

USE OF GLYCEROL AND SUGARCANE ETHANOL VINASSE AS RAW-MATERIALS FOR THE PRODUCTION OF 2,3-BUTANEDIOL / ACETOIN BY *Enterobacter aerogenes*

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Abstract

The production of biofuels in Brazil, especially ethanol and biodiesel, has been even more increased. In these processes, there is a considerable generation of the residues vinasse and glycerol, respectively. Both residues could be employed as raw-materials for the fermentative production of 2,3-butanediol, a substance that could be useful for the chemical industry and as fuel. As such, the aim of this work was to assess the use of glycerol as a carbon source and vinasse as a nutrient source in the cultivation of *Enterobacter aerogenes* ATCC 13048 envisaging the production of 2,3-butanediol. PC medium (Pirt and Callow, 1958) containing 60 g/L of commercial glycerol was used as the basis for the formulations evaluated and had the following composition (g/L): $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0; KOH, 0.45; EDTA, 0.51; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.30; $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, 0.09; $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$, 0.023; $\text{ZnSO}_4 \cdot 4\text{H}_2\text{O}$, 0.0075; $\text{MnSO}_4 \cdot 7\text{H}_2\text{O}$, 0.0038. The following formulations, in g/L, were compared in the tests: V1 - PC medium; V2 - $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0; KOH, 0.45; EDTA, 0.51; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.30; $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, 0.09; V3 - $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0; KOH, 0.45; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.30; $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$, 0.09; V4 - $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0; KOH, 0.45; $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$, 0.30; V5 - $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0; KOH, 0.45; V6 - $(\text{NH}_4)_2\text{SO}_4$, 7.2; $(\text{NH}_4)_2\text{HPO}_4$, 6.0. Medium components were solubilized in vinasse provided by PETROBRAS S.A. and the pH value was adjusted to 6.5 prior to inoculation. Cultivations were carried out in 500-mL Erlenmeyer flasks containing 100 mL of medium, under reciprocal agitation of 300 rpm (B. BRAUN CERTOMAT), at 37°C. Cell concentration was measured gravimetrically, glycerol was quantified by a colorimetric method and products (2,3-butanediol and acetoin) were determined by HPLC. Taking in account the equilibrium observed between 2,3-butanediol and acetoin in this process, the analysis of results was done considering both substances together. The highest conversion of glycerol to cell biomass ($Y_{X/S}$) was observed with medium V6 (0.080 g/g), indicating that vinasse, excepting for mineral nitrogen, is an adequate source of nutrients for *E. aerogenes* growth. Product yields ($Y_{P/S}$) were similar in experiments V2 (0.44 g/g) and V6 (0.41 g/g), these values corresponding to 90 and 84% of the theoretical maximum, respectively. The results made clear the potential of using both residues in the formulation of media for the production of 2,3-butanediol / acetoin by *E. aerogenes*.

Keywords: 2,3-butanediol / acetoin, *Enterobacter aerogenes*, glycerol, sugarcane ethanol vinasse

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