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Bioprospecting of marine resources for biopolymer production

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The main sector of the seaweed production in Indonesia is the seaweed culture. Unfortunately, the traditional method used for seaweed culture in the sea as well as weather dependency and only following the past experience of some seaweed culturists, cause the seaweed production in Indonesia is much lower than the other seaweed production countries. There has been a guide book which could help the seaweed culturists find the best time to cultivate the seaweed offshore, however it was inapplicable. Thus, this project is to create a software application called PEKA TALA (seaweed cultivation calendar guide in android based software application), which is accessible and applicable for the seaweed culturists. This software application is able to help the seaweed culturists understand the best time (climate, weather and tides) and the best place (temperature, salinity, brightness, depth and pH) for conducting a seaweed culture production offshore. This software also contains additional information about the seaweed disease, pest and weeds as well as the ways to prevent them during the culture process. West coast of India can be considered as important area for collecting diverse marine microorganisms with biopolymer producing capacity. In this attempt, 200 marine isolates from west coast of India was obtained, out of which one strain CSMCRI's Bacillus licheniformis PL26 was found to be potential for producing ε-polylysine and polyhydroxyalkanoate simultaneously in same fermentation medium. An efficient process was designed for simultaneous production of 0.2 g L^{-1} extracellular ε-polylysine utilizing Jatropha biodiesel waste residues as carbon rich source. The PHA produced by Bacillus licheniformis was found to be poly-3-hydroxybutyrate (P3HB). Further, in order to improve the ε-polylysine production, the carbon source was replaced with glucose which yielded 1.2 g L^{-1} ε-polylysine as oxygen transfer rate is very low in the medium containing crude glycerol. However, the developed process needs to be statistically optimized further for gaining still better product yield in an efficient manner. Therefore, an advanced modeling and optimization technique was applied to optimize medium parameters for enhanced ε-polylysine production by marine bacterium Bacillus licheniformis. The critical nutrients including glucose, yeast extract, magnesium sulfate and ferrous sulfate were incorporated in artificial neural networks (ANN) as input variables and ε-polylysine as the output variable. The ANN topology of 4-10-1 was found to be optimum upon training the model with feed-forward back propagation algorithm and on application of the developed model to particle swarm optimization resulted in 3.56±0.16 g L^{-1} of ε-polylysine under the following optimal conditions: Glucose, 34 g L^{-1}, yeast extract, 2.3 g L^{-1}, magnesium sulfate, 0.44 g L^{-1} and ferrous sulfate, 0.08 g L^{-1}. Thus, this optimization technique could significantly improve ε-polylysine by 196.7% as compared to un-optimized medium.

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