PERFORMANCES OF BIOFILM REACTORS

WITH DIFFERENT SUBSTRATES

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ABSTRACT

Water is one of the most important resources, and its availability for drinking, irrigation, and ecosystem's habitat is still subject to anthropogenic disturbance. During the last decades, understanding aquatic pollution and improvement in water management have developed. One of the most effective achievements concerning water use is surely the establishment of biofilm reactors in common wastewater treatments. These filters provide a substrate that reproduces the ideal environment for bacteria and microorganisms, commonly referred as biofilm, to develop and react with dissolved and suspended organic substances in the water.

As is the case in natural ecosystems, the development of a biofilm depends on the chemical and physical characteristics of the supporting medium. The main objective of the research is to investigate the relationships between the medium and the biofilm performance by testing and comparing various types of media on the wastewater treatment process. The choice of a specific medium could lead to an expected performance or specific treatment.

A small-scale replica of an aquaculture wastewater bioremediation system using independent series of biofilm reactors provided an ideal mechanism for study. The system consisted of five biofilm reactors, each containing a different substrate: coral rubbles, lava rocks, blue stone gravel, coconut fibers, and industrial cloth. In addition to a study of the choosen media, the water quality and chemistry of the system's influent and the effluent of each biofilm reactor were monitored over time. An emphasis was made on

the performance of each filter to deal with the concentration of nutrients found in the aquaculture wastewater.

During this experiment, differences were observed in the wastewater treatment dynamics of the biofilm reactors. The effluents' concentrations of nutrients were affected differently along time for each filter. The average ammonia removal rate for lava rocks, industrial cloth, blue stone gravel, coral and coconut fibers media were 87.3%, 79.6%, 64.6%, 43.4% and 27.7% respectively. Although similarities were observed in the statistical analysis of these performances, certain materials have demonstrated specific results. Whereas the biofilm reactor containing the coconut fibers achieved the nitrification process poorly, its denitrification performance was much better thanthe others. An average nitrate removal of 73% was observed for the biofilm reactor with coconut fibers as medium.

The relationships between the media and the biofilm performances observed during the research demonstrate the importance of the role of the media in the biofilm reactors functions. These relationships could be exploited in order to combine different material for a better treatment of wastewater. The development of new water treatment methods are promising if they can be applied to specific activities.