Chapter 18
Sewage Water Treatment in Constructed Wetlands With Vetiver Grass

Dhanya Gopalakrishnan Nair
https://orcid.org/0000-0002-1192-8176
University of Kerala, India

Vinod Gopal Venugopal
University of Kerala, India

Jaya Divakaran Sarasamma
University of Kerala, India

ABSTRACT

Untreated sewage is the main reason for soil and water pollution. Constructed wetland technology is an emerging and acceptable wastewater treatment method as it can effectively remove almost all types of pollutants without harming the environment. The aim of this study was to find the effectiveness of constructed wetland technology using the vetiver plants (vetiveria zizanioides l. Nash) in sewage treatment. The vetiver plants were planted in the constructed wetland. After 90 days, the test groups were treated with 250ml of sewage on alternate days and are allowed to grow for further 15 days. After the experiment, the treated sewage from the tank was collected and the changes in physico-chemical characteristics were examined. The results show that more than 65% of the total pollution load including heavy metals in the sewage was eliminated within 15 days of treatment in the constructed wetland. So, the vetiver-constructed wetland can be considered as an effective, low-cost, eco-friendly technology for sewage treatment.

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INTRODUCTION

Beginning with the industrial revolution in the 19th century, pollution becomes a more noticeable phenomenon. Along with the rapid spread of industrialization and the growth of the human population to unprecedented levels resulting in an exponential increase of waste by-products, the sanctity of nature was irrevocably ruined causing the major environmental disasters and impacting the basic necessities for life on the Earth - air, water and land making them unfit for their primary designated uses (Bhatia, 2001).

Due to the scarcity of fresh water, wastewater reuse is now a growing practice worldwide, that has become an attractive option for conserving and expanding the available water supplies. Treated wastewater can have many applications, including irrigation, aquaculture, landscape irrigation, urban and industrial uses, recreational and environmental uses, and artificial groundwater recharge. Predominantly, the wastewater can be used for all the purposes for which the fresh water is used, given the appropriate treatment. One of the most important soil and water-polluting source in India is the discharge of untreated sewage into the land and water courses. Sewage refers to wastewater from sources including domestic, municipal, or industrial liquid waste products disposed of, usually *via* a pipe or sewer system. The population is the basic and dominant factor governing the estimation of sewage volume, sewer network size, and capacity of the sewage treatment plant. Out of about 38254 million liters per day of sewage generated in class I cities and class II towns, the treatment capacity exists for only about 11787 million litres per day. Thus, there is a huge gap between the generation and treatment of wastewater in India. Even the existing treatment capacity is not effectively utilized due to operation and maintenance problems. Operation and maintenance of existing plants and sewage pumping stations are not satisfactory, as nearly 39% of plants are not conforming to the general standards prescribed under the Environmental (Protection) Rules for discharge into the streams as per the CPCB's survey report (CPCB, 2021).

Sewage is characterized by volume or flow rate, physical condition, chemical and toxic constituents, and its bacteriological status. Untreated sewage may contain water; nutrients (nitrogen and phosphorus); solids (including organic matter); pathogens (including bacteria, viruses, and protozoa); helminths (intestinal worms and worm-like parasites); oils and greases; runoff from streets, parking lots, and roofs; heavy metals (including mercury, cadmium, lead, chromium, copper) and many toxic chemicals including PCBs, PAHs, dioxins, furans, pesticides, phenols and chlorinated organics (Tot *et al*., 2013). The agricultural sector needs water to meet its demands for irrigation, so it will have to increasingly rely the polluted or partially treated waste water as an alternate source of irrigation. The nutrient content in the waste water itself makes the effluents partially suitable for irrigation, whereas the use of the ground water recharge must follow the strict hygienic guidelines (Patel *et al*., 2006). The unscientific disposal/ use of wastewaters in the soil/water bodies creates serious environmental and health problems due to the translocation of heavy metals and other toxic chemicals through the food chain by means of bioconcentration (Fiedler *et al.,* 2000).

A plethora of evidence revealed that the disposal of untreated sewage deteriorated the water as well as soil quality in the nearby areas. Studies by Owli (2003), Hariharan and Muralikrishna (2011), Ghosh *et al*. (2012) and Tanimu *et al*. (2013) showed that the discharge of untreated sewage resulted in soil and groundwater pollution in the nearby areas and long-term application of untreated sewage resulted in the heavy metal accumulation. Azzouz *et al*. (2017) reported that sewage water and sludge is highly enriched with various nutrients as well as heavy metals. According to Tytla (2019) and Kowalik *et al*. (2021), considering the heavy metal content in the sewage, the risk of environmental contamination is very high. For this reason, the treatment of wastewater is necessary to correct the wastewater charac-