Post Treatment of UASB Reactor Effluent in an Integrated Duckweed and Stabilization Pond System

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ABSTRACT

The reuse of domestic wastewater in agriculture is a global practice of particular importance in arid and semi-arid regions of the world, where the scarcity of water supply is a common problem. It provides farmers with a steady supply of cheap nutrient and water. Many wastewater treatment methods such as upflow anaerobic sludge blanket digester are not capable of producing effluents that meet World Health Organization's guidelines for irrigation. An incorporation of some form of post-treatment is necessary for UASB to comply with the WHO guidelines. An integrated pond system, consisting of algae and duckweed ponds, has proved to be a simple and effective method for post treatment of UASB. The integrating duckweed and stabilization ponds in one system neutralize their respective disadvantages. Efficient removal of both pathogens and suspended solids can be achieved. The final effluent has a high quality and satisfies the bacterial guidelines of the WHO for unlimited irrigation (1000 fecal coliforms per 100 ml) and thus is suitable for irrigation from a health perspective.

KEY WORDS

Algal Pond, Duckweed Pond, Fecal Coliforms, Pathogens, UABS

INTRODUCTION

The reuse of domestic wastewater in agriculture is a global practice of particular importance in arid and semi-arid regions of the world, where the scarcity of water supply is a common problem. The reuse of domestic wastewater provides both an additional supply of water for irrigation and a source of nutrients and organic material, which can act as crop fertilizers and soil conditioners.

The World Health Organization (WHO) has stated that removal of pathogenic organisms is the main objective of treating wastewater that will be used in agriculture. These pathogens such as rotaviruses are still a major cause of diarrhea and vomiting in children and acute gastroenteritis in adults. Infected person excrete large numbers of rotaviruses around 1011 fluorescent foci per gram of faeces (wet weight) and these can survive for many days in wastewater (Oragui et al., 1995). WHO recognizes the important role that the pathogenic organisms play in transmitting water borne diseases and issued a guideline based on epidemiological assessment of health risks for treated wastewaters that will be used in agriculture. The guidelines stated that the effluent of wastewater treatment system must meet the standard of pathogen removals. For example, the effluent should have less than one intestinal nematode egg per litter and less than one thousand fecal coliforms per one thousand milliliter to permit its use in unrestricted irrigation (Dixo et al., 1995)

Many wastewater treatment methods are used to treat domestic wastewater for agricultural uses. The Upflow Anaerobic Sludge Blanket (UASB) reactor is a reliable and simple technology for the preliminary treatment of domestic sewage. This technology is applied in wastewater treatment and reuse in arid and semi-arid regions. However, the UASB effluent still contains high counts of fecal microorganisms, which does not meet the effluent quality required by WHO for unrestricted irrigation. For example, UASB removes 89.6% of nematode eggs at a mean volumetric egg loading of ($5.8\times\ 10^{7}/m^{3}.d$) and a theoretical retention time of seven hours (Dixo et al., 1995). Efficient fecal coliform removal is of paramount importance, because the fecal coliforms count in the effluent indicates health risk. In order to achieve the effluent standard of WHO, the UASB effluent should undergo post treatment.