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Multi response optimization for production of citric acid from agricultural raw material using *Aspergillus niger*

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Citric acid is the most important organic acid produced in tonnage and is extensively used in food and pharmaceutical industries. It is produced mainly by submerged fermentation using *Aspergillus niger* and alternative sources of carbon such as agriculture raw materials have been intensively studied showing great perspective to its production. Citric acid is produced from Mahua flower by submerged state fermentation (SSF) using *Aspergillus niger* MTCC 282. There is a great worldwide demand for citric acid consumption due to its low toxicity when compared with other acidulates. Other applications of citric acid can be found in detergents and cleaning products, cosmetics and toiletries. Global production of citric acid has reached 1.4 million tones and there is annual growth of 3.5-4.0 % in demand/consumption of citric acid. As a result of the adverse market conditions, only big producers have survived. Any increase in citric acid productivity would be of potential interest and hence there is an obvious need to consider all possible ways in which this might be achieved. The production by submerged fermentation is still dominating. A cost reduction in citric acid production can be achieved by using less expensive substrate. The use of Mahua flower as support in submerged fermentation is economically important and minimizes environmental problems.

Mahua (*Madhuca indica*), a member of the family sapotaceae, is an Indian subtropical tree, grown throughout India. Mahua is valued much for its flowers, fruits and seed. The mahua flowers are rich in sugars, varying from 21 to 25% in fresh flowers and 55 to 58% in dried flowers. The flowers are also rich in vitamins (Vit A and Vit C), minerals and calcium and are regarded as cooling tonic and demulant. Mahua flowers can be utilized in different food preparations, alcohols, bakery products, vinegar and syrup. Spent flowers (after fermentation) can be used as a cattle feed. The Mahua fruit is berry-like and egg shaped, highly rich in sugars and is utilized for making the absolute alcohol. A mature Mahua tree can produce around 200kg of seeds annually. Seeds are much valued for its edible oil. The major unsaturated fatty acid found in mahua oil is linoleic acid, which has therapeutic use in reducing the cholesterol content in the blood serum and is therefore recommended to heart patients. While Mahua seeds are used for soap manufacturing, its oil is used in lubricating grease, candles, medicine for skin diseases, rheumatism, headache and laxatives. Mahua seeds may also be used for the preparation of defatted flour, which has greater potentiality in bakery products. Seed cakes obtained after extraction of oil constitutes fertilizer and it has also an insecticidal properties.

Keywords: citric acid, submerged fermentation, solid-state fermentation, agro-industrial residues, Optimization.

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