Antimicrobial potential of different propolis extracts

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Introduction

Propolis is a mixture of different types of beeswax and resins collected from plants by bees (*Apis mellifera*). The role of propolis in the hive is related to its mechanical properties and it is used to construct, adapt and protect the hive; its antimicrobial activity ensures an aseptic environment.[1, 2] Propolis is known for having antibacterial activity conferred by the presence of flavonoids, aromatic acids and esters in their composition and for the presence of ferulic and caffeic acids. [1, 3]

Several authors reported that the activity of each chemical compound present in propolis is influenced by the extraction method. [4] These compounds are quite soluble in ethanol, however, the extracts resulting from this solvent can only be used if the ethanol is food grade. Other solvents such as propylene glycol, glycerol and oils, as well as other techniques, have been tested and have shown promising results regarding their composition and biological activities .[1, 4]

Objectives

The objective of this study was to evaluate the chemical characteristics and antimicrobial activity of propolis extracts obtained using different solvents (propylene glycol, ethanol, water at pH 8.0, sunflower oil and olive oil) at two temperatures (room temperature and 50 ºC).

Methods

4 samples of propolis from different sources

extracted

With Solvents
- Ethanol
- Propylene glycol
- Water at pH 8.0
- Sunflower oil
- Olive oil

At Temperatures
- 50 ºC
- Room temperature

Chemical characterization

- Determination of pH
- Quantification of total phenolic content by spectrophotometry
- Determination and quantification of phenolic compounds by high performance liquid chromatography (HPLC)
- Determination of total antioxidant activity (DPPH)

Antimicrobial activity

- Determined by disk diffusion method against 32 target microorganisms
- Determination of minimum inhibitory concentrations for the extract inhibiting growth

Results

- pH of the propolis extracts ranged between 4.00 and 5.84.

Table 1. Quantification of phenolic (mg/l) and antioxidant (Trolox concentration / 100ml extract) compounds for each propolis extract

Propolis Extract	ET	Phenolic compounds					Antioxidant compounds				
		Ethanol	Water	Sunflower oil	Olive oil	PG	Ethanol	Water	Sunflower oil	Olive oil	PG
1	RT	39.20	0.38	0.54	0.62	5.26	1.60	1.16	1.14	1.25	1.56
	50 ºC	10.60	5.35	2.04	0.37	5.02	-	1.57	0.35	1.20	1.59
2	RT	8.07	-0.57	1.48	4.20	5.18	1.58	-0.03	1.28	0.14	1.56
	50 ºC	7.99	-0.27	0.51	3.23	8.47	1.59	0.52	0.37	0.79	1.56
3	RT	8.55	-0.50	0.21	0.91	2.70	1.59	0.41	1.24	1.13	1.62
	50 ºC	9.12	0.24	1.09	1.32	7.65	1.55	0.67	1.25	0.74	1.61
4	RT	21.90	-1.02	0.16	-1.53	9.49	1.62	0.67	0.93	1.51	1.62
	50 ºC	11.70	-0.77	-0.01	3.11	11.32	1.61	1.02	1.03	1.60	1.62

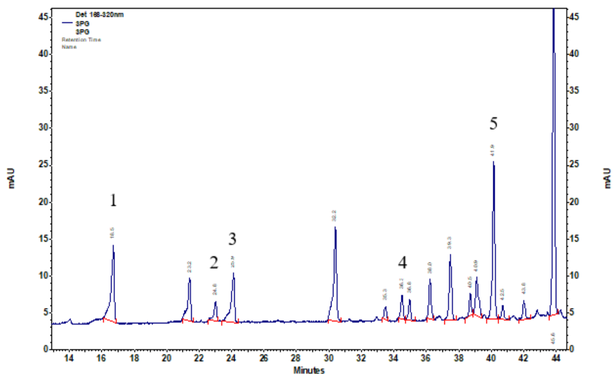

Figure 1. Example of a phenolic profile obtained for an ethanolic propolis extract at 320 nm, by HPLC.
Legend: 1- caffeic acid; 2- coumaric acid; 3- ferulic acid; 4- quercetin; 5- kaempferol.

Discussion & Conclusions

- Apparently, the solvent did not affect the pH value of the propolis extracts.
- Ethanol and PG allowed better extractions of the phenolic compounds presented in propolis, with similar concentration values.
- The antioxidant activities of all extracts were similar and their composition was identical, varying only in the content of flavonoid compounds.
- Caffeic acid, coumaric acid, ferulic acid, quercetin and kaempferol were identified by HPLC.
- Propolis extracted with ethanol and PG showed higher antimicrobial activity against several microorganisms.
- All propolis extracted with PG, at both temperatures, inhibited most of the microorganisms tested. However, at 50 ºC, 0.3125 µg/ml of propolis extract was enough to inhibit a large number of microorganisms.
- Propolis 1, extracted with PG at 50 ºC demonstrated quite promising results.

As conclusion, although further tests are required, propolis extracted with PG, a compound that according to the United States FDA is Generally Recognized as Safe (GRAS), could be a promising product to be used in food industry to, for example, reduce the microbial loads of raw meats and avoid cross-contaminations.

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