OXYGEN TRANSFER AND MIXING IN STIRRED TANK, AIRLIFT AND PACKED BED BIOREACTORS WITH CARBON SOURCE IMMISCIBLE AND DIFFERENT OPERATING CONDITIONS FOR BIOSURFACTANT PRODUCTION

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Introduction. There are different configurations of bioreactors that can be used to carry out a biotechnological process. In the case of biosurfactants production, the most commonly used bioreactors are stirred tanks because their ease operation. Nevertheless airlift and packed beds bioreactors have not been so used.

The principal parameters to determine in a bioreactor are oxygen transfer and mixing. For aerobic bioreaction, oxygen transfer can be a limiting factor in productivity due to the low solubility of oxygen in the medium. In the case of mixing, when this is insufficient the culture medium, homogeneity is lost and affects cell growth, oxygen transfer, pH, temperature, and limited product formation (1).

The aim of this study is to evaluate the oxygen transfer and mixing in a stirred tank, airlift and packed bed bioreactors, using corn oil as immiscible carbon source in order to propose the best operating conditions of each bioreactor for the production of rhamnolipids by *Burkholderia sp.*

Methods. The stirred tank (Applikon-Easy Control) was operated at 200 and 350 rpm; in airlift were tested in two different internal diameter columns and in the packed bed three packaging different. In all cases, the aerations tested were 0.5, 1 and 2 vvm. To assess the oxygen transfer, the dissolved oxygen was measured in Bushnell-Haas mineral medium with 8% v/v corn oil, using an oxygen sensor for subsequently determining the volumetric oxygen transfer coefficients (k_La) of each operating condition tested. For the mixing tests the pulse experiments (2) were made with tracer (methylene blue), taking samples at different time intervals.

Results. The oxygen transfer tests showed that k_La is increase directly with the air flow (3), and when stirred tank is operated at 350 rpm, using a smaller diameter inner column in airlift and a curved packing in packed bed (Figure 1).

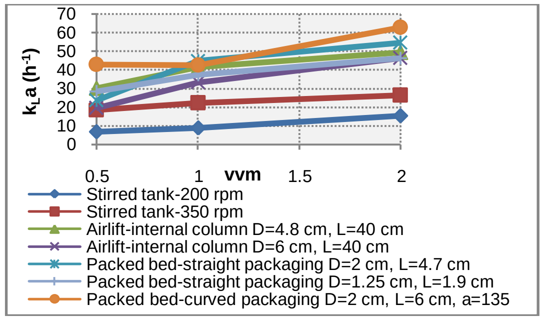

Fig.1 Volumetric oxygen transfer coefficients (k_La) in the three bioreactors.

In the case of mixing, the curves of the distribution function E(t)&t (Figure 2) in the three bioreactors showed no differences, so it was decided to use the tanks in series model (n) to determine the value of "n"; using as criterion that lower value of n, the mixing is better.

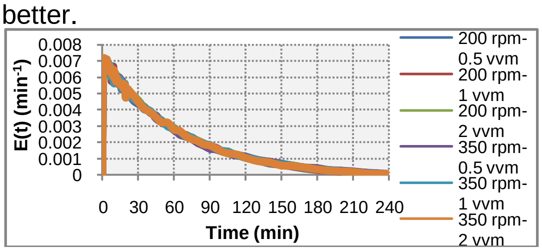

Fig.2 Curve of the distribution function E(t)&t of stirred tank

Conclusions. The mixing tests and k_La obtained, allowed to determine the best operating conditions for the rhamnolipids production by *Burkholderia sp* in the three bioreactors: stirred tank at 350 rpm with 0.5 vvm; airlift with internal column of smaller diameter to 0.5 vvm and packed bed with curved packing to 1 vvm.

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References.

1. Najafpour, G. (2007). *Biochemical Engineering and Biotechnology.* Elsevier, Oxford. 14-21.
2. Fogler, H. (2004). *Elements of Chemical Reaction Engineering*. Prentice Hall, New Delhli. 813-814.
3. Sauid, M. and Murthy, V. (2010). *Applied Science,* 10(21):2745-2747.