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High-performance sustainable platform based on eutectic mixtures to recover stable anthocyanins from grape pomace and their application in food-grade silica

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PURPOSE OF THE ABSTRACT

Globally, 1.3 billion tons of foods per year are wasted or lost, representing around 30% of the total produced. This leads to several economic losses estimated at S$2.6 trillion annually, besides a high environmental impact. Associated with the high volume of residues produced, there is also the drawback to overcome related to the use of synthetic pigments as dyes. Despite their high dyeability and high stability (high half-life), synthetic pigments are also harmful to the environment, thus, among other issues, contributing to a high carbon footprint. As an alternative in the last years, much more attention is being given to replacing synthetic with natural colorants. However, much more needs to be investigated, aiming at developing the most appropriate and sustainable extraction processes of these natural pigments since some of these have been studied as food supplements. Thus, considering both nutritional & environmental issues, fruits' wastes are up-and-coming candidates for developing new extraction sustainable platforms to recover natural colorants. In this sense, viticulture represents one of the world's most productive and valuable agricultural activities, totalizing around 74 million tons produced annually. Anthocyanins are the primary pigments from grapes' wastes and are responsible for naturally reddish-purple color. In addition, these pigments have substantial antioxidant properties that can reduce the risks of cancer, stroke, and heart diseases. From an industrial perspective, anthocyanins are potent nutraceutical or pharmaceutical ingredients. Still, there are challenges concerning color instability, especially during food processing, temperature variations, storage, and commercialization. To overcome these challenges, Deep Eutectic Solvents (DES) have been successfully used to replace VOS on extraction processes to recover natural pigments, enhancing the extraction yield while improving their thermal stability and selectivity. Another strategy to improve the anthocyanins' chemical stability and shelf life is loading them in solid host materials, like gums, starches, and silicas. In this sense, silicon dioxide (SiO2), food-grade silica, able to convert any liquid into powders with high bulk density and excellent flow properties, becomes a desirable alternative to be investigated. In this context, the main objective of this work is to create a new sustainable and high-performance platform to recover stable anthocyanins from grape pomace by using aqueous solutions of DES and loading them in a solid food-grade material. The extraction was optimized, being the result obtained represented by a 3-fold better yield than the same process mediated by traditional solvents. In the end, a purple extract (90.90% purity) was obtained while the solvent (91.85%) was recycled. In the end, the anthocyanins were loaded into food-grade silica, which improved the thermal stability of the extracted pigments for at least 3-times fold compared to the liquid's extracts.

FIGURES

FIGURE 1

FIGURE 2

KEYWORDS
natural pigments | eutectic mixtures | sustainable process | thermal stability

BIBLIOGRAPHY