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Extraction of anthocyanins from Syrah grape (Vitis Vinifera L.) pomace using pressurized liquids assisted by ultrasound.

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Abstract
Pressurized liquid extraction (PLE) is a clean technology able to extract valuable compounds from plant matrices that, when combined with ultrasound, appears as an appropriate technique to reduce the extraction time. In this context, the objective of this work was to obtain extracts with high concentrations of anthocyanins from grape residue using PLE assisted by ultrasound. In the PLE assisted by ultrasound, ultrasonic powers of 240, 400 and 520 W were evaluated. The power of 240 W produced extracts with higher content of monomeric anthocyanins, phenolic compounds and antioxidant capacity.

Key words:
Anthocyanins, PLE extraction, ultrasound.

Introduction

The use of agro-industrial waste is able to reduce environmental impacts and to obtain added value products. Grape pomace from winemaking has large amounts of phenolic compounds such as anthocyanins, of pharmacological and economic interest. Studies have shown that these pigments are able to prevent premature aging and avoid diseases due to their antioxidant properties[1]. Pressurized Liquid Extraction (PLE) is efficient in phenolics recovery from plant matrices and uses controlled temperature and pressure, with the use of GRAS (Generally Recognized as Safe)[2] solvents. High ultrasound intensity is used to modify the physico-chemical matrix structure in order to accelerate the extraction. This technique can be employed in several types of process, being considered green and able to improve yields of several operations[3]. The present study evaluated the conditions of PLE assisted by ultrasound to obtain anthocyanins from grape pomace. The extractions were made using a hydroethanolic solvent (1:1 m/m) pH 2.00, temperature of 40 °C and pressure of 10 MPa with different ultrasonic powers (240, 400 and 520 W) and without ultrasound.

Results and Discussion

The results of the analyses of monomeric anthocyanins (differential pH method), phenolic content (*Folin Cioucateau* method) and antioxidant capacity (FRAP and ABTS) of the extracts recovered in the first and the three total hours of processing are shown in Table 1, where: %: Global Yield (%), MA: Monomeric Anthocyanins (mg equivalent malvidin-3-glucoside/g dry matter), PC: Phenolic Content (mg equivalent gallic acid/g dry residue) and FRAP and ABTS (µmol equivalent of Trolox/g dry residue). The condition of 240 W was the one that obtained extract with the highest contents of anthocyanins and phenolics, besides presenting the greatest antioxidant capacity by the methods of FRAP and ABTS. The power of 520 W provided higher global yield, but produced extracts with lower concentration of target compounds. As observed in other works, the use of higher ultrasonic powers did not improve the recovery of target compounds, and under these conditions there was greater degradation of anthocyanins[4].

Table 1. Global yield, anthocyanin and phenolic contents and antioxidant capacity of extracts obtained in PLE assisted by ultrasound.

Condition	(%)		MA		PC		ABTS		FRAP	
	1 hour	3 hours	1 hour	3 hours	1 hour	3 hours	1 hour	3 hours	1 hour	3 hours
240 W	8,13 (± 0,05)	8,38 (± 0,06)	8,94 (± 0,60)	1,34 (± 0,50)	36,14 (± 0,66)	104,96 (± 2,52)	225,24 (± 4,09)	474,76 (± 11,86)	231,70 (± 0,75)	432,57 (± 12,73)
	6,91 (± 0,05)	7,01 (± 0,05)	8,00 (± 0,20)	0,94 (± 0,50)	38,51 (± 0,73)	76,58 (± 3,44)	253,36 (± 5,28)	343,74 (± 4,64)	230,96 (± 3,48)	315,08 (± 4,56)
400 W	7,88 (± 0,11)	8,36 (± 0,06)	5,61 (± 0,40)	0,85 (± 0,50)	34,45 (± 0,47)	95,29 (± 4,67)	218,14 (± 4,12)	413,64 (± 10,34)	191,50 (± 4,52)	315,73 (± 11,87)
	8,77 (± 0,06)	8,86 (± 0,02)	5,11 (± 0,50)	0,82 (± 0,20)	22,03 (± 0,88)	41,88 (± 0,65)	197,88 (± 2,38)	429,40 (± 10,86)	223,31 (± 2,41)	413,52 (±2,33)
520 W	10,58 (± 0,04)	10,71 (± 0,03)	2,93 (± 0,10)	0,55 (± 0,30)	21,91 (± 0,75)	41,95 (± 0,68)	187,08 (± 3,54)	410,81 (± 8,66)	209,77 (± 7,70)	404,45 (± 8,12)
	15,42 (± 0,33)	15,91 (± 0,02)	3,88 (± 0,10)	0,75 (± 0,44)	29,95 (± 0,93)	72,57 (± 2,51)	196,16 (± 1,77)	394,84 (± 6,98)	200,58 (± 7,35)	439,74 (± 7,23)
Without ultrasound	15,34 (± 0,03)	15,92 (± 0,05)	4,19 (± 0,10)	0,53 (± 0,75)	29,47 (± 0,90)	82,69 (± 3,25)	231,14 (± 8,00)	490,80 (± 6,32)	231,10 (± 2,09)	424,80 (± 15,82)
	10,96 (± 0,02)	11,09 (± 0,02)	2,60 (± 0,80)	0,41 (± 0,31)	20,59 (± 0,22)	40,77 (± 0,87)	163,23 (± 5,44)	359,90 (± 15,77)	172,05 (± 3,50)	342,50 (± 8,59)
	9,63 (± 0,01)	10,38 (± 0,02)	1,00 (± 0,40)	0,18 (± 0,20)	17,77 (± 0,39)	30,19 (± 0,36)	150,22 (± 2,38)	345,10 (± 12,07)	121,44 (± 4,11)	225,36 (± 8,88)

Conclusions

The analysis of the extracts allowed verifying that ultrasound is capable to increase the yield and the recovery of anthocyanins and phenolics from grape residue. The condition of 240 W resulted in higher contents of monomeric anthocyanins and phenolic compounds, besides presenting the higher antioxidant capacity. Higher powers were not advantageous and appear to have degraded target compounds more intensely.

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