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Title: Box-Behnken design for extraction optimization of crude polysaccharides from Tunisian *Phormidium versicolor* cyanobacteria (NCC 466): partial characterization, *in vitro* antioxidant and antimicrobial activities



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Box-Behnken design for extraction optimization of crude polysaccharides from Tunisian***Phormidium versicolor* cyanobacteria (NCC 466):****partial characterization, *in vitro* antioxidant and antimicrobial activities**Dalel Belhaj^{1,2*} dalel_belhaj@yahoo.fr; dalelbelhaj2@gmail.com, Donyez Frikha¹, Khaled Athmouni¹, Bouthaina Jerbi²Mohammad Boshir Ahmed³, Zouhaier Bouallagui⁴, Monem Kallel², Sami Maalej¹, John Zhou³, Habib Ayadi¹^{1*}*University of Sfax-Tunisia, Faculty of Sciences. Department of Life Sciences, Laboratory of Biodiversity and Aquatic Ecosystems, Ecology and Planktonology, Street of Soukra
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Abstract

In this study, response surface methodology (RSM) based on Box-Behnken design (BBD) was employed to optimize the aqueous extraction of crude polysaccharides from Tunisian cyanobacteria *Phormidium versicolor* (NCC 466). The optimal extraction conditions with an extraction yield of $21.56 \pm 0.92\%$ were as follows: extraction temperature at $81.05\text{ }^{\circ}\text{C}$, extraction time of 3.99 h, and water to raw material ratio of 21.52 mL g^{-1} . Crude *Phormidium versicolor* polysaccharides (CPv-PS) are found to be a hetero-sulfated-anionic polysaccharides that contained carbohydrate ($79.37 \pm 1.58\%$), protein ($0.45 \pm 0.11\%$), uronic acids ($4.37 \pm 0.19\%$) and sulfate ($6.83 \pm 0.28\%$). The carbohydrate fraction was composed of arabinose, xylose, ribose, rhamnose, N-acetyl glucosamine, galactose, glucose, mannose, glucuronic acid and saccharose with corresponding mole percentages of 2.41, 14.58, 2.18, 6.23, 7.04, 28.21, 26.04, 3.02, 0.86 and 5.07, respectively. Evaluation of the antioxidant activity *in vitro* suggested that CPv-PS strongly scavenged radicals, prevented bleaching of β -carotene and reduced activity. Furthermore, the CPv-PS exhibited effective antimicrobial properties.

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