DECREASING THE START-UP PERIOD OF ANAEROBIC SLUDGE BLANKET (UASB) REACTOR FOR THE BIODEGRADATION OF OLIVE MILL WASTEWATER

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Introduction

Olive mill wastewater (OMW) generated by the olive oil extraction process is the main waste product of this industry. The uncontrolled disposal of OMW is becoming a serious environmental problem, due to its high organic COD concentration, and because of its high content of microbial growth-inhibiting compounds, such as phenolic compounds and tannins. The improper disposal of OMW to the environment or to domestic wastewater treatment plants is prohibited due to its toxicity to microorganisms, and also because of its potential threat to surface and groundwater. Within the different anaerobic treatment systems studied so far, up-flow anaerobic sludge blanket (UASB) reactor is considered to be one of the most popular bioreactors to treat agro-industrial wastewaters characterized with high organic load.

Literature reports on the adaptation of anaerobic biomass using UASB reactors generally describe a prolonged start-up period, typically gradually increasing the COD content from 1 to 25 g/L within a minimum period of one month. This time is considered crucial when dealing with seasonal wastewater such as OMW.

Project goals

- Reducing the organic material load in OMW generated in the region so that they can be disposed directly to municipal wastewater systems.
- Developing a new procedure for enhancing the activity of UASB reactors and shorten their adaptation periods, start-up period and hydraulic retention time.

Materials and Methods

1. OMW Characterization

OMW for this study was obtained from different olive mills in the Galilee area and was refri-gerated at 4℃. The parameters COD, BOD, TSS, VSS, pH, and alkalinity of the collected OMW samples were determined according to the Standard Methods for the Examination of Water and Wastewater, 20th Edition 1998. All chemicals of analytical grade were purchased from Sigma.

2. UASB Reactor and Biomass Inoculum

Figure 1 shows the schematic drawing of the UASB reactor of 28L. A volume of 6 liters of biomass (5 kg of dry base after centrifugation) of Prigat sludge were inoculated into the two reactors respectively. After this, the two reactors were filled with tap water.

The raw olive mill wastewater was diluted by 1:5 followed by rough screening by 32 mesh screen in order to remove large particle. The pH of the diluted OMW was adjusted to 7 using NaOH/NaHCO3 2 M. Due to nitrogen lack in OMW, 0.25 g/l of Urea (commercial) were added.

The feed was pumped into the UASB by peristaltic pump and the flow rate was maintained to have a hydraulic retention time (HRT) of 2.8 days. Each reactor was started-up by gradual increase in the organic loading rate from 2 to 16 g COD/l d (equivalent COD of about 5000 to 40,000 mg/l respectively). These values were equivalent to HRT of 2.7-2.8 days.

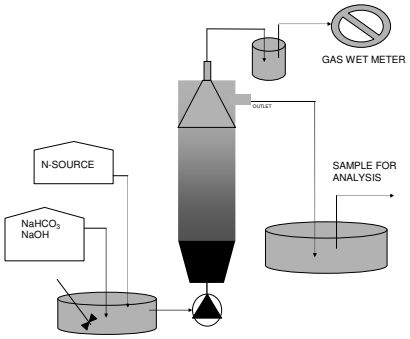

Fig. 1: Schematic drawing for the UASB 28 L in volume reactor system

Results

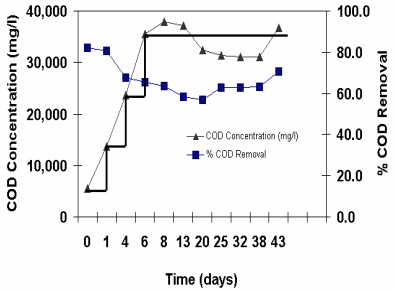

Figure 2: The COD concentration and COD % removal as a function of time in the being studied UASB reactor using a fresh biomass exposed to high concentrations of OMW within a short adaptation period. Experimental conditions: Organic loading rate was 12g/L.day, temperature of 35oC, and pH of 7.

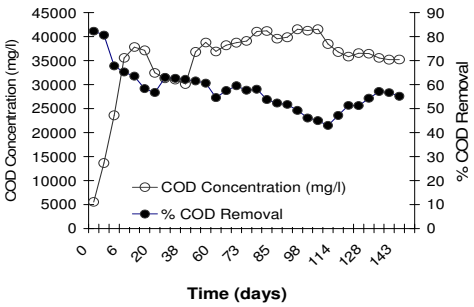

Figure 3: The COD concentration (mg/L) and COD % removal as a function of time in a UASB reactor using a fresh biomass exposed to high concentrations of OMW within a short adaptation period. The OMW influent was not supplemented with urea.

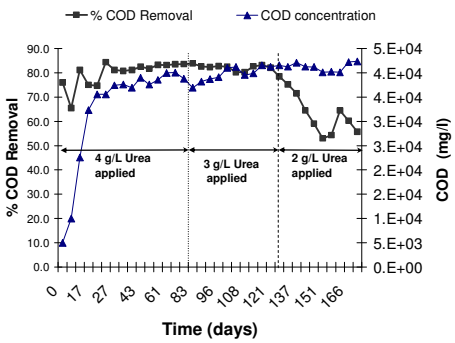

Figure 4: The COD concentration (mg/L) and COD % removal as a function of time in a UASB reactor using a fresh biomass exposed to high concentrations of OMW within a short adaptation period. The OMW influent was supplemented with different concentrations of urea as a source of nitrogen as specified on the figure.

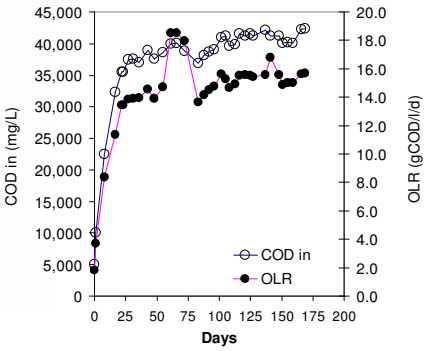

Figure 5: The COD concentration (mg/L) and OLR as a function of time in a UASB reactor using a fresh biomass exposed to high concentrations of OMW within a short adaptation period. The OMW influent was supplemented with different concentrations of urea as a source of nitrogen as specified on figure 4.

Conclusions

1. The use of UASB reactors for the treatment of OMW could be an efficient tool for the degradation of organic materials
2. The OMW feed should be supplemented with additional nutrition to ensure high removal rates of organic materials
3. The adaptation period for the biomass in UASB reactor can be shortened to a minimum of two weeks with 2.8 days of hydraulic retention time.

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