



OIL-DEGRADING MICROBIAL CONSORTIUM PRODUCTION IN DIFFERENT BIOREACTOR SCALES USING THE VARIABLE U_g STRATEGY

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Introduction. The ratio of transfer rates of $C_{16}H_{34}$ and O_2 (TRH/TRO) was evaluated as an engineering approach to improve the production of hydrocarbon-degrading consortia in an airlift bioreactor (ALB) (1). The objective of this work is to evaluate, considering this ratio, the production of oil-degrading microbial consortium when performing a scaling down with a scale factor of 20:1 (0.5 to 10 L) using the variable U_g strategy proposed in a previous work (1).

Methods. The superficial gas velocity (U_g) was varied in each of the ALB (0.5 and 10 L) according to a previous work between 0.61 to 2.7 cm/s (1). U_g of 0.61 cm/s was used during the first three days of cultivation; from the fourth day until the end of the culture time, U_g was increased to 2.7 cm/s. Initially, the ratio of transfer rates of $C_{16}H_{34}$ and O_2 was close to $0.012 \text{ g } C_{16}H_{34} (\text{g } O_2)^{-1}$ and decreased to $0.0015 \text{ g } C_{16}H_{34} (\text{g } O_2)^{-1}$ on the third day. The increase in U_g (2.7 cm/s) allowed TTH / TTO increase to $0.0021 \text{ g } C_{16}H_{34} (\text{g } O_2)^{-1}$. The $C_{16}H_{34}$ was exhausted by the tenth day, just as production of suspended solids (SS) peaked to $8.1 (\text{g } SS) \text{ L}^{-1}$. Figure 1 shows the profiles of $C_{16}H_{34}$ and SS using the variable U_g strategy.

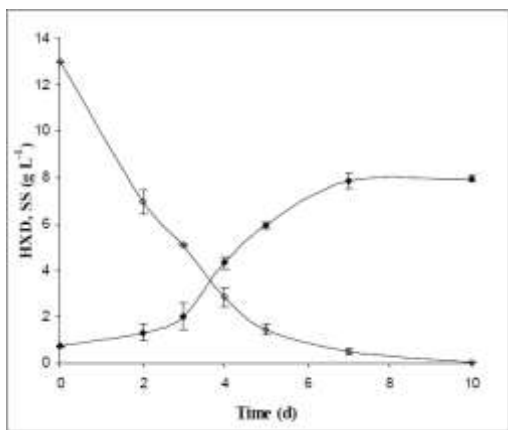


Figure 1. $C_{16}H_{34}$ (◇) and SS (◆) profiles using the strategy of variable U_g

Results. The performance in grams of the consortium per gram of hydrocarbon consumed is the same for the two scales using variable U_g strategy. In previous papers, working with a bubble column bioreactor, the major scale (10.5 L) showed lower yields. Other researchers (2) found that biomass production may decrease with the scaling of the bioreactors.

Data shown in Table 1 was obtained in assessing the productivity and performance in the ALB when performing a scaling of 20:1 with variable U_g strategy and the use of TRH/TRO ratio.

Table 1. Production of SS, yield and productivity for different scales (20:1) using the variable U_g strategy.

U_g	ALB capacity (L)	Production of SS	Yield	Productivity
		(g SS/L)	(g SS/ (g $C_{16}H_{34}$))	(g SS/(Ld))
Variable 0.61 y 2.7 cm/s	0.5	7.9 ± 0.21	0.55 ± 0.01	1.02 ± 0.03
	10	7.8 ± 0.23	0.55 ± 0.13	1.01 ± 0.05

Conclusions. It was demonstrated that using the variable U_g strategy to control the ratio of transfer rates hydrocarbon and oxygen (TTH/TTO) as operating criteria for the production of an oil-degrading microbial consortium maintains performance even with a change of scales 20:1.

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References.

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