USE OF A SEQUENTIAL BATCH REACTOR WITH MOLASSES AS A CARBON SOURCE FOR GROWTH OF A BACTERIAL CONSORTIUM CAPABLE OF DEGRADING HYDROCARBONS

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Introduction. Hydrocarbons are one of the four most important contaminants in water and soil. Biodegradation is one of the most frequent solutions, and includes the use of bacterial consortia for treating toxic substances (1). These bacterial communities get adapted in the presence of pollutants, where symbiotic interactions and environmental conditions build an ideal environment for hydrocarbons to be used as a carbon and energy source (4).
The objective of this work was to grow a bacterial consortium capable of degrading hydrocarbons in a sequential batch reactor (SBR) with molasses as the carbon source.

Methods. A kinetic study was carried in 1 L flasks using Bushnell Haas (BH) medium with 0.5, 1, 3 y 5% v/v of sterile cane molasses and 5% v/v of inoculum (37°C, 150 rpm, 5 days). Biomass increase was measured using Peterson technique. DNS was used for reductive sugars (RS) measure.
Same conditions were carried out in a 3 L reactor with 0.5% v/v of sterile cane molasses. Retention time (RT) of 36 h and sedimentation of 1 h were applied in each cycle, after which 50% of the total volume was drained and refilled with fresh medium with molasses.
For petroleum assay, 100 ml flasks were used with 0.5% v/v of petroleum and 5% v/v of inoculum from reactor, under same conditions except for a RT of 3 weeks. In addition to the Peterson's technique, Gas Chromatography (GC) was used for the measure of the decrease of hydrocarbons.

Resultados y discusión. During the kinetic study, the Specific Growth Rates (μ) were 0.1825, 0.1801, 0.1125 and 0.1005 h^{-1} for 0.5, 1, 3 and 5% v/v of molasses respectively. Stationary Phase was achieved at a range of 30-36 h. It was observed a decrease in μ with each substrate concentration increase, probably due to the presence of organic acids, an increase of the osmotic pressure or the formation of toxic by-products for some of the consortium's species. 0.5% v/v of molasses was the concentration with the greater value of μ and thus this was chosen for the reactor inoculation.
Five consecutive cycles was analyzed in the reactor, and it was observed an increase in μ with each one, arising 500.1 mg/ml for biomass concentration in the last one. The consumption rate of RS was also increased to 0.1179 h^{-1}.

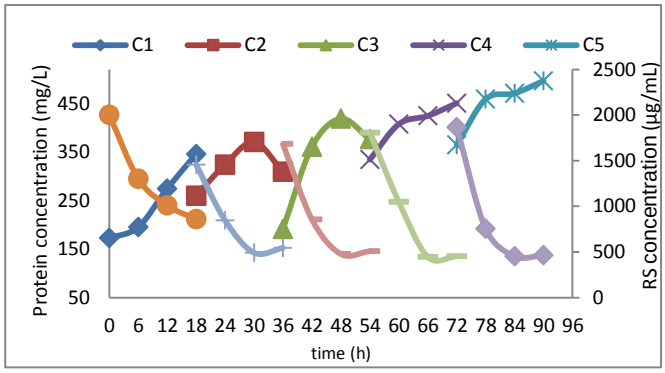

Fig 1. Microbial growth kinetics (left) and RS consumption (right) for cycles 1 to 5 (C1-C5) in a 3 L reactor with 0.5% v/v of cane molasses.

In the subsequent petroleum assay, it was found a μ of 0.013 h^{-1} and a total of 60.1% of the petroleum light part was consumed. It also was observed a fluctuation in degradation with time, probably due to the formation of certain intermediaries in the degradation of more complex molecules.

Conclusions. It was achieved a 119% increase for the consumption rate of RS thanks to the SBR, showing that the bacterial consortium is capable of using cane molasses as a carbon source. It was also demonstrated that the consortium maintains its capacity of degrading hydrocarbons.

References

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