Efficient management and value addition from water hyacinth (*Eichhornia crassipes*), growing in Jakkur Lake.

Joint project report submitted by Tellus Habitat Pvt Ltd & Jalaposhan

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Problem addressed

Water hyacinth (*Eichhornia crassipes*) is one of the prominent invading macrophytes growing in the Jakkur lake. It is amongst the fastest growing, invasive free-floating weed which is capable of deriving nutrients directly from the water. On average, water hyacinth can assimilate at a rate of 10-12 $g/m^2 \cdot d$ which can further increase to 40-50 $g/m^2 \cdot d$ in polluted water. The faster growth rates of water hyacinth result in the rapid development of thick mats on lakes and water bodies causing the following ailments,

i. They impair the penetration of sunlight in water resulting in the death of various oxygen generating (i.e. photosynthetic) life forms such as macrophytes, algae, etc.
ii. Water hyacinth prevents oxygen diffusion across the air/water interface causing depletion of oxygen (i.e. anoxic conditions) in water.
iii. The depletion of oxygen results in the death of fish and other aquatic life due to suffocation
iv. Reduction in the population of fish and aquatic life leads to the simultaneous reduction in populations of birds (i.e. avian fauna) and other higher life forms.
v. Longer accumulation of water hyacinth mats become an anchor and substratum for the shore side grasses such as *Cyperus sp*. Once established, these are very difficult to break and disperse.
vi. The dead biomass of water hyacinth decomposes in the lake-bed creating foul odor, accumulation of sludge and sediment.
vii. Water hyacinth acts as a physical barrier to the flow of water creating flooding on the upstream.
viii. Downstream transportation of water hyacinth to other lakes starts the vicious cycle.

Thus, periodic removal of water hyacinth is imperative for the efficient functioning of the lake and the sustaining of the local ecology. Jakkur Lake, located in northern Bengaluru, has been exercising the physical harvestmen and removal of water hyacinth every month and spreading it in the surrounding garden areas of the lake to promote mulching. However, this approach of management has not proved to be very effective due to the requirement of a large area, high moisture content (>85%) making this process very slow and ineffective, furthermore, composting in open space creates foul odour and aesthetically unpleasant.

Due to low density and waxy coating, hyacinth biomass tends to float and form separate strata during conventional biodigester treatment. Thus, alternative biodigester designs have been conceptualized, developed and they would be implemented by Tellus Habitat Pvt. Ltd, a startup established by Ph.D. graduates and research scholars from premier research organization, Indian Institute of Science, IISc, Bengaluru.

The objectives of this project were as follows, Demonstration of a small-scale, biomethanation plant for the conversion of harvested water hyacinth biomass into biogas and the subsequent application of residue/digestate as suitable plant manure and conditioner. The generated biogas will be used by the local fisherman for minor heating needs such as boiling water, etc.

Responsibilities & Implementation

Party one: Tellus Habitat Pvt ltd

1. **Design, manufacturing & Installation:** Biodigester/Anaerobic digester had a capacity for treating 50 kg fresh hyacinth biomass/day. It was made of stainless-steel grade MS powder coated with a gas holder made up of HDPE/PE. Several other accessories to operate the biodigester were designed and provided including handheld, manual tools for feeding the biomass and removal of digestate, gas-proof tubings, and fittings under the scope of this grant.

   Additionally, installation included transportation, initiation of operation of the biodigester, **the addition of specific starter microbial culture for biogas production, the addition of micro and macronutrients necessary for microbial growth.**

2. **Operation training**

Area near the science centre was chosen to finish this installation.

There was an additional challenge since there was lack of hyacinth in the lake thus a mixture wet grass and hyacinth was recommended.

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Collecting the wet waste

Homogenizing waste using shredder

Feeding & Pushing into shredder

Weighing the overall material.

Feeding into Bio-Digester

Pushing to ensure mixing with inoculum mixture.

Connecting biodigester to gas collection tank

The gas connections, purging of collected gas and usage options were explained in detail by Naveen (Director of Tellus Habitat Pvt Ltd)

Gas collection unit filled with biogas. (During the second training, the feed from first week had digested)

System was inspected by the Jalaposhan team and they participated in the training.

Party one: Jalaposhan

The following activities come under the purview of Jalaposhan and were carried out by the Jalaposhan

1. Selection of a suitable site within the lake premises and the basic site/ground preparation for installation of the biodigester.
2. Operation of the biodigester such as the collection of aquatic plants, shredding of aquatic plants, feeding the biodigester and removal of digestate, subsequent use of digestate as manure.
3. The shredder/chopper for the shredding of aquatic plants will be provided by the Jalaposhan.
4. The electricity required for the operation will be provided by the Jalaposhan.
5. Gas unless being used, needs to be purged out from the gas collector. It **is recommended** to do that

Recommendations (For Jalaposhan Group)

- Do not add the **water hyacinth** without shredding and it has to be done carefully.
- Always ware safety equipment while working with shredder.
- Always weigh and feed the shredded **water hyacinth only. (Or grass)**
- Always maintain minimum water level in **water jacket and in gas holding tank**.
- Do not feed in excess than what is suggested.
- Do not keep the input lip open at any time
- Do not alter the valve positions,
- **Biogas should be removed periodically (Preferably once a week)**

- **Do not light fire** around the reactor and gas holder**. (FIRE HAZARD)**
- Transportation of gas in a biogas bag is not recommended since it is highly flammable.
- Biogas produced in this project should be used for cooking purposes only.
- Avoid any **physical damage** to biogas digester or to the gas holder. In such a situation, we recommend calling the company right away instead of trying to med leakage on your end.