



Abstract

Reusing Food Waste: Ascorbic Acid Extraction from Orange Peel Using Ultrasound-Assisted Extraction and Natural Deep Eutectic Solvents [†]

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Abstract: The food industry generates a huge amount of waste from the production of food and processed products. There is a need to find a different outcome for this waste, use or reuse, to minimize this problem. Regarding citrus fruits, the waste of this cultivar has a significant amount of bioactive compounds, such as ascorbic acid (AA). The extraction of these compounds can also contribute to environmental pollution due to energy usage and polluting organic solvent by-products. Nonconventional extraction techniques and less-polluting solvents to recover these compounds from citrus waste would be a better and less-polluting choice. In this study, six hydrophilic natural deep eutectic solvents (NADESs) were prepared to extract AA from orange peel (navel cultivar). EtOH 50% was used as the control. The extraction was performed with the aid of ultrasound-assisted extraction (UAE). The following optimized UAE parameters were used: extraction time (5, 10, and 15 min), intensity (100 W, 200 W, and 400 W), and a magnetic stirring time after UAE (0, 20, 30, and 45 min). The determination of AA was made by HPLC-UV/VIS. Mobile phase A included Milli-Q water/formic acid (95:5), while mobile phase B included acetonitrile/A (60:40). An injection volume of 1 µL and a flow rate of 0.5 mL/min were used. A standard calibration curve was constructed using the same conditions as the samples ($R = 0.9998$). The selected optimal conditions were 10 min of extraction, 100 W of intensity (no statistical differences found among intensities), and 45 min of magnetic stirring after treatment. The NADES that presented the highest extraction yield was malic acid with glucose (11.76 mg/100 mL) followed by L-proline with malic acid (7.44 mg/100 mL). NADES provided higher extraction yields than did EtOH 50% (5.41 mg/100 mL). In conclusion, two of the studied NADESs extracted more AA from orange peel than did EtOH 50%.

Keywords: natural deep eutectic solvents; ultrasound-assisted extraction; orange peel

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