Study of Weeds Formation in Chithrapuzha and its Control by Utilization

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***Abstract*—Cochin backwater is facing serious threat of heavy metal pollution caused by rapid urbanization and industrialization. Increased levels of heavy metals by local industrialization are the main reason for this. Northern part of the backwater is more polluted by heavy metals compared than southern and middle part. High levels of heavy metals were also found. The concentrations of heavy metals and sediment in the water at different locations in the backwater system are constant with the industrialization. Northern part of the estuary is found to be most polluted compared to other part. Heavy metals in some aquatic organisms exceeds safety limit. So it is necessary to give more attention to accumulation of heavy metals in organisms along with the seafood industry and public health is concerned. Precise environmental protection measures are be taken, to control this discharge from anthropogenic sources.**

Keywords—Weeds control; Chithrapuzha; Bio gas plant;

I. INTRODUCTION

The study focused on anaerobic digestion of aquatic weeds such as water hyacinth and salvinia. The physic-chemical analysis indicated that water weeds had a total carbohydrate content of approximately 40, 32 % and C/N ratio about 29, 23, respectively. AD of the aquatic weeds is carried out in batch mode at 2:1 inoculum to feedstock ratio for a period of 60 days with cow dung. Yield of bio gas produced from water hyacinth and salvinia were 552 L kg-1 volatile solids and 221 L kg-1 VS, respectively. The maximum methane content obtained in the current study was 62 and 63 % for water hyacinth and salvinia. The chemical oxygen demand was reduced by 66 and 71 % while the VS content was reduced by 27 and 33 % respectively for water hyacinth and salvinia, after 60 days of digestion period.

A. Study of Weeds

Water hyacinth is known to be a free-floating perennial aquatic plant. It has broad, thick, glossy leaves, which may rise above the surface as much as 1 meter in height. Hyacinths have long, spongy and bulbous stalks. Its feathery, freely hanging roots are purple-black. Their erect stalk supports a single spike of 8-15 attractive flowers, mostly lavender to pink in colour with six petals. They reproduce by runners or stolons, which eventually form daughter plants. Each plant produces thousands of seeds per year, and these seeds can remain alive for more than 28 years. Some of them found to grow up to 2 to 5 meters per day. The water hyacinths (Eichhorniacrassipes) are vigorous growers and they double their population in two weeks. The invasiveness of the hyacinth is related to its ability to clone itself.

B. Threats Posed by Water Hyacinth

1) Destruction of Biodiversity

Water hyacinth is a challenge to the ecological stability of freshwater water bodies, out-competing other species growing in the vicinity, posing a threat to the aquatic biodiversity. They suppress the growth of native plants and negatively affect microbes. They prevent the growth of phytoplankton under large mats, ultimately affecting fisheries.

2) Oxygen Depletion and Reduced Water Quality

Large mats of water hyacinth prevent the transfer of oxygen from air to water surface, or decrease the oxygen production by all other plants and algae. When plant dies and sinks to the bottom their decomposing biomass depletes oxygen content in the water. Dissolved oxygen levels reach dangerously low concentrations for aquatic life. Low dissolved oxygen levels releases phosphorus from sediment which accelerates eutrophication and lead to a subsequent increase in water hyacinth or algal bloom. Death and decay of water hyacinths in large masses deteriorates water quality, and increase the treatment costs for drinking water.

3) Breeding Area of Pests and Vectors

Floating mats of water hyacinth support organisms that are dangerous to humans. The ability of their mass of fibrous, floating roots and semi-submerged leaves and stems to decrease water currents increases the breeding habitat for malaria causing anopheles mosquito. Mansonioides mosquitoes, the vectors of human lymphatic filariasis causing nematode and breed on the weeds of hyacinth. Snails serving as the parasite for the parasite of Schistosomiasis (Bilharzia) reside in weed mat. It also harbours the causative agent for cholera.

4) Blockage of Waterways Hampering Agriculture, Fisheries, Recreation and Hydro Power

The dense mats interrupt with social and subsistence activities such as ship or boat navigation, access to water for recreation, fisheries, and tourism, if there is any block in waterways or clogging in water pipes. The floating mats will

limit the access for breeding, nursery and feeding grounds for some fish species.

