

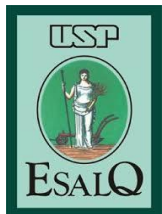
**Foods
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The 1st International Electronic Conference on Food Science and Functional Foods

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A greener and fast approach for determination of phenolic compounds by smartphone-based colorimetry

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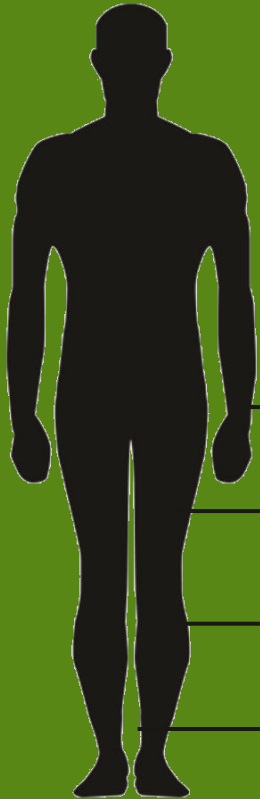


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Phenolic compounds



- Are secondary metabolites produced by plants in response to ultraviolet-light, water stress and attack by pests, like insects, viruses, and bacteria.
- These compounds have been investigated due to their benefits to human health, such as:

Antioxidants properties

Cardioprotective and anti-inflammatory properties

Antimicrobial property

Carcinogenesis inhibitor

- Regular consumption of fruit, vegetables and plant-based beverages.

Phenolic compounds

Acerola (*Malpighia emarginata* D.C)

- Tropical and subtropical climate fruit
- High ascorbic acid and bioactive molecules content

