

Water Purification in Artificial Wetlands from Livestock and Farmland Wastewater

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The end-point treatment of point pollution sources is the best way to improve the quality of water and prevent pollution, all over the world. Nevertheless, non-point pollution sources that influence the quality of surface water are serious concerns. Wetlands receive surface water inputs from streams, surface runoff, precipitation, and overland flow and subsurface water inputs from surface infiltration, stream hyporheic zones, and ground water. In this study water source includes effluent from livestock farms and domestic wastewater. By monitoring and analyzing the variations in the water quality, the removal efficiency in different ponds of the artificial wetland for various pollution sources can be obtained. Factor analysis and cluster analysis are adopted to describe the spatial characteristics of the data and seasonal variations in the water quality respectively.

Factor analysis (FA) is an approach that explains the observed relationships among many variables in terms of simpler relationships to offer insight into the structure that underlies the variables. These simpler relationships are expressed in terms of a new set of variables, called latent factors. A varimax rotation redistributes the variance of each variable such that each variable has a high loading on a single factor, with near-zero loadings on the other factors; this facilitates the interpretation of factors [1,2]. Factor scores are projections of the data onto the corresponding eigenvectors. They can be regarded as the actual values of water quality for each sampling site based on the underlying factors [3]. Cluster analysis seeks to determine groups such that each group is as homogeneous as possible with respect to characteristics of interest, and such that all the groups differ from each other as much as possible. Factor scores were used in the cluster analysis primarily because the data included a few groups of highly correlated variables.

The use of factor scores in cluster analysis reduces the effects of the over-weighting of those dimensions that are over-represented by the set of highly correlated variables. The Ward's technique consistently outperformed other methods of classification [1].

The result reveals,

1. Overall, there is regular reduction of nutrient sources and fecal pollution. The highest content is seen at the water inlet and concentration gradually decreases over densely planted zone I, the open water zone, densely planted zone II and the discharge orifice, reaching the minimum level at the outlet.
2. The suspended solids factor shows inconsistent variation in different ponds possibly due to algae growth.
3. According to the cluster analysis of water quality characteristics, the open water zone and densely planted zone II have similar water quality characteristics regardless of wet or dry seasons. The inlet and densely planted zone I also share similar water quality characteristics.
4. Livestock fecal pollution can be effectively eliminated by the wetland.

References

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