Domestic Wastewater Treatment using "Water Hyacinth"

Municipal wastewater discharge i.e. sewage, is one of the most serious threats to the ecosystem. Therefore, the sewage needs to be treated appropriately before the wastewater is released into the environment. A large number of technologies, such as oxidation ponds or activated sludge processes, have been applied for domestic wastewater treatment but most of these practices are expensive to install and run. So, there is a need for a substitute system to overcome these drawbacks and achieve a high elimination rate of pollutants.

In recent years, the application of constructed wetlands (with rooted, emergent and free-floating aquatic plants), and facultative ponds treating domestic sewage have attracted considerable attention because they offer an environmentally sound approach. The mechanisms of pollutant removal in constructed wetlands involve an interaction between the bacterial metabolism, plant uptake and accumulation. The impurities are removed in facultative ponds entirely by natural processes involving both algae and bacteria. In that order, vegetation is considered as a dominant feature of constructed wetlands, and acts as an important biotic factor in the treatment process.

Among the free-floating species, the water hyacinth *(Eichhornia crassipes)* appears to be a promising candidate for pollutant removal owing to its rapid growth rate and extensive root system. The water hyacinth lagoon functions as a horizontal trickling filter, where the submerged roots provide physical support for the bio-film bacterial to growth. Nevertheless, despite the efforts made worldwide, the construction of aquatic systems, particularly the water hyacinth treatment process, has not gained much popularity due to the requirement of a large land area and considerable capital investment.

In any conventional water hyacinth system, the water column can be divided into three distinct zones, aerobic, facultative and anaerobic, depending on the oxygen transfer through the floating plants. An excess pond depth (typically ~50–100 cm depth) reduces the oxygen transfer efficiency through the roots and sustains high anaerobic microbial growth. The oxygen concentration is likely to be high in the upper part of the lagoon, and begins to decrease further down the water column, approaching almost zero below a 200 mm depth. The higher pond depth can rise to the anaerobic zone; resulting a slow biodegradation process, and cause the emission of foul odors. To counter these disadvantages, a shallow pond water hyacinth system was reported.

The shallow pond system is an alternative to the conventional water hyacinth process because it has a low water depth (140–150 mm) based on the fully matured plant root submerged (80–130 mm) to avoid the anaerobic zone. This condition ensures the optimal interactions between the wastewater effluent and microbial biomass in the phytoremediation treatment practice. The

shallow pond technique is an attempt to minimize these constraints due to the better oxygen diffusion efficiency through the roots and the accumulation of a larger aerobic bacterial population. This is a robust biological process that can be applied to the efficient and reliable elimination of pollutants at a lower hydraulic retention time (HRT) compared to the conventional water hyacinth system, even under environmental stress conditions. Despite its adequate performance, further improvements can establish the shallow pond water hyacinth practice as an effective tool for purifying municipal wastewater effluent.