C. Control Measures

1) Chemical Control

Chemical herbicides are only used in for severe infiltration of water hyacinth. However successful use of the herbicides is when it is used for smaller areas of infestation. Yet, it can lead to the environmental effects as it can penetrate into ground water system. It can affect not only the hydrological cycle in an ecosystem but also negatively affect the local water system and human health. The chemical regulation of water hyacinths can be done using common herbicides like 2,4-D, glyphosate, and diquat.

2) Physical Control

Physical control will be performed by machines like as bucket cranes, drag lines, or broom or by water based machinery such as aquatic weed harvesters, dredges, or vegetation shredders. It is, however, costly and requires the use of land and water vehicles. Yet it took many years for the lake to become in poor condition then reclamation will be a continual process. Transportation and disposal of the harvested water hyacinth is a challenge. Practice of mechanical harvesting will not effective in large-scale infestations of the water hyacinth, because this aquatic species grows much more rapidly than it can be eliminated.

3) Biological Control

Since chemical and mechanical removal is expensive and ineffective, researchers have turned to biological control agents to deal with water hyacinth. USDA researchers released three species of weevil known to feed on water hyacinth into the United States of America, N. eichhorniae, and the water hyacinth borer Sameodesalbiguttalis. The weevil species were introduced into the Gulf Coast states, where there is thousands of acres of infestation from water hyacinth.

4) Reduction by utilization

a) Waste Water Treatment and Clean-Up of Polluted Environment.

The water hyacinth used to treat waste water from dairies, pulp, sugar factories and paper industries, distilleries, palm oil mills, etc. This plant can absorb large quantities of heavy metals from the water column into its tissues. Then grows very well in water polluted with organic contaminants along with high concentrations of plant nutrients.

b) As Alternative Fuel and Energy Source

Water hyacinth has all the criteria deemed necessary for bio energy production – it is perennial, abundantly available, non crop plant, biodegradable and have high cellulose content. Though its drawback is that it has about 90% water content will complicates harvesting and processing. Biomass is used bio gas production for generating energy for household uses in rural areas. It can also be used for producing ethanol.

c) Semi-industrial Uses and Household Articles

Water hyacinth has been used in India for paper, wallets, vases, rope, basket, mats, bags, shoes, sandals, etc. But these are rarely successful to reduce infestations. But the market for these products is far too small to have any impact.

d) Animal Feedstock and Agricultural Use

When sun-dried, water hyacinth is rich in protein, vitamins and minerals. It is useful as a high quality feedstock for some poultry, non-ruminant animals and fishery in so many countries. Yet it is not recommended for use for removal of the heavy metals and toxic substances from waste water. Decomposed water hyacinth can also be used as green manure or for compost that improves poor quality soil. However, its high alkalinity. The potentially toxic heavy metals contents will restrict the use of flowering-plants. And with no recommended allowable application to horticulture for edible vegetables.

II. DESIGN OF PLANT

A. Points Considered

Following points are considered in design:

- The design period should be taken between 25 to 30 years.
- The design of the treatment units should be economical; easy in maintenance and should offer flexibility in operation.
- Cleaning of the plant should be easy.
- Sizing of bio gas plant is done based on parameters such as
  - Daily feed,
  - Retention time
  - Digester volume
  - Demand of natural gas and the consumption pattern
  - The on-site nature of the soil
  - Air temperature in the region
  - Level of water table
  - Wind direction

B. Dimensions of Plant

Assuming the Retention time to be 40 days and daily feed to be 50 l/day then the digester volume can be calculated as,

Digester volume = 50 (l/day) x 40 (days) = 2000 l (1)

So let us take, capacity of plant = 1 m^3

The basic dimensions of the plant are:

- Depth of digester tank = 150 cm
- Outer diameter = 132.5 cm
- Gas holder diameter = 108.5 cm
- Diameter of inlet pipe = 11.5 cm
- Diameter of outlet pipe = 6 cm
- Height of the gas holder = 79 cm
- Thickness of base = 10 cm

III. METHODOLOGY

A. Site Investigation, Site Selection and Site Clearance

1) Site Investigation

Site investigation which is used to enable a geotechnical and geo environmental assessment of the ground conditions and analysis of the environmental and engineering considerations related to the proposed development.