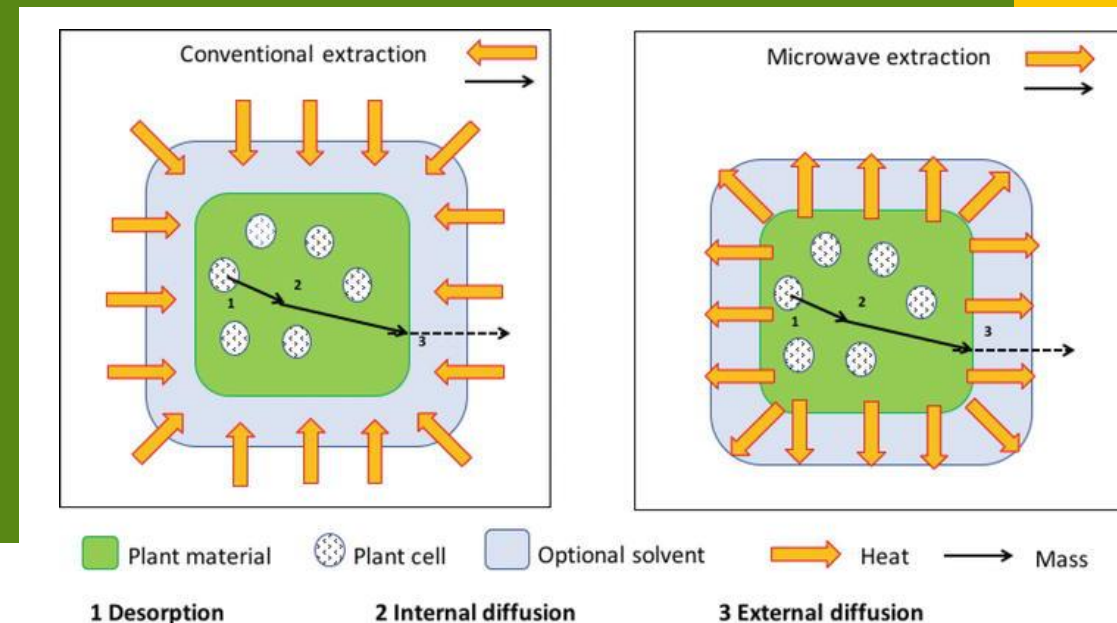


**Potential substitute for
synthetic antioxidants**

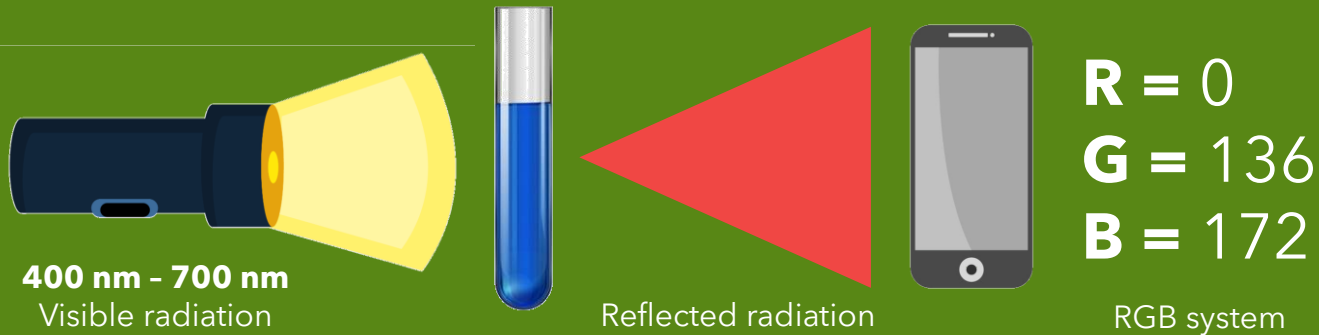


Microwave-assisted extraction

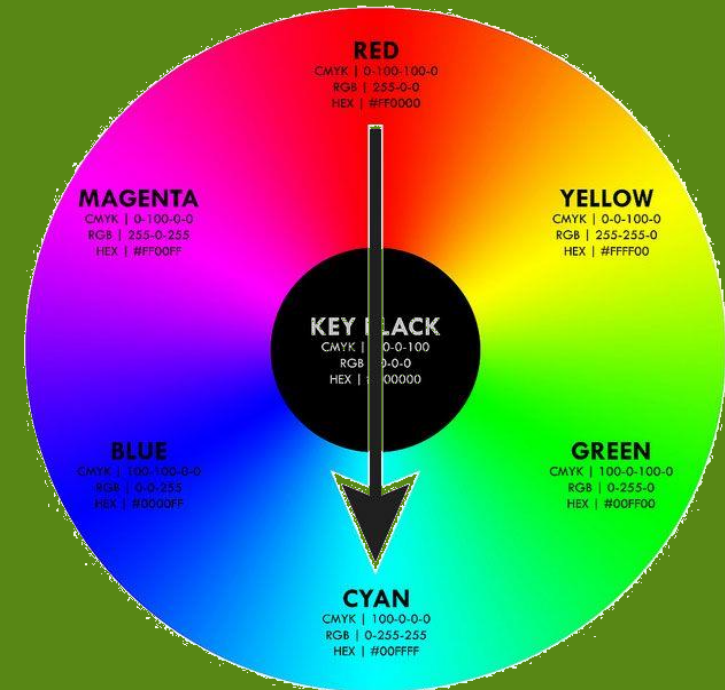
- Fast heating produced by non-ionizing electromagnetic waves (300 MHz to 300 GHz)
- HEATING MECHANISM: **Dipolar rotation** and **ionic conduction** occur due to alternating electric field (2,45 GHz)
- High pressure inside the cell causes the disruption and release of bioactive compounds



Digital image photometry



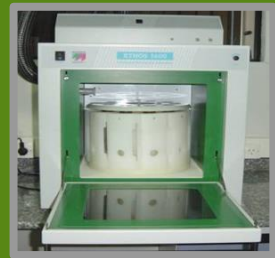
- The RGB system ranges from 0 to 255
- The reflected radiation is converted in mensurable data from the RGB system
- The channel corresponding to the complementary color of the sample is more attenuated



Materials and Methods



Acerola lyophilized



Microwave oven
(Ethos 1600, Milestone)



Hydroalcoholic
extract



Hydroalcoholic
extract filtered

Smartphone-based photometric detection



Styrofoam box with
LED lamp and
smartphone holder



(48 MP)



Colorgrab app



Spectrophotometer - Femto®



Total phenolic content
(TPC)
(Folin-Ciocalteu reagent)

Results

Real values, coded values, and TPC content in extraction conditions indicated by the Doehlert design

