SHORT COMMUNICATION

Chemical composition, antioxidant activity and development of a facial serum formulation from the extract of *Hancornia speciosa*

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**ABSTRACT**

The goal of this work was to chemically characterise *Hancornia speciosa* extracts to develop an antioxidant serum formulation. Stem and bark extracts were prepared using 70\% hydroethanol solution by Soxhlet and ultrasound assisted extraction. The content of total phenols, flavonoids, and antioxidant activity were evaluated, and chemical characterization was performed by HPLC -detector UV-VIS (SPD – 10 A). The formulation was developed with stem extract (0.250 mg/g) in hydroxyethylcellulose fluid gel. Stem extracts had higher total phenols and flavonoids, and higher antioxidant activity than bark extracts. The formulation presented low viscosity, a yellowish colour, 81.28\% ± 0.14 of antioxidant activity. In the stability test, the physicochemical characteristics showed small variations, remaining more stable at a temperature of 5 °C, with an antioxidant activity of 64.81\% ± 0.75. Therefore, the stem of *H. speciosa* has the potential to be used in antioxidant formulations.

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1. Introduction

*Harconia speciosa* Gomes is a tree of the *Apocynaceae* family that naturally occurs in the Brazilian Cerrado. Although few studies report identification and quantification of metabolites in the stem and bark, an interesting chemical profile and antioxidant capacity was showed (Leite et al. 2020).

Natural antioxidants have been shown in the literature to be effective in combating and preventing ageing (Cherubim et al. 2019). Thus, it is important to study plants that contain metabolites with antioxidant activity, such as potential extracts for green cosmetics manufacture.

Given the relationship between phenolic compounds and antioxidant activity, the purpose of this work was to chemically characterise *H. speciosa* stem and bark extracts and to develop an antioxidant serum formulation.

2. Results and discussion

2.1. Determination of total phenolic content, total flavonoids and antioxidant activity

The stem (S) and bark (B) hydroethanolic (70%) extracts were obtained by Sohxlet (SOX) and ultrasound (US). Stem extracts showed higher amounts of phenols and flavonoids, which led to greater antioxidant activity than the extracts obtained by ultrasound. The bark extracts had a lower concentration of phenolic compounds and flavonoids, but for this part of the plant, US extraction was more effective, possible due to various chemical substances.

The IC50 value determined in S_SOX (28.63 ± 3.05 μg/mL) was comparable to that found by Penido et al. (2017) in *H. speciosa* stem extract prepared by maceration in 70% ethanol. Leite et al. (2020) found higher values of flavonoids, phenols and antioxidant activity in *H. speciosa* bark from ethanol/dichloromethane extracts than those found in S_SOX. US extraction in the presence of water may have degraded phenolic compounds in the S_US and B_US extracts (Biesaga 2011).

2.2. Chemical Characterization by high performance liquid chromatography

The HPLC fingerprint of the authentic standards, S_SOX, S_US, B_SOX and B_US *H. speciosa* extracts were obtained in a Phenomenex Luna C18 5 μ (2) reversed-phase column and Phenomenex C18 pre-column (Costa et al. 2020). In the S_SOX extract, p-coumaric acid and chlorogenic acid were identified, while in the S_US extract, catechin and quercetin were identified. In the B_SOX extract, no compound was identified, while in the B_US extract, catechin and chlorogenic acid were identified.

Rodrigues et al. (2007) identified catechins in an *H. speciosa* bark infusion, while Leite et al. (2020) found catechins in the bark extract produced by ultrasound in dichloromethane and ethanol. Quercetin was found to protect the skin from UV radiation damage, decreasing inflammation and slowing the ageing process (Shin et al. 2021). Chlorogenic acid has healing and antioxidant activity (Tošović et al. 2017).
Studies identifying $p$-coumaric acid in the stem of *H. speciosa* were not found in the literature.

2.3. Activities of the serum formulations

The serum containing S_SOX extract presented an antioxidant activity of $81.2 \pm 0.14\%$, higher than that found in other formulations (Cefali et al. 2015; Nešić et al. 2019). Thus, this formulation has the potential to act as anti-ageing.

The results obtained for Sun Protection Factor (SPF) were $1.24 \pm 0.03$ for the control and $1.25 \pm 0.01$ for the serum, which demonstrates that the formulation has a low SPF. Although the developed formulation did not show an important SPF value, products with high antioxidant activity are able to promote tissue recovery caused by photoaging, in addition to preventing DNA damage and skin cancer (Sajadimajd et al. 2020).

The spreadability of the formulations was evaluated by adding different weights. When subjected to 200 g, the mean sample area was $4616.43 \pm 69.38 \text{mm}^2$, increasing to $13171.13 \pm 117.44 \text{mm}^2$ when exposed to 800 g. Spreadability was linear in relation to the added weights ($R^2 = 0.9971$), ideal for this type of formulation (Cefali et al. 2015).

The incorporation of 0.250 mg/g of S_SOX did not cause macroscopic signs of instability. As a result, the formulations are able to follow through on preliminary stability and accelerated stability tests. The Serum Base (SB) colour did not change during the preliminary stability test. On the other hand, the formulation Serum (S) colour presented a change in intensity in the last cycle. This variation can be due to the oxidation of substances present in the extract.

Formulation S presented a yellow coloration, and SB was uncoloured. Both formulations were odourless and their aspects remained unchanged. The parameters pH, density, and viscosity practically did not oscillate over the 6 cycles, which indicates that the formulations are stable under the conditions to which it was submitted. Density and viscosity parameters remained stable during the 90 days of accelerated stability. The final pH varied from 5.52 to 5.24 for SB and 5.19 to 5.21 for formulation S. Although there was an increase in the pH value relating time and temperature, the values found remained acidic, ideal for skin homeostasis.

In the accelerated stability test, the formulations remained stable for 90 days. Given the decrease in antioxidant activity, Formulation S developed a more intense yellow color by day 60, most probably due to phenolic oxidation. Formulation S showed constant antioxidant activity up to the 60th day, decreasing on the 90th day, mainly at high temperatures. Once the efficiency of antioxidant agents is linked to long-term usage and to the possibility of a cumulative effect (Cefali et al. 2015), the formulation S can be used as an antioxidant.

3. Experimental

See supplemental material for standards and chemicals, extraction, antioxidant activity and formulation assays and HPLC procedure.
4. Conclusion

The extractive method influenced the extraction of antioxidant compounds, so that the S_SOX extract showed the highest amount of total phenols and the highest antioxidant activity. Characterization by HPLC identified compounds with recognized antioxidant activity. The developed serum showed adequate physical and chemical characteristics, in addition to antioxidant potential, despite the fact that it has a low SPF. In this way, it is possible to direct this formulation to skin retention and permeability tests and, thus, verify the antioxidant potential in the skin.

Disclosure statement

No potential competing interest was reported by the authors.

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