World Academy of Science, Engineering and Technology
International Journal of Biotechnology and Bioengineering
Vol:11, No:03, 2017

Adjustment and Scale-Up Strategy of Pilot Liquid Fermentation Process of Azotobacter sp.

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Abstract : The genus Azotobacter has been widely used as bio-fertilizer due to its significant effects on the stimulation and promotion of plant growth in various agricultural species of commercial interest. In order to obtain significantly viable cellular concentration, a scale-up strategy for a liquid fermentation process (SmF) with two strains of A. chroococcum (named Ac1 and Ac10) was validated and adjusted at laboratory and pilot scale. A batch fermentation process under previously defined conditions was carried out on a biorreactor Infors®, model Minifors of 3.5 L, which served as a baseline for this research. For the purpose of increasing process efficiency, the effect of the reduction of stirring speed was evaluated in combination with a fed-batch-type fermentation laboratory scale. To reproduce the efficiency parameters obtained, a scale-up strategy with geometric and fluid dynamic behavior similarities was evaluated. According to the analysis of variance, this scale-up strategy did not have significant effect on cellular concentration and in laboratory and pilot fermentations (Tukey, p > 0.05). Regarding air consumption, fermentation process at pilot scale showed a reduction of 23% versus the baseline. The percentage of reduction related to energy consumption reduction under laboratory and pilot scale conditions was 96.9% compared with baseline.

Keywords : Azotobacter chroococcum, scale-up, liquid fermentation, fed-batch process
Conference Title : ICBCP 2017 : International Conference on Biological and Chemical Processes
Conference Location : Madrid, Spain
Conference Dates : March 26-27, 2017

Open Science Index, Biotechnology and Bioengineering Vol:11, No:03, 2017 publications.waset.org/abstracts/57291.pdf