Experiment	Variables			Analytical response ¹	
	Temperature (°C)	Ethanol concentration (% v/v)	Extraction time (min)	Reference method	Proposed method
1	60 (1)	50 (0)	30 (0)	107 ± 2	107 ± 2
2	53 (0.500)	99 (0.866)	30 (0)	101.4 ± 0.8	102 ± 2
3	53 (0.500)	66 (0.289)	50 (0.817)	106 ± 2	107 ± 3
4	30 (-1)	50 (0)	30 (0)	131 ± 1	131.1 ± 0.8
5	38 (-0.500)	0 (-0.866)	30 (0)	76.5 ± 0.9	77 ± 2
6	38 (-0.500)	33 (-0.289)	10 (-0.817)	121.3 ± 0.9	124 ± 4
7	53(0.500)	0 (-0.866)	30 (0)	79 ± 2	78 ± 1
8	53 (0.500)	33 (-0.289)	10 (-0.817)	129 ± 2	132 ± 1
9	38 (-0.500)	99 (0.866)	30 (0)	124.4 ± 0.9	126.3 ± 0.8
10	45 (0)	83 (0.577)	10 (-0.817)	114.6 ± 0.6	119.0 ± 0.8
11	38 (-0.500)	66 (0.289)	50 (0.817)	145.0 ± 0.7	146 ± 4
12	45 (0)	17 (-0.577)	50 (0.817)	120 ± 5	120 ± 5
13 (CP)	45 (0)	50 (0)	30 (0)	122	123
14 (CP)	45 (0)	50 (0)	30 (0)	113	113
15 (CP)	45 (0)	50 (0)	30 (0)	120	116
16 (CP)	45 (0)	50 (0)	30 (0)	126	124
17 (CP)	45 (0)	50 (0)	30 (0)	113	116

The experiment n. 11 presented the highest efficient of extraction

Extraction by convective heating (extraction with 14.5% (v/v) ethanol, at 55.6 °C for 50 min)

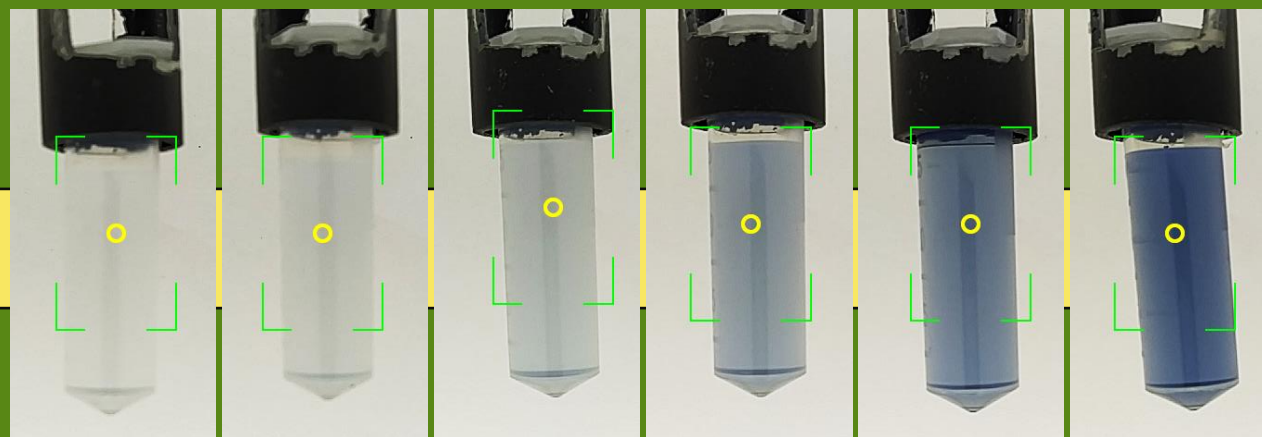
↓ Temperature ↑ TPC

Results

LOD = $3 \mu\text{g mL}^{-1}$
LOQ = $10 \mu\text{g mL}^{-1}$

Volume per analysis
1 mL

↑ Channel R



Blank
solution

Concentration of gallic acid ($\mu\text{g mL}^{-1}$)

↓ Channel R

Conclusion

- More efficient extraction achieved by microwave-assisted extraction
- The smartphone-based detection presented an efficient, cost-effective, simple, and fast approach to determine the total phenolic content in acerola extracts
- Minimization of reagent consumption and waste generation (Green Chemistry)
- **Next steps:** determination of the phenolic profile using HPLC

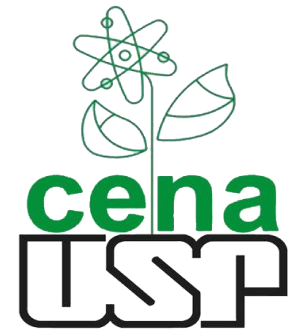
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