

Lecture Notes in Bioengineering

Doraiswami Ramkrishna
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Advances in Bioprocess Engineering and Technology

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Lecture Notes in Bioengineering

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Preface

Bioprocess engineering and technology is primarily associated with the commercial application of living organisms on large scale. Commercialization of biological discoveries requires substantial engineering work. Bioprocess engineering and technology is an interdisciplinary subject which brings disciplines of biology and engineering on the same platform. A large number of disciplines like microbiology, genetics, chemistry, biochemistry, engineering mathematics, modelling and simulation and computer science have contributed significantly in achieving the target of delivering product and process to the society. In this spectrum, a large number of research findings are accumulating every day from all these disciplines. Many of these findings require proper scrutiny to find their place to the initiative for bioprocess development for future commercialization. The collection of data for scrutiny and review are primarily required by the experts for any further promotion of bioprocess to the next phase. It is true that global young generation is trying hard to generate data in this domain and aimed at the production of biopharmaceuticals, bio fuels and, development of biosensors, pollution control technologies, such as, mineral recovery, bioremediation of soil and water and so on. With the objective to assemble these data, Heritage Institute of Technology, Kolkata (HITK), India, hosted the 1st International Conference on Advances in Bioprocess Engineering and Technology on 20–22 January, 2016. The grand success in the effort tempted the institute to arrange second such conference: 2nd International Conference on Advances in Bioprocess Engineering and Technology on 20–22 January, 2020 (ICABET 2020). Department of Biotechnology and Department of Chemical Engineering of HITK successfully organized the conference. The conference aimed to highlight areas like fermentation technology and bioreactor; environment and agriculture; food, pharmaceutical and health care; sustainable energy; nanomaterials and nanotechnology. Each session was well participated, particularly by young generation of researchers. Many of them got the opportunity to meet and discuss

their research with expert seniors. I personally appreciate the objective and success of the conference and hope continuation of such conference in future with balance participation of senior and junior researchers.

Kolkata, India

Subhabrata Sengupta

Introduction

Biotechnology covers a broad segment of science and technology and commands worldwide research because of its potential impact on the improvement of quality of life. A bioprocess is the technology to obtain desired product or process with the help of living cells or their component or products like enzymes. Bioprocess engineering is a sub discipline within Biotechnology that is necessary for the translation of discoveries of this field into usable products, and processes deliverable to the society. Bioprocess technology was initiated in the first half of 20th century with the production of penicillin and citric acid by classical fermentation processes and later on fortified significantly by recombinant DNA technology, plant and mammalian cell culture techniques. Nano biotechnology, as a promising technology is also progressing, classically for cancer targeted drug development. Bioprocessing today became a major part of biotechnology domain involved in the production of huge number of human health care products, as well as products for agriculture, industries, and food processing. Apart from these, development of biosensors, detoxification of environmental pollutants, biofuel generation are major focused research in this domain.

In earlier days putting the biology in bottle took much longer time. It took almost 15 years for penicillin from discovery to application as drug. Glucose isomerase for high fructose syrup commercialization took 10 years or more. Products, that are now under development, demands novel bioprocess techniques which is more efficient and more economic, so as to reduce the time gap between discovery and application. Bioprocess Engineering by its very nature is interdisciplinary subject and thus requires more coherent approach to cross disciplinary research and education. Although bioprocess industries have successfully translated many basic research in biological science and molecular biology into valuable products, but more intense research is needed for the development of more effective biopharmaceuticals for many catastrophic diseases like cancer, heart diseases and kidney diseases. A second generation products should be available whose price-cost difference is low. Bioprocess for the generation of alternative energy source like ethanol, biohydrogen, biomethane, bioelectricity from renewable biomass should reach to consumer within a reasonable time period at affordable cost. Utilization of

renewable resources for production of renewable energy through bioprocess route has tremendous impact on lowering our energy budget. At the juncture of novel process development, the cost effectiveness and cost input for a bioprocess should be given importance for successful delivery to the society. Bioprocess engineering must carefully consider more economic route for the production, not only for new products but also for older products so that the larger fraction of society gets benefitted.

The major challenge in achieving optimal benefit from the technology is to bring about the synergistic combination of skills of biology, biotechnology, chemical engineering, bioprocess engineering and computer science on a single platform. In future, nanotechnology and information technology will see substantial progress and expansion of bioprocess engineering and technology.

Finally, it may be added that engineering in the traditional sense of scale up and cost reduction is not enough. Significant advances and efforts are required for implementing new ideas other than traditional pathways. An academic policy maker should take more responsibility of educating young generation of students in different cross fields of bioprocess engineering in a comprehensive manner from a single platform.

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Fungal Production of Single Cell Oil Using Defatted Oilseed Meals as Feedstock

[Ruma Dutta](#), [D. K. Bhattacharyya](#) & [Jayati Bhowal](#) 

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Abstract

In the present study, the production of single cell oil by three soil isolated strains of *Aspergillus* sp. was investigated in various basal lipid production media and by adding defatted oilseed (flaxseed, mustard, and rice bran) meal as supplements.

Microorganisms were identified after screening from rice bran oil industry-drained soil, and their growth and lipid production rate were investigated in various fermentation media. The organisms were

incubated with various oilseed cakes for higher oleic acid (18:1) and linoleic acid (18:2) contents. Growth and lipid production were monitored for 10 days, in which the 7th day showed optimum results. An increase in lipid yield from 24 to 55% was observed when supplemented with defatted oilseed meals. The maximum lipid content was observed in potato dextrose medium when the microorganism was supplemented with 3% flaxseed meal for 7 days. Gas chromatography (GC) analysis showed that the major fatty acids produced were palmitic (16:0), palmitoleic (16:1), stearic (18:0), oleic (18:1), linoleic (18:2), and linolenic (18:3).

Keywords

Single cell oil **Meal supplements**

Aspergillus sp. **Oleic acid** **Linoleic acid**

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