C J Andrade et al., J Biotechnol Biomater 2015, 5:2
http://dx.doi.org/10.4172/2155-952X.S1.038

OMICS International
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8th Euro Biotechnology Congress

August 18-20, 2015 Frankfurt, Germany

Simultaneous production of surfactin and 2, 3-butane diol using optimized culture medium

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Currently, industries focus on environment friendly processes. An alternative is replacement of chemicals by bioproducts with similar properties – obtained from biotechnological processes - (eg. surfactants to biosurfactants). The main bottlenecks implementing of this technology are: culture medium and downstream process. Culture medium represents ≈25-35% of production cost whereas downstream ≈60-85%. Cassava wastewater (CWW) is well-described as culture medium for surfactin production, which is a sort of biosurfactant (BS). On the other hand, only a few papers evaluated the affect of activated carbon (AC) and whey on surfactin production. BS are amphiphilic compounds, mainly from microbial origin. The 2,3-Butanediol (2,3-BD) is a promising compound, which can be produced also by bioprocess. BS and 2,3-BD have a wide range of potential applications. The two main producers of 2,3-BD are Bacillus and Klebsiella. Compared with Klebsiella, Bacillus has lower yields, however, Bacillus synthesis only the isomer D-(-)-2,3-BD, which is advantageous. The aim of this work was evaluated different concentrations of CWW, whey and AC – as culture medium – for the simultaneous production of surfactin and 2,3-BD, from Bacillus subtilis LB5a. Whey and CWW were dried by spray dry and lyophilizer, respectively. Then, they were rehydrated at different concentration and used as culture media. The central composite design (erlenmeyer), was carried out with 3 variables (CWW, whey and AC), which –α=0 g.L-1 and +α=as twice the original concentration or recommended by literature, as following: (experimental points=g.L-1): CWW (-1.68=0; -1=29.95; 0=74; +1=118.04; +1.68=140.8); whey (-1.68=0; -1=26.26; 0=55; +1=87.73; +1.68=110); AC (-1.68=0; -1=10.12; 0=25; +1=39.88; +1.68=50). After 72h of fermentation, samples were collected, centrifuged and mixture to ethyl acetate (1:1) and kept for 24h (equilibrium). Then, 1µL of organic phase was injected in CG-FID to analysis the concentration of 2,3-BD. Thus, was identified the optimum concentration of CWW, AC and whey. Then, the experiments of validation were carried out (erlernmeyer). Finally, it was scale-up to bioreactor (7.5L) 3L working volume. Foam ≈230mL (high content of BS) from the top of bioreactor was collected, centrifuged, precipitated (pH=2), neutralized, rehydrated (200mg.L-1) and analyzed by HLPC. On the bench experiments, the 2,3-BD production was evaluated by SPME and liquid-liquid extraction. AC may induce the BS production by growth as biofilm and improve also the transfer coefficient of oxygen. The central composite design indicated the ideal culture medium composition is (g.L-1): ≈74 (CWW), 27.7 (whey) and 25 (CA). Therefore, regarding to these substrates is unnecessary dry them. On the bench experiments, for the first time was identified the 2,3-BD production by SPME and liquid-liquid extraction, in which the highest production interval (both analysis) was between 60 and 72h, ≈300 mg/L (80% by liq-liq and 20 % SPME). ABS, after acid precipitation, reached ≈55% of purity. Therefore, it was confirmed the production of surfactin and 2,3-BD, simultaneously.

Biography

C J Andrade is a PhD student in Biotechnological Processes at State University of Campinas, and has been working on methods to use industrial wastes as a culture medium. Among the compounds of his interest are biosurfactants, galacto-oligosaccharides, enzyme, flavours, etc. He is also interested on the integration between fermentation and purification, in particular, ultrafiltration.

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