SUSTAINABLE WASTE DISPOSAL SYSTEM FOR A RURAL AREA

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Introduction / background:

The rural villages generate a larger quantity of wastes in both the form of solid and liquid waste and which has a limited access in waste collection and processing facilities in and lead to environmental problems. The rural waste management needs a genuine, organized, environment-friendly and cost-effective, sustainable management system for the future betterment of living in the villages (Moharana. 2012). Therefore, the present study is focused on the sustainable waste management in the village of Bhagavati, Karnataka, India.
The construction of wetland has gained the higher attention in wastewater treatment system. Compared to the physico-chemical process, the wetlands have been found to be the cost effective, minimum energy requirements, easy maintenance, and good landscape integration bioremediation techniques for the wastewater treatment at rural areas and which was sustainable and environmentally friendly in nature (Yadav et al. 2021). In addition, the improper sanitations in the rural area results in the unhygienic environment due to untreated/unscientific sewage disposal and pathogens from the contamination adversely causes on the human beings (Jain et al. 2019). Further, the severe threat to public health was found due to higher generation of solid waste and in which the higher amount of biodegradable waste was predominantly observed in rural areas (Moharana. 2012). Therefore, the sustainable and economical method has been proposed for the wastewater treatment using azolla weed and vetiver plant for wetland construction and solid waste management in rural village of Bhagavati.

Objectives:

- To design a sustainable, eco-friendly waste disposal system for the village.
- Characterization of domestic waste water generated from the village.

- Treatment of wastewater by constructed wetlands with floated and rooted plants in the laboratory.
- To design the upscaled, low-cost floating wetland for the village for disposal of wastewater.
- To design a suitable solid waste management system for the village.

Materials: Lab scale wetland construction was carried out in concrete rings (height = 35 cm and diameter = 78 cm) using floating weed of azolla and vetiver plant was placed in steel wire mesh embedded with the PVC pipe. Cow-dung is mixed with domestic wastewater for provision of nutrition and helps in rapid multiplication of azolla.

Methodology:

Treatment of wastewater: Floating wetland technique for the treatment of wastewater using azolla and vetiver was taken for the wastewater treatment. The addition of 3 vetivers inside the PVC pipe was placed in the concrete ring, whereas the azolla weed was sprinkled in the other concrete ring (Fig. 1.a and b) using hydroponic technique of phytoremediation wastewater can be treated effectively. Then the physico-chemical characterization of pH, turbidity, conductivity, biochemical oxygen demand, chemical oxygen demand, total dissolved solids, nitrite, phosphorous was analysed at different time intervals of treatment period to find the treatment efficiency by the construction of wetlands and further, the upscaled wetland system was designed for the Bhagavati village.

Fig. 1 Floating wetlands (a) Vetiver grass, (b) Azolla pinnata

Solid Waste Management:

Solid waste management system is designed for the village considering Vermicomposting method for organic waste generated in the Bhagavati village and an area at the corner of the village was selected for vermicomposting and the schematic representation is shown in figure 2. In addition to that, the awareness program for the village people has been conducted and, the villagers are made aware of proper disposal of the waste and maintenance of hygienic conditions are explained to the villagers.

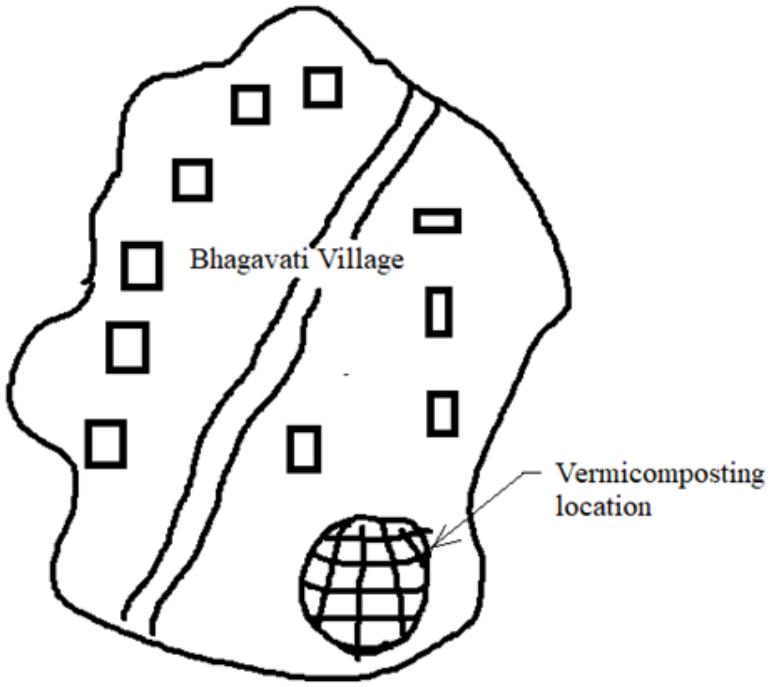

Fig.2 Line diagram of solid waste management of vermicomposting for Bhagavati Village

Results and Conclusions:

Performance of the Treatment:

The physicochemical parameters of the waste-water studied were carried out before and after the introduction of azolla and vetiver plant in wetland construction. The first sampling of the wastewater showed the highest concentration of COD and BOD of 276 and 88 mg/l with nitrates of 63 mg/l and phosphate found to be 22mg/L. While the 19 days of vetiver treated sample recorded the lowest nitrate and phosphates of 48 mg/L and 16 mg/L, respectively. The treatment results of vetiver grass found to be the reduction in BOD_5, COD, nitrite and phosphate with the removal efficiency of 36%, 30%, 24% and 27% respectively during 19 days of treatment period. Whereas, the treatment results for azolla found to be 34%, 35.5%, 21% and 36% respectively for BOD_5, COD, nitrite and phosphate after 28 days of treatment period of wastewater. The wetlands proved to be the low-cost treatment method and effective treatment of wastewater in the Bhagavati village and vetiver grass showed the higher removal efficiency of BOD at 19 days of treatment period. Further, the effectiveness of treatment using both weeds have to be carried out in the future study. Darajeh et al. (2019) Effectively utilise the vetiver grass for the phytoremediation of municipal wastewater with the removal efficiency of organic nitrogen of 83.8% and COD of 46.2%, whereas high capacity of uptaking of nitrogen was obtained and in the present study the higher removal of phosphorus was obtained with the use of vetiver grass In addition, proper sanitation in rural areas can be achieved by providing the awareness program to the villagers and

vermicomposting technique is major component of organic farming which was designed for the rural village of Bhagavati.

Conclusions:

Floating wetland system is cost effective and energy efficient and wetland system also provides additional environmental benefits for aquatic habitat. In the present study results showed higher reduction in the concentration of BOD_5 (34.09%), COD (35.50%), nitrite (20.64%) and phosphate (36.36%) at 28 days using azolla weed and vetiver grass showed the reduction of BOD_5 (36.36%), COD (30.07%), nitrite (23.80%) and phosphate (27.27%) during 19 days of treatment period using vetiver grass in wetland for wastewater treatment. Further, the effective vermicomposting design was proposed with awareness program to the villagers benefits the cost effective and proper disposal methods with sustainable solid waste management to the Bhagavati village.

Scope for future work:

The design of floating wetland and vermicomposting technique will be given to the village panchayat to adopt these techniques for the proper treatment of wastewater and management of solid waste in the Bhagavati village.

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