can be used to chip from 1 inch to 3 inches wood. In order to accomplish the task, machine will be either heavy or "expensive". In this study, the machine was designed strictly to shred water hyacinth. Cutting blade are thin and sharp for maximum shearing effect. Space between each blades was placed so that the catted pieces is small enough and can be packed tightly. Other used of this machine besides shredding is not recommended

5 References

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