

Optimization of ultrasound assisted extraction of bioactive compounds from *Psidium guineense* fruits using response surface methodology

Dayenne A. A. de Souza (PG)^{1*}, Camila F. B. Albuquerque (PG)², Pablo Luis B. Figueiredo (PQ)³, Claudia Quintino Rocha (PQ)⁴, Massuo Kato (PQ)⁵, Renan Campos Chisté (PQ)², Joyce Kelly R. da Silva (PQ)^{1,2}

joycekellys@ufpa.br; dayenne@ufpa.br

¹Programa de Pós-Graduação em Química, UFPA; ² Programa de Pós-Graduação em Biotecnologia, UFPA; ³ Programa de Pós-Graduação em Ciências Farmacêuticas, UFPA; ⁴ Programa de Pós-Graduação em Química, UFMA; ⁵ Instituto de Química, USP.

Keywords: *Myrtaceae*; phenolic compounds; antioxidant activity; process optimization; caffeoyl-quinic acid.

Highlights

The experimental design made it possible to obtain an extract from araçá fruits (*Psidium guineense* Sw.) rich in total phenolic compounds and with high antioxidant activity. The results show the viability of the use in the industrial process for producing bioactive compounds with cosmetic applications.

Resumo/Abstract

The Araçá (*Psidium guineense* Sw.) is a non-native Myrtaceae species in Brazil that is commonly found in the Pará state. It is an important fruit for the local economy and traditional medicine as it possesses medicinal properties and is used to treat inflammation and gastric disorders¹. The fruit contains phenolic compounds that have several applications in different sectors, particularly in cosmetics. The fruits were collected in Belém, cleaned, cut and frozen, and were subsequently freeze-dried for 72 hours. In this study, the ultrasound-assisted extraction method was optimized using the central composite design 2³ to extract these bioactive compounds from the fruit (pulp, peel, and seeds). The study evaluated the effect of different factors, including ethanol concentration (%), solid-liquid ratio (SLR), and extraction time (min), on the total phenolics content (TPC) and antioxidant activity (DPPH, % radical inhibition) according to matrix of table 1. A polynomial model was obtained from linear regression, considered predictive and significant at 95% of confidence ($p < 0.05$). The optimized parameters were found to be EtOH 25%, SLR 1:5, and 10 min extraction time, resulting in 304.6 ± 7.7 mg EAG/g of TPC and $59.5 \pm 1.7\%$ of DPPH inhibition. The optimized extract also displayed inhibition of β -carotene lipid peroxidation, with an IC₅₀ value of 20.9 μ g/mL and a good sun protection factor (SPF 16.0 ± 1.0). Furthermore, the optimized extract contained total flavonoids and carotenoids, with values of 309.2 ± 17.7 mg QE/g, 108.2 ± 11.1 μ g/g, and 20.9 μ g/mL, respectively. The analysis of the optimized extract by HPLC-DAD-MS identified several bioactive compounds, including quinic acid, ellagic acid, valoneic acid dilactone, and caffeoyl-quinic acid. The significant antioxidant activity was found to be correlated with these bioactive compounds², revealing the potential of Araçá fruits for use in cosmetics.

Table 1- CCD matrix and average values TPC and % DPPH inhibition of the *Psidium guineense* extract

Experiment	EtOH (%)	RSL	T (min)	TPC (mg GAE.g ⁻¹)	DPPH (%)
1	3:4 (+1)	1:5 (-1)	10 (-1)	270.28 $\pm$ 6.07 ^a	58.74 $\pm$ 2.34 ^{a,b}
2	1:4 (-1)	1:5 (-1)	10 (-1)	262.18 $\pm$ 11.43 ^{a,b}	74.42 $\pm$ 1.70 ^c
3	3:4 (+1)	1:15 (+1)	10 (-1)	108.85 $\pm$ 7.19 ^c	43.87 $\pm$ 1.46 ^{d,e,f}
4	1:4 (-1)	1:15 (+1)	10 (-1)	113.79 $\pm$ 9.85 ^c	39.77 $\pm$ 3.58 ^{d,f}
5	3:4 (+1)	1:5 (-1)	30 (+1)	304.56 $\pm$ 7.71 ^d	59.49 $\pm$ 1.69 ^{a,g}
6	1:4 (-1)	1:5 (-1)	30 (+1)	237.75 $\pm$ 8.25 ^b	64.80 $\pm$ 5.72 ^{a,c}
7	3:4 (+1)	1:15 (+1)	30 (+1)	79.63 $\pm$ 4.61 ^e	34.03 $\pm$ 2.45 ^f
8	1:4 (-1)	1:15 (+1)	30 (+1)	134.35 $\pm$ 10.28 ^c	47.69 $\pm$ 2.35 ^{b,d,e}
9	1:1 (0)	1:10 (0)	20 (0)	200.00 $\pm$ 10.17 ^f	52.31 $\pm$ 2.03 ^{b,e,g}
10	1:1 (0)	1:10 (0)	20 (0)	175.29 $\pm$ 13.54 ^f	53.76 $\pm$ 3.39 ^{a,f}
11	1:1 (0)	1:10 (0)	20 (0)	226.12 $\pm$ 10.61 ^{a,b}	55.34 $\pm$ 9.49 ^{a,e}

¹Nascimento, K. F., et al. Antioxidant, anti-inflammatory, antiproliferative and antimycobacterial activities of the essential oil of *Psidium guineense* Sw. and spathulenol. *Journal of Ethnopharmacology*, 210, 351–358. 2018.

²Senanayake, C. M., et al. Phenolic extracts of the leaves of *Psidium guineense* Sw. improve the shelf life of sunflower oil and baked cake and antioxidant status of Wistar rats. *Journal of Food Biochemistry*, e12632. 2018.

Agradecimentos/Acknowledgments

FAPESPA for the financial support.