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Title of the Research: Treatment of Domestic Grey Water to Control Surface Water Pollution

Period: November 2013

Wetlands are among the most important ecosystem on earth because of their unique conditions and their role as ecotones between terrestrial and aquatic system. The ability of wetlands to transform and store organic matter and nutrients has resulted in wetlands often being described as “the kidneys of the landscape”. Constructed wetlands also have great potential as a clean-up technology for varieties of wastewater.

In order to assist treating wastewaters, Constructed Wetlands (CWs) are engineered systems that have been designed and constructed to utilize the natural processes involving wetland vegetation, soils, and the associated microbial assemblages. CWs for wastewater treatment may be classified according to the life form of the dominating macrophyte into systems with free-floating, floating leaved, rooted emergent and submerged macrophytes. Further division could be made according to the wetland hydrology (free water surface and subsurface systems). Again, subsurface flow CWs could be classified according to the direction of the flow; horizontal and vertical. Constructed wetlands with free water surface (FWS CWs) are not used as much as the HF or VF systems despite being one of the oldest designs in Europe. Constructed wetlands could also be combined in order to achieve a higher treatment effect by using advantages of individual systems. Most hybrid constructed wetlands combine VF and HF stage.

Removal of organics is high in all types of constructed wetlands. VF constructed wetlands are nearly always used for primary or secondary treatment while FWS are often used for tertiary treatment and HF CWs are often used for treatment of wastewater diluted with storm water runoff. In combined systems, the advantages of the HF and VF systems can be combined to complement each other. It is possible to produce an effluent low in BOD, which is fully nitrified and partly denitrified and hence has much lower total-N concentrations.

Constructed wetlands have been used for decades mostly for the treatment of domestic or municipal sewage. For a small community with limited funds for expanding or updating wastewater treatment plants, constructed wetlands are an attractive option. In addition, rural municipalities have access to adequate inexpensive land, and wetlands blend into a natural landscape setting and once the wetlands that might serve as a treatment plant for domestic

wastewater, will be economic and help re-use of wastewater to reduce demand on current available sources.

The main objectives of this research were:

- Evaluation of the removal performance of pollutants, such as TSS, organic matter, nutrients and faecal coliform, thus improving quality of wastewater in the downstream.
- Analyze removal of pollutants by wetland plants and filter materials.

Findings/conclusions from the research: In Bangladesh, wastewater management system is yet to cope with the demand, especially for urban areas, where the increasing rate of urbanization is adding more to ponder; a major portion of wastewater pollutes natural water bodies creating health hazards to human beings and the ecosystem as a whole. As the increasing demand is threatening the current wastewater management practices, constructed wetland could become an alternative as an on-site wastewater treatment system if used in community or household level. Even though constructed wetland systems are simple and low cost wastewater treatment option, use of this is limited due to lack of information.

The possible outcomes of the research study was to achieve removal of pollutants efficiently up to desired level from wastewater runoff in order to reduce the concentration of wastewater to be discharged in the natural water bodies and if possible, re-use this treated water for specific purposes. Also the identification of suitable filter media and vegetation species and its effects on biological uptake in constructed wetlands and to promote design and implementation of small scale decentralized wastewater treatment plant among the community were the possible outcomes from this study. Therefore, this research could be useful to submit the design recommendations for hybrid and single-staged constructed wetlands for wastewater treatment in Bangladesh.

Constructed wetlands with horizontal or vertical sub-surface flow are viable alternative for grey water treatment for organics, nutrients and suspended solids removal. Removal of organics (BODs and COD) is very high of these systems. Removal of color and suspended solids also show good results for both the systems. As the concentration of nutrients is not very high in grey water, the removal efficiency of $\text{NH}_3\text{-N}$ and total phosphorus was also found very high for both the systems. The high removal of $\text{NH}_3\text{-N}$ and P concentration is low, soil can be considered with the used emergent plants where the soil helps the adsorption of phosphorus and also helps keeping the normal landscape condition. Being simple in construction, operation and maintenance, sub-surface flow constructed wetlands can be adopted in towns, institutions and households. Any of these two systems could be used to recycle and reuse grey water and mitigate the water crisis of Dhaka and any other cities of Bangladesh.

For more information on this research, please contact the National Resource Centre, NGO Forum for Public Health, Email: nrc@ngof.org