

Extraction of anthocyanins from black bean hull with aqueous solutions of deep eutectic solvents by high pressure fluid

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There is currently a great interest in the search for new sources of natural pigments that can, through their consumption, make the diet more functional and healthy. Beans have drawn the attention of researchers because they contain a high amount of bioactive compounds that are beneficial to health. Among these compounds, anthocyanins (present in the peels) stand out, which are antioxidant compounds also responsible for the red, blue, purple, and orange color of many plant species. However, in the process of harvesting and processing beans, a large amount of waste with low commercial value, the “bandinhas”, is generated. This term is popularly used to classify the broken bean grains obtained during the processing of the product. In this context, the purpose of this work was to obtain extracts rich in phenolic compounds and anthocyanins from the industrial residue of beans (*Phaseolus vulgaris*). For this, deep eutectic solvents (DES) were selected as water modifiers to perform subcritical water extraction (SWE), aiming at selective extraction. To identify an efficient and environmentally friendly solvent, the COSMO-RS model was used, which could predict the affinities of individual anthocyanins on different DES modifiers in water. In this case, the combination of choline chloride and citric acid as water modifiers was the most promising solvent. Temperature, flow and percentage of DES in subcritical water extraction were optimized. The best anthocyanin extraction (3 mg C3G g⁻¹) was obtained at 90 °C, 5 mL min⁻¹, and 1 % DES, three times more than pure water. The extracts did not show cytotoxicity (normal fibroblastic L929 cells) and showed cytoprotection of L929 cells when subjected to oxidative stress with H₂O₂. Therefore, the implementation of SWE with DES opens up the possibility of increasing extraction efficiency, meeting the requirements of a green and sustainable approach to the application of extracts with anthocyanins as natural dyes.