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COMMON WATER HYACINTH BRIQUETTES; A SUSTAINABLE APPROACH

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***Abstract*: Water hyacinth and water moss have been choking many water bodies in the country, causing serious ecological and economic problems. Decades ago, water hyacinth (Eichhorniacrassipes) spread from its native ecosystem in Amazonia, Brazil, and became an invasive species in water bodies across the globe. It also reached India and has ever since eaten into a number of lakes in India, such as the Katraj lake in Pune, the Pichhola lake in Udaipur and Ulsooru lake in Bangalore. Measures to remove the hyacinth have mostly been either through chemical treatments or manual removal. Either way, they have proven extremely ineffective and expensive. The only hope lies in the economic utilization of these 'natural resources' by economically viable techniques – the concept of eradication through utilization. The main purpose of this study is to use these natural resources into sustainable energy form as binder less briquettes. Two methods of water hyacinth briquettes are adopted – Dry water hyacinth briquettes & Wet water hyacinth. Energy properties like moisture content, fixed carbon content, ash content, calorific value. Mechanical properties like bulk density, durability, water resistance capacity, water boiling time. Also, Fuel Value Index (FVI) & Compressive strength is to be calculated. As per previous studies the water hyacinth briquettes possess the high material strength as well as high value combustible fuel, which qualify them as alternative to firewood for domestic and industrial energy.**

***Keywords*: Sustainable energy, Dry water hyacinth briquettes, Wet water hyacinth briquettes, binder less briquettes, Economic utilization.**

1. Introduction

Eichhorniacrassipes, commonly known as common water hyacinth, is an aquatic plant native to the Amazon basin, and is often a highly problematic invasive species outside its native range. Water Hyacinth is one of the fastest growing plants known. Its primary means of reproduction is by way of runners or stolons, which eventually form daughter plants. It also produces large quantities of seeds that are viable for up to 30 years. Because of water hyacinth's ability to quickly reproduce, populations often double in size in just two weeks. The temperature tolerance of the water hyacinth is the following; its minimum growth temperature is 12 °C (54 °F); its optimum growth temperature is 25–30 °C (77–86 °F); its maximum growth temperature is 33–35 °C (91–95 °F), and its pH tolerance is estimated at 5.0–7.5. Leaves are killed by frost and plants do not tolerate water temperatures > 34 °C (93 °F). Water hyacinths do not grow where the average salinity is greater than 15% that of sea water. In brackish water, its leaves show epinasty and chlorosis, and eventually die. Rafts of harvested water hyacinth have been floated to the sea where it is killed. Azotobacterchroococcum, a nitrogen-fixing bacterium, is probably concentrated around the bases of the petioles. But the bacteria do not fix nitrogen unless the plant is suffering extreme nitrogen-deficiency. Fresh plants contain prickly crystals. This plant is reported to contain HCN, alkaloid, and triterpenoid, and may induce itching. Plants sprayed with 2,4-D may accumulate lethal doses of nitrates, and other harmful elements in polluted environments.

A. Uses

i. Bioenergy
ii. Phytoremediation, waste water treatment
iii. Edibility
iv. Medicinal use
v. Potential as bioherbicidal agent
vi. Other uses

1) Advantages

i. Environment and Health.
ii. Biomass densification and processing can make productive fuel out of otherwiseuseless by-products.
iii. Renewable.
iv. Widely Available.
v. Does not contribute to deforestation and land degradation like traditional firewoodconsumption.
vi. Pelletized and briquette fuels dramatically decrease emissions.
vii. Gender/Livelihood (There is also a role for both men and women to serve as entrepreneurs and thecreation of employment opportunities in the collection of biomasses and the productionand distribution of briquettes and pellets)
viii. Efficiency.
ix. Briquettes and pellets are consistent in size and shape and ready to use uponpurchase, so the sameamount of energy is delivered during each use, unlike firewoodwhich can vary in size, moisturecontent and temperature making it difficult todetermine how much fuel is needed.
x. Affordability.
xi. Raw materials for briquetting are abundant in many developing regions, and
xii. productive use of them could save on the cost of waste disposal.

2) Disadvantages

i. Not totally clean when burned.
ii. Requires lot of space.
iii. Expensive.

B. Water hyacinth scenario: India

Like the mystical Neelakurinji flower, which carpets the Nilgiris every twelve years with its purple foliage, the water hyacinth also manages to catch the eye of passers-by with its dense spread of beautiful purple flowers. But don't let its vibrant hues fool you, for the plant happens to be one of the most noxious aquatic weeds in the world with its toxic ability to engulf vast expanses at an exponential pace and making inland navigation almost impossible.

However, the killer weed's final onslaught comes in the form of choking the life out of every freshwater ecosystem it manages to infest. By forming a dense layer across the surface of ponds, lakes or even rivers, water hyacinths restrict sunlight penetration that is required by the underwater fauna for sustenance. This amounts to a state of absolute decay and the plants eventually die out. What follows is the trickling down of dissolved oxygen levels, which ends up killing the fishes and other aquatic beings in the water bodies.

Fish is a supplement food in Bengal, and because of the fish scarcity in Bengal caused by Eichhornia, the water hyacinth is also called "Terror of Bengal". In Bangladesh, projects have begun to utilize Water hyacinth for the construction of floating vegatable gardens.

1) Water hyacinth scenario: Pune

The Pune Municipal Corporation's (PMC) struggle with rising vector-borne diseases under its limits has been ineffective and badly managed, leading to regular cases of dengue, chikungunya more across areas. For long, the civic body's health department has also been on its toes to remove water hyacinth on the city's rivers.

2) Raw materials include

Dry Water Hyacinth Briquettes	Wet/Fresh Water Hyacinth Briquettes
Dry Water Hyacinth	Green Water Hyacinth
Agricultural waste (dried)	Cow dung
Sugarcane waste (dried)	Fruit waste
Saw dust	Saw dust
Groundnut shells (dried)	
Coconut coir (dried)	

2. Figures

Fig. 1. Rivers covered with water hyacinth in rivers/ponds

Fig. 2. Site of sample collected of water hyacinth in PCMC

Fig. 3. Manualremoval of water hyacinth

Fig. 4. Mechanical harvester for removal of water hyacinth

Fig. 5. Dry Water hyacinth Briquettes

Fig. 6. Briquetting machine (Mainly designed to prepare briquettes from agricultural waste)

3. Methodologies

Energy properties	moisture content, fixed carbon content, ash content, calorific value
Mechanical properties	bulk density, durability, water resistance capacity, water boiling time
Fuel Value Index (FVI)	
Compressive strength	

4. Results & Analysis

Results are to be derived by performing number of tests with both wet water hyacinth briquettes & dry water hyacinth briquettes.

Water hyacinth derived briquettes compared to those derived from other wood plant material have:

i. greater moisture content (mc) 8.28% versus 4.48%
ii. similar amounts of volatile matter (vm) 26.03% versus 25.19%
iii. much greater ash content (ac) 62.92% versus 21.99%
iv. significantly much less fixed carbon (fc) 2.78% (h8 = 0.09%) versus 48.35%
v. much lower calorific value (cv) 3.70 K cal/g versus 7.90 K cal/g

5. Conclusions

The briquettes under study possess moderate calorific values as well as moderate value combustible fuel, which qualify them as alternative to firewood and charcoal for domestic and small-scale industrial energy.

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