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Optimization of cyanobacteria-mediated synthesis of silver nanoparticles through response-surface methodology

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Cyanobacteria can produce a wide variety of bioactive compounds that can be exploited in phyconanotechnology sector. Conventionally, nanoparticles (NPs) are synthesized using chemical and physical methods, which often require significant energy and resources, leading to the production of potentially toxic and polluting waste materials. Cyanobacteria can synthesize NPs both from extracellular and intracellular compounds. NPs find extensive use in various fields due to their small size (below 100 nm) but large surface-to-volume ratio. This study aimed to select the best method forNPs synthesis optimization with two halophilic cyanobacteria from *Cyanothece* cluster 3 “*Halothece*”, Synthesis tests were conducted using $AgNO_3$ and the polysaccharides released into the cultivation medium or the cellular extracts obtained from two strains. Once the experimental conditions were established, an experimental design using the Box-Behnken design was formulated to assess the effect of three factors (extract concentration, metal concentration, and reaction temperature) and the combination of their levels on the response variable, i.e., the absorbance peak height at the spectrophotometer. The results were studied using the Origin Pro data visualization and imaging software. The optimal synthesis route was found to be the use of solutions containing cellular extract, and solutions containing Ag. The subsequent use of the Box-Behnken design and analysis of the obtained data led to the determination of the optimum combination of factors: metal concentration 1.5 mM, extract concentration 0.55 g/L, and reaction temperature 70°C.

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