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Aloe vera agro-wastes valorisation by microwave-assisted extraction

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Introduction

In the last decades, the growing environmental concerns, combined with the imminent depletion of fossil fuels, have encouraged the circular economy concept as an environmentally friendly approach to prevent waste generation in productive processes and to develop natural-based products to reduce the fuel-based materials dependence. Currently, *Aloe vera* processing industries generate a huge quantity of solid wastes. In most cases, this biomass lacks commercial applications, being discarded, composted, or incinerated. However, it has been reported that it could be a promising source of bioactive compounds with antioxidant and/or antimicrobial activities which might be used in food, food packaging, pharmaceutical, or biomedical applications.
Nowadays, green advanced extraction techniques, such as microwave-assisted extraction (MAE), have gained importance for the recovery of target compounds due to its enhanced extraction yield combined with its better management of solvent consumption, energy, and time. This study focuses on the optimization of a microwave-assisted extraction (MAE) method for obtaining active compounds from *Aloe vera* skin (AVS) to increase the added value of this agricultural waste.

Experimental

AVS characterization was carried out following AOAC official methods and ash, fat, protein and moisture contents were determined. A Box-Behnken experimental design (BBD) was used to analyse the influence of four experimental factors (ethanol concentration, extraction temperature, time and solvent volume) on total phenolic content (TPC), aloin content, antioxidant activity (DPPH and FRAP methods) and extraction yield in the obtained extracts, and the optimum MAE conditions were determined. Phenolic profile, thermal and structural properties of the optimized *Aloe vera* skin extract were also determined by HPLC-DAD/MS, thermogravimetric analysis (TGA) and Fourier transform infrared spectroscopy (FTIR), respectively. Moreover, morphological changes on AVS structure due to the MAE process were studied by scanning electron microscopy (SEM).

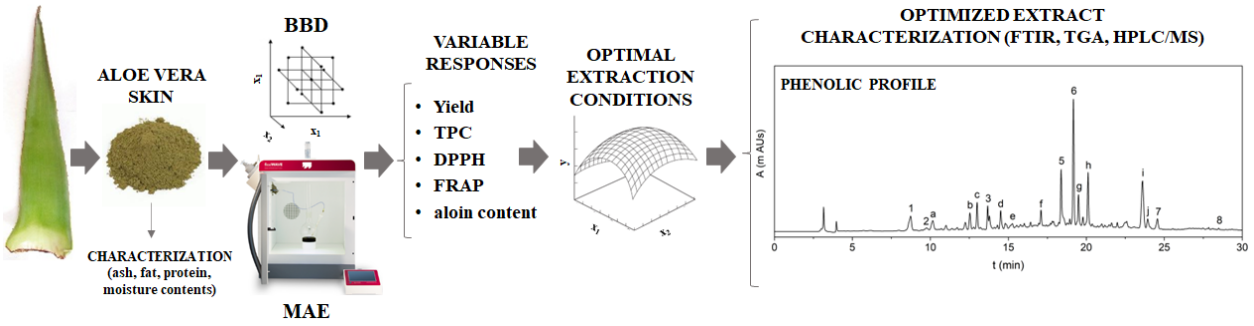

Figure 1. MAE optimization process and AVS extract characterization.

Results and Discussion

A great variability was found among the different sets of experimental factors which maximized each response variable. Consequently, a simultaneous optimization procedure using the desirability function was carried out and optimum extraction conditions were obtained as follows: 80% ethanol:water (v/v), 80 °C, 36.6 min and 50 mL. Moreover, eight phenolic compounds (aloesin, chlorogenic acid, orientin, aloeresin D, aloin B, aloin A, cinnamic acid and aloe-emodin) were identified and quantified by HPLC-DAD/MS, while eight other compounds were also tentatively identified.

Conclusions

A new MAE methodology was developed for the extraction of bioactive compounds from *Aloe vera* skin wastes as a green and fast strategy for the valorisation of these agrowastes. The obtained quadratic models were reliable for optimizing the extraction of bioactive compounds from AVS in the studied experimental domain, resulting in a high degree of correlation between the experimental data and predicted values. All results demonstrated the potential of AVS as a promising source of bioactive compounds increasing the added value of this agricultural waste.

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Biography

Ignacio Solaberrieta, Chemical Engineer from the National University of Mar del Plata, Buenos Aires, Argentina (2015). Part-time Professor at the Department of Analytical Chemistry, Nutrition and Food Sciences in the University of Alicante since 2021. He is currently developing his PhD studies focused on *Aloe vera* agrowastes valorisation and holding a junior collaborator position at NANOBIOPOL group in the University of Alicante. He is co-author of 7 research papers mainly focused on the valorisation of agrowastes through the recovery of valuable compounds using different extraction techniques.