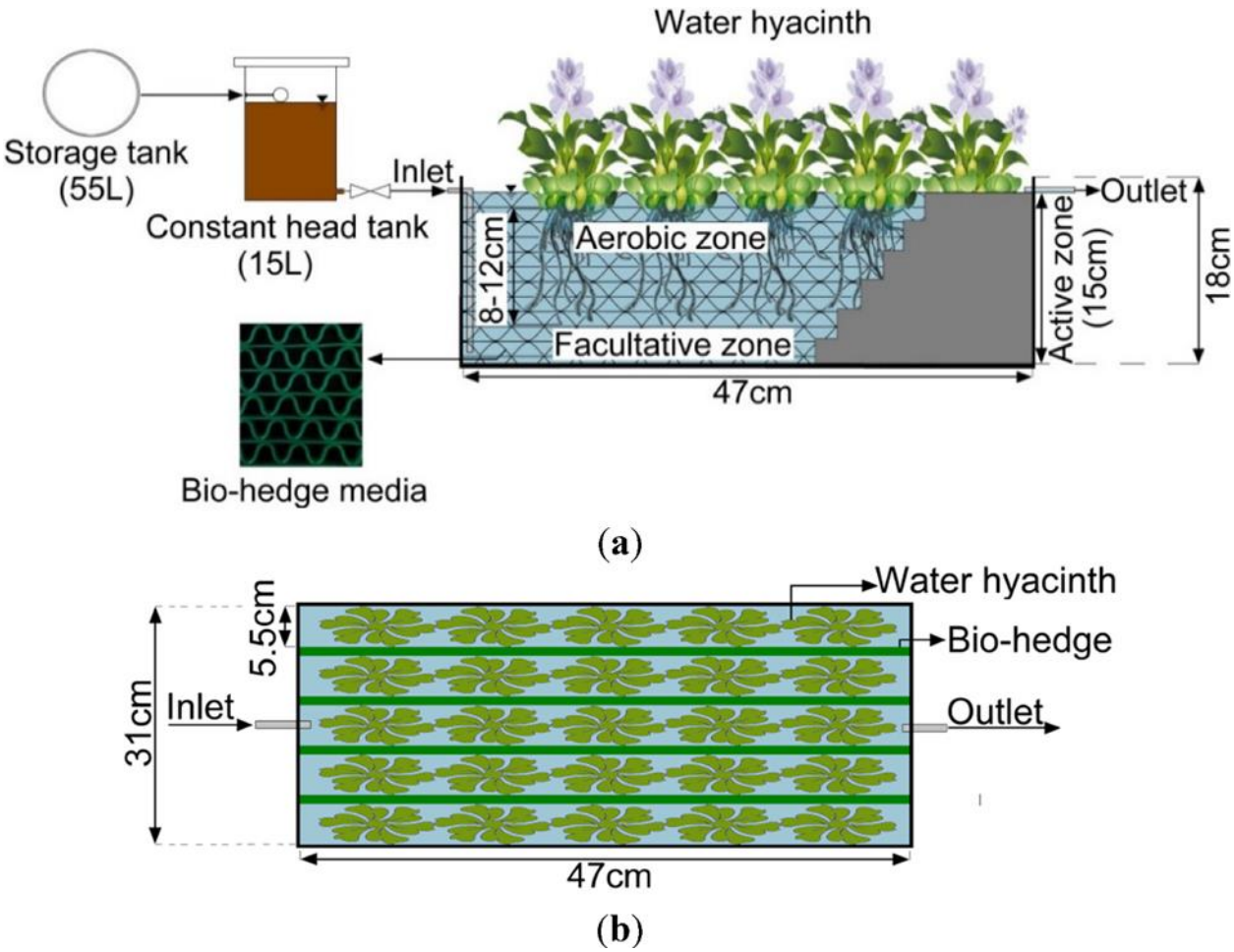

Image Source: http://www.mdpi.com

Innovation in Sewage Treatment using Water Hyacinth

Professor S.A. Abbasi from Pondicherry University, Chinna Kalapet in Puducherry has devised a simple, low cost and efficient waste water management system using aquatic plants. The wastewater treatment plant, called SHEFROL (which stands for sheet flow root level) bioreactor is designed by digging trenches over which non-permeable sheets are placed. Two aquatic plants – four leaf clover and water hyacinth – are grown over the sheets as waste water is allowed to flow slowly across.

These two aquatic plants act as natural agents of phytoremediation and absorb the chemicals, microorganisms and pathogens from wastewater thus detoxifying and improving it for further use in irrigating fields and gardens. The SHEFROL plant is easy to construct, is scalable depending on the need and requires low maintenance. As compared to a waste water treatment plant which costs Rs. 50 lakhs, the SHEFROL plant can be set up for up to Rs. 20,000.

A small fishing hamlet in Villupuram district in Tamilnadu has shown the way in realizing the Union government's ambitious campaign, `Swachh Bharath Abhiyan'. There are about 100 households in the village. The panchayat has established a clean, green and inexpensive sewage treatment plant with technical expertise from a team in Pondicherry University and has been running the plant successfully for the past one year. The treatment plant with a capacity of 10,000 litres measures 9 mtr by 2 mtr and treats sewage water from more than 35 houses in the locality. Water hyacinth used in the facility absorbs pathogens and microorganisms and the treated water is used for irrigation. A plant to treat waste water from 30 to 40 households can be set up with an investment of Rs 15,000 to Rs 16,000 using this technology. Moreover, the technology is very efficient. The plant is totally green and eco-friendly as it uses no chemicals.

http://www.networkedindia.com/2017/03/16/aquatic-plants-provide-low-cost-waste-water-treatment-solution-puducherry/