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Evaluation of the antimicrobial and anti-inflammatory activity of *Lippia javanica* against pathogenic microorganisms

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INTRODUCTION & AIM

Cosmetics are defined by the European Union as substances or mixtures intended to come into contact with the external parts of the human body or the oral cavity, with the main or exclusive purpose of cleaning, perfuming, protecting, altering the appearance, maintaining in good condition or correcting body odours [1,2]. However, these formulations provide favorable conditions for the development of a wide variety of microorganisms due to the presence of nutrients such as water, lipids, polysaccharides, proteins, amino acids, carbohydrates, peptides and vitamins, which facilitate their growth [3]. Microbial contamination of cosmetic products is a significant public health concern, as it can compromise the quality, safety, and stability of formulations, particularly in settings where quality control is limited. In this context, *Lippia javanica* emerges as a noteworthy species. This medicinal plant, widely used in Angola and other African countries, is recognized for its bioactive compounds with antimicrobial and anti-inflammatory properties. These characteristics support its traditional use in treating infections and inflammatory conditions and highlight its potential as a natural new active ingredient for the cosmetic and pharmaceutical industries [4,5].

METHOD

Extract preparation

L. javanica extracts were obtained from dried leaves using a hydroalcoholic solution (70/30 (v/v) ethanol/water), followed by shaking and ultrasound for better extraction of bioactive compounds, followed by concentration in a rotary evaporator. The concentrated extracts were resuspended in propylene glycol.

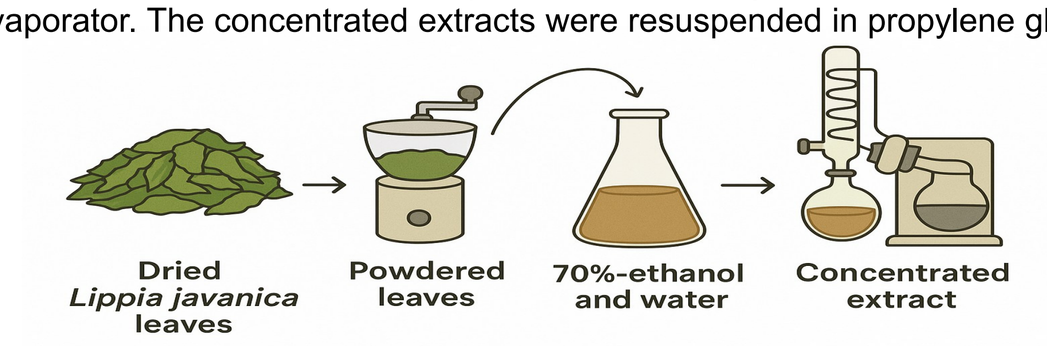
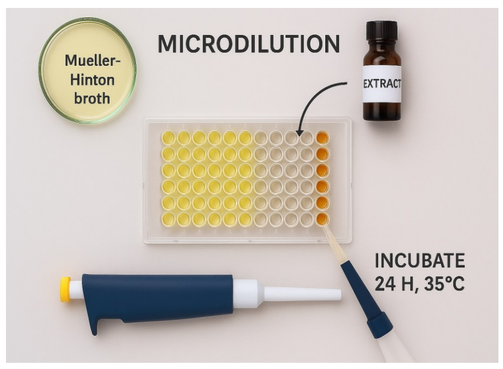


Plate diffusion method

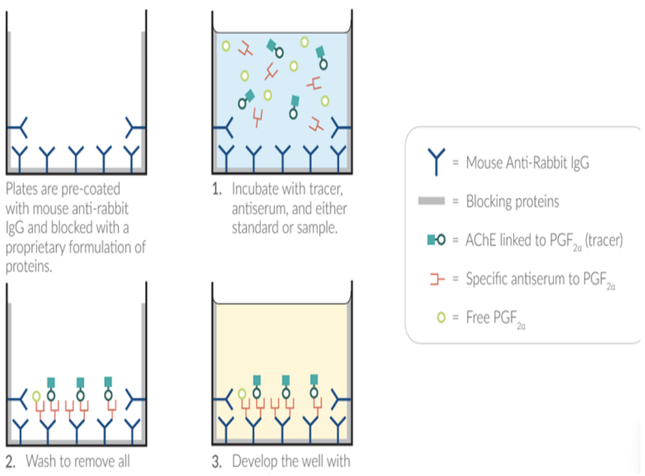
The antimicrobial activity of the hydroalcoholic extracts was evaluated by diffusion in agar wells. Different microorganisms were tested, and growth at 37ºC ware observed after 24 hours of incubation. Inhibition zones measuring ≥6.0 mm in diameter were measured to assess antimicrobial activity.

Determination of minimum inhibitory concentration (MIC)



The MIC of *L. javanica* extract was determined by the broth microdilution method. The extract (100 mg/mL) was subjected to serial dilutions in microplates with Mueller-Hinton medium and incubated at 37 °C for 24 h. The MIC was defined as the lowest concentration without visible turbidity.

Anti-inflammatory activity assay (ELISA method)



Cyclooxygenase (COX) is an enzyme that converts arachidonic acid and oxygen into prostaglandin G2. Its peroxidase activity reduces PGG2 to PGH2. The anti-inflammatory activity of the extracts was evaluated by COX-2 inhibition using a specific kit. The assay measures PHF2α through PGH2 reduction quantification via ELISA.

RESULTS & DISCUSSION

The ethanolic extract of *L. javanica* proved effective against *Streptococcus mutans, Streptococcus mitis, Streptococcus pyogenes*, and *Staphylococcus epidermidis*, with halos of up to 15.5 mm, but not against *Candida albicans* and *Escherichia coli*. The results are partially consistent with the literature, which describes activity against *E. coli* with acetone extracts. This difference may be associated with the extract-solvent ratio.

Table 1. Diameter of inhibition halos (mm) of *Lippia javanica* for the different microorganisms under study

Microorganisms	Mean and standard deviation of the inhibition halos of the hydroalcoholic extract (mm)
***B. cereus* ATCC® 11778**	7.00 ± 5.00
***C.albicans* ATCC® 10231**	0.0
***E. faecalis* ATCC® 29212**	10.50 ± N/A*
***E.coli* ATCC® 8739**	0.0
S. aureus ATCC® 6538	9.30 ± 4.60
***S.aureus (MRSA)* ATCC® 33591**	9.25 ± 4.60
***S.mitis* NCIMB® 13770**	14.00 ± N/A*
S. Mutans ATCC® 25175	14.00 ± N/A*
S. epidermidis ATCC®12228	14.00 ± N/A*
S. pyogens ATCC ® 12384	15.50 ± N/A*
Propylene glycol (negative control)	0.0

L. javanica showed consistent antimicrobial activity, with a low MIC of up to 0.15 mg/mL against *B. cereus* and *S. aureus*. It was also shown to be active against *MRSA*, and *Enterococcus faecalis*, although with higher values. This is in line with the results presented in Table 1, which demonstrates its inhibitory potential, particularly relevant for Gram-positive bacteria.

Table 2. Minimum inhibitory concentration (MIC) of *Lippia javanica* extract against different microorganisms