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Artificial Neural Network Approach for Modeling and Optimization of Conidiospore Production of Trichoderma harzianum

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Abstract : Trichoderma harzianum is a fungus that has been utilized as a low-cost fungicide for biological control of pests, and it is important to determine the optimal conditions to produce the highest amount of conidiospores of Trichoderma harzianum. In this work, the conidiospore production of Trichoderma harzianum is modeled and optimized by using Artificial Neural Networks (AANs). In order to gather data of this process, 30 experiments were carried out taking into account the number of hours of culture (10 distributed values from 48 to 136 hours) and the culture humidity (70, 75 and 80 percent), obtained as a response the number of conidiospores per gram of dry mass. The experimental results were used to develop an iterative algorithm to create 1,110 ANNs, with different configurations, starting from one to three hidden layers, and every hidden layer with a number of neurons from 1 to 10. Each ANN was trained with the Levenberg-Marquardt backpropagation algorithm, which is used to learn the relationship between input and output values. The ANN with the best performance was chosen in order to simulate the process and be able to maximize the conidiospores production. The obtained ANN with the highest performance has 2 inputs and 1 output, three hidden layers with 3, 10 and 10 neurons in each layer, respectively. The ANN performance shows an R2 value of 0.9900, and the Root Mean Squared Error is 1.2020. This ANN predicted that 644175467 conidiospores per gram of dry mass are the maximum amount obtained in 117 hours of culture and 77% of culture humidity. In summary, the ANN approach is suitable to represent the conidiospores production of Trichoderma harzianum because the R2 value denotes a good fitting of experimental results, and the obtained ANN model was used to find the parameters to produce the biggest amount of conidiospores per gram of dry mass.

Keywords : Trichoderma harzianum, modeling, optimization, artificial neural network
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