2) Site Selection

- The site should easy for construction works.
- The site should be such that the construction cost is minimized
- The site should ensure easy operation and maintenance processes like feeding of plant, use of main gas valve, use of slurry, checking of leakage of gas and draining condensed water from pipeline.

3) Site Clearance

- Involves the removal of hedges, walls and trees, other vegetation and services
- Also involve clearance of fly-tipped materials.

B. Excavation

Excavation is the process of moving rock, earth or other materials with tools, equipment or explosives. It includes trenching, earthwork, wall shafts, tunneling and underground**.** Before the excavation process can begin, the site must be carefully examined for make sure that the natural habitat and artifacts surrounding it are persevered throughout excavation. The hole of 80cm diameter and 92 cm depth is excavated. The purpose of excavation is the minimum utilization of ground. The half of digester portion is placed underground.

C. Concreting

Concrete is a mix of aggregates and past. The paste, composed of Portland cement and water, coats the surface of the fine and coarse aggregates. The base of the plant constructed using P.C.C of 1:3:6. Which is helps to protect the seepage of water and Balance moister content.

D. Side Wall Construction

The side walls of the plant constructed using bricks arranged vertically for getting correct radius. The brick where arranged at inner radius of 53.25cm from center and outer radius of 66.25 cm. Each layer of side wall consists of 45 bricks.

Fig.1. Bio gas plant

E. Plastering and Finishing

Plasterwork refers to construction done with plaster, such as a layer of plaster on an interior or exterior wall structure. The process of creating plasterwork called plastering or rendering. The plastering work is done by 1:5.

F. Curing

Curing is the process by which the concrete is protected from loss of moisture and kept within a reasonable temperature range. Curing is also a key player in mitigating cracks, which can severely affect durability. Period of curing is 5 days.

G. Feeding Cow Dung

Bio gas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. It can be produced by anaerobic digestion with anaerobic bacteria, which will digest material inside a system, or fermentation of biodegradable materials. It is primarily methane and carbon dioxide and have small amounts of hydrogen sulfide (H2S), moisture and siloxanes. The gases methane, hydrogen, and carbon monoxide (CO) can be combusted or oxidized with oxygen can be used for any heating purpose, such as cooking. Primarily we are feed cow dung in to the plant.

H. Placing Of Gas Holder

Gas holder is made up of fiber. So it undergoes fewer damages compared to plastic. The produced gas is stored in the gas holder. It is supported on four steel beams. At the initial stage the gas holder is in rest position. When the gas is produced the gas holder will rise upwards.

I. Feeding Weeds

Weeds are collected from Chithrapuzha. First we fed cow dung. After 5 days weeds are fed in to the biogas plant. After 45 days the gas will be produced. The weeds are fed after crushing or grinding. Substances such as egg shell, fibre etc should not feed in to the plant.

J. Gas Connection

The connection of gas was done through the pipes. The pipes are free from leakage and the gas flow through the pipe freely. The stay wire and birded hose in the connection are fixed together using cable tie. Solvent cement is used as the glue. FTA adapter which has outside thread and MTA adapter which has inside thread is being used.

IV. CONCLUSION

The level of many pollutants in Cochin backwaters is very high even to the extent of causing serious threat to its biodiversity. Industrial pollution has already caused fish mortality in the regions of Chitrapuzha and Periyar, which is an indication towards taking necessary steps to prevent such practices. Using Bio gas plant is an effective measure for weed control caused by this environmental pollution. If a large Bio gas plant is constructed for the polluted area, it will

be economical rather constructing it for each house. The LPG supply system of Delhi can also be adopted. Many developed countries has already adopted this method.

ACKNOWLEDGMENT

I convey my sincere thanks to Er. Anue Marry Mathew, Er. Reshma Theresa (HOD, CE Dept.) and parents for their sincere support and constant guidance. At last but not least, I thank almighty for his constant blessings, showered on me.

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