Article

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Biodegradation of Toilet Wastewaters Generated in Aircrafts

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Wastewater generated in buses and aircrafts are known as blue water due to the addition of blue chemical products to deodorize, sanitize and break down solid waste in tank holdings. The blue water at high concentration presents inhibitory effects on microorganisms making difficult their treatment. This research evaluates the acclimation and degradation of aircraft blue water using discontinuous and continuous bioreactors. Acclimation was conducted in batch mode. In a discontinuous biological process with an initial COD concentration of 1150 mg COD/L, the removal efficiency was higher than 80% as COD, TOC and BOD_5. Total Suspended Solids in the effluent were lower than 60 mg/L. In the continuous activated sludge system an initial concentration of 850 mg COD/L of blue wastewater was applied. Here, removal efficiencies up to 72 and 88% as COD and BOD_5 were obtained, respectively. For both processes, the application of punctual high concentration of blue water resulted in decrease of removal efficiency (< 40%).

Keywords: Blue water; SBR; Inhibitory wastewater; Activated sludge.

INTRODUCTION

Wastewaters generated in public transportations such as aircrafts, buses, rail and marine vehicles are known as blue waters due to the addition of blue dyes products to deodorize, sanitize and break down solid waste in tank holdings. Besides dye, the sanitizing product may contain formaldehyde, glyoxal, glutaraldehyde, quaternary ammonium, alkyl phenols and glycols.[1] The blue water is characterized by a high chemical oxygen demand, undiluted organic matter, toilet paper and in addition to the chemicals present in the product, which can inhibit the growth and activity of microorganisms.[2]

Sequencing batch reactor (SBR) processes have been demonstrated as efficient technology to treat industrial wastewater containing inhibitory compounds.[3] Mainly, SBR operates under five well-defined phases: fill, react, settle, draw, and idle. The advantages of SBR has been attributed to their single-tank design and the flexibility of allowing them to meet many different treatment objectives, which derives from the possibility of adjusting the duration of the different phases. In SBR, the microorganisms are exposed to pressure selection which increase the possibility to obtain acclimated biomass to degrade inhibitory compounds; this was proved in the case of the blue waters in this research. During the acclimation there is a selection and a multiplication of specialized microorganisms and physiological transformations can occur in the metabolic system of the microorganisms. In aerobic microbial communities, the acclimation periods range from several hours to several days.[4] In this sense, there are not reports about the acclimation of microorganisms applied to blue water degradation.

Thus, the objective of this research was to evaluate the degradation of the blue water coming from aircrafts using a discontinuous and a continuous reactor via an acclimated microbial population.

EXPERIMENTAL

The experimental set up was divided in three phases: 1) The evaluation of the inhibitory effect of synthetic blue water on the microorganism's respiratory activity, 2) The acclimation of microorganisms to degrade blue waters from aircrafts in an SBR reactor, and 3) Degradation of blue water using the acclimated biomass in a continuous process. Blue water was collected from the holding tank of an international airport where aircrafts toilet waste is discharged.

Inhibitory effect on microorganisms' activity: The effect of different initial chemical oxygen demand (COD) concentrations of a commercial blue product was evaluated using respirometric activity test. The respirometric measurements were performed in a mini-reactor of 160 mL. 10 mL of aerobic culture was used as inoculum and the different blue water concentrations

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