

A PERSPECTIVE ON THE POTENTIAL OF PHYTOREMEDIATION IN TREATMENT OF KITCHEN GREYWATER IN TROPICAL CLIMATES

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Abstract: The exponentially growing global population has put a strain on the limited resources this planet has to offer, such as water. Exploring the possibility of treating contaminated water and implementing reuse practices would reduce the stress placed on water bodies worldwide. Among the various water treatment procedures available, phytoremediation comes across as one of the most cost effective biological and ecofriendly methodologies. Kitchen greywater is a major contaminant of water bodies and is composed of microorganisms, organic and inorganic substances. In this paper, focus has been laid on the potential of phytoremediation for the treatment of kitchen greywater. Several aquatic plants are found in nature that can be used for the process of phytoremediation and three of those are water hyacinth, water lettuce and water chestnut. This paper explores all the three aforementioned plant species that can be used for phytoremediation in tropical climates and their efficiency in treating kitchen greywater.

The treatment of wastewater is one of the biggest concerns facing environmentalists all over the world. Kitchen greywater is defined as the urban wastewater that is composed of water from dishwashers, and kitchen sinks. The reuse of greywater has begun to gather a large amount of attention due to the fact that it contains lower pollution levels in comparison to domestic wastewater. In certain projects reuse greywater has been utilized for non-potable uses such as toilet flushing and garden irrigation. A number of kitchen greywater treatment methodologies can be utilized such as UV treatment and disinfection, phytoremediation, electrodialysis and reverse osmosis. Phytoremediation is a cost effective biological and eco-friendly kitchen greywater treatment methodology where contaminants are removed by macrophytes. The pollutants are absorbed by the plants which act as a biological filter that remove organic materials and nutrients from the wastewater. In order to address the depleting water levels in India, we aim to consider and review the 3 plant species that have the potential to treat large volumes of kitchen greywater and reduce the contaminant concentration.

Water hyacinth and water lettuce, along with water chestnut to provide a larger and more economical perspective for a tropical climate have been studied and considered in this review.

The following parameters are found common in the study of various researchers as phytoremediation plants have a direct effect on them and they are important standards for classification of treated wastewater: Chemical Oxygen Demand (COD), Biochemical oxygen demand (BOD), Total Solids, Total Dissolved Solids and Total Suspended Solids (TS, TDS, TSS), Ammoniacal nitrogen (AN), Total Phosphorous (TP), Total Sulphur (TS).

Except sewage (blackwater), all the produced domestic wastewater falls under the category of greywater. Kitchen greywater contributes about 10% of the total greywater volume. It is contaminated with food particles, oils, fats and other wastes. It is usually acidic owing to the presence of fermentation bacteria and contains liquid wastes having a high BOD, COD and organic matter. The report of the Central Water Commission of India determines a standard Water Quality Index (WQI) for classifying water on the basis of their contaminant content and usage. According to the report, water belonging to CLASS E or WQI can be used for irrigation and other agricultural purposes.

In this paper, we have evaluated the efficiency of three aquatic plants – water hyacinth, water lettuce and water chestnut for the treatment of kitchen wastewater through the process of phytoremediation. A complete analysis of the literature was reviewed demonstrates that the plant species studied are in fact appropriate for kitchen greywater treatment. The wastewater hence treated falls under the ‘Class E’ of water quality classification laid out by CPCB as the final quantities of TDS is less than 2100 mg/L and pH lies in the given range of 6.0-8.5. As the BOD of the treated water is more than that required by CLASS D of water, it falls out of that category. Hence, the wastewater treated by phytoremediation can be utilized for Irrigation, industrial cooling and controlled waste disposal. As per Fonkou et al water lettuce reduced the BOD levels from 605 to 85 and the TDS was reduced the most by water hyacinth by 69.79%. The plant species considered also demonstrated the capability of reducing ammonia, sulfur and some hard metals which may also be present in certain greywater samples. The above literature reiterates to us the fact that phytoremediation is indeed a promising solution for kitchen greywater treatment as it does reduce the pollutant concentration in an eco-friendly way, thus providing treated wastewater that is indeed suitable for non-potable uses such as cleaning and horticultural activities. Globally, 80% of wastewater flows back into the ecosystem without being treated or reused. Water treated by phytoremediation falls in the Class V of water quality index, thus qualifying for agricultural usage. Farmers are increasingly looking into non-conventional water resources, mainly wastewater, whether due to its high nutrient content or lack of conventional water resources. Improvements in wastewater will not only improve the health of farmers but also cause food security and livelihood improvements. Phytoremediation can be widely applied in the field of agriculture as it's an easily operated process, cheap, simple to construct and can be run by untrained personnel. Every phytoremediation setup restores an ecosystem whilst providing a great aesthetic view. The process doesn't generate any sludge or by-product and overall requires

very less energy – thus being a green alternative to wastewater management and posing a plausible solution to the ongoing water crisis.

Index Terms— Phytoremediation, greywater, water lettuce, water hyacinth, water chestnut.