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CONTINUOUS PRODUCTION OF BIOPOLYMER (PHB) FROM BY-PRODUCT OF BIODIESEL INDUSTRY (GLYCEROL) USING HIGH CELL DENSITY CULTURE

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Versatile qualities of strength and lightness of petroleum derived plastics have an ever-increasing demand in society but are restricted primarily due to its non-biodegradable nature and its production from disappearing petrochemical resources. Alternatives are therefore, sought for the polymer of similar properties which is not only biodegradable but also produced from renewable resources. Some microbes have shown a distinct ability to accumulate biodegradable polymer PHB (poly-hydroxybutyrate) when grown under limiting concentration of nitrogen and phosphates. However, the cost of production of these polymers is significantly higher than that derived from fossil fuel resources. Attempts are made to use glycerol (by product of bio-fuel industry) as substrate to economize the production. To further increase concentration, yield and productivity of bio/copolymer, the process is optimized to be carried out in fed batch followed by continuous mode with cell retention or cell recycle device. Batch cultivation of C necator in glycerol exhibited a long lag phase. To overcome this, attempts were made to use glycerol and glucose as mixed substrate for above cultivation to improve the process performance. Statistically optimized concentrations of glycerol and glucose, 25g/l and 5g/l were used to study growth kinetics in batch mode. The results were used to develop a mathematical model for the growth of biomass and accumulation of PHB, which was further extrapolated for fed batch and continuous mode. To establish a better method for high cell density, both spin filter (cell retention device) and inclined settler (cell recycle device) were used in separate sets of experiments. It was observed that spin filter, the cell retention device, has higher retention efficiency as it produced 12.7g/l biomass and 8.6g/l PHB as opposed to 10.98g/l biomass and 6.9 g/l PHB in case of inclined settler. The advantages and limitation of use of either devices for cell retention.

BIOGRAPHY

Ashok Kumar Srivastava has received his PhD degree from the McGill University, Montreal in 1990. He has 40 years of industrial research teaching experience in Biochemical Engineering and Biotechnology. He has 110 international journal papers, 154 international/national presentations and two patents to his credit. He has supervised 16 PhD (five continuing) and 73 master's theses. His major interest is in modelling simulation, optimization and control of bioprocesses, microbial/plant cell/hairy root cultivations for important metabolite production (bio/copolymer production, podophyllotoxin, azadirachtin, ajmalicine, shikimic acid production etc) and novel bioreactor development.

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