**Influence of Fluid-Dynamic Conditions in STBR on *S.Blattae* (P424ibpso) Cultures for Isobutanol Production.**

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**Highlights**

* Hydrodynamic stress was detected for high stirrer speeds in STBR cultures
* Metabolite distribution as function of OTR-OUR variations is shown
* The oxygen conditions have effects over bacterial growth and metabolism

**1. Introduction**

Nowadays, there are a growing interest in obtaining alternatives for bioethanol as biofuel, among them isobutanol is a good alternative [1]. Isobutanol can be used as additive improving gasoline properties and also as chemical platform, to produce solvents or plasticizers agents [2]. It is well known that the fluid-dynamic conditions could critical in bacteria cultures [3], affecting culture performance. The objective of this work is to study the effect of fluid-dynamic conditions in STBR on *S. blattae* (p424IbPSO) cultures for the production of isobutanol.

**2. Methods**

Seven STBR cultures of S.blattae (p424IbPSO)[4] strain were carried out under different fluid-dynamic conditions, changing the stirrer speed from 100 to 1200 rpm and remaining constant the air flow (1vvm). The bacteria growth were measured by spectrophotometer analysis and the cell viability evaluated by total viable count technique. The cell morphology was also evaluated by electron microscope observations. During the growth, the time course of glucose, isobutanol and by-products were measured by HPLC analysis. The kLa values were estimated for the seven experiments under different conditions, and OTR, OURmax and qO2 were also calculated from kLa values and the DO concentration measurements with time. The isobutanol production in resting cells state was also studied employing cells collected from cultures under different fluid-dynamic conditions and growth times.

**3. Results and discussion**

The biomass growth rate increases in the runs carried out employing stirrer speeds between 100 and 600 rpm, and remain constant in the runs performed from 600 to 1000 rpm. However, the biomass growth rate decreases in the runs using stirrer speeds higher than 1000 rpm. The cell viability decreases for high agitation speeds, in the runs conducted at agitation greater than 800 rpm. Cells aggregates, cell damage and cell elongation were also detected, all these phenomena appearing for high agitation speeds. The increases of stirrer speeds produces an increase in the OTR values, and, depending of the conditions, also in the OUR values. When OTR < OUR maximum value, the DO concentration quickly falls to zero, and the culture produces more lactic acid, ethanol and isobutanol. On the other hand, when OTR > OUR maximum, the culture produces more acetic acid and biomass. In Figure 1, It can be seen the yield of each compound.

The same carbon flux distribution is maintained when the cultures are performed on resting cells with cells cultured under different oxygen conditions.



***Figure 1.*** *Yield value on biomass and the main compounds referred to consumed glucose vs stirrer speed in STBR culture. The yield on lactate (La), acetate (Ac) and CO2 can be seen in graphic A. The yield on isobutanol (Ib), ethanol (Et) and succinate (SuA) for each agitation (N) can be seen in the graphic B. The yield on high oxidation products (OxP) and biomass (X) it can be observed in graphic C.*

**4. Conclusions**

The hydrodynamic stress appears when high stirrer speeds were employed in STBR. The metabolite distribution is clearly affected by DO concentration, as a consequence of the relative values of OTR and OUR maximum values. It is relevant that these effects are maintained when the culture is carried out in resting cells, in these assays under the same conditions.

**References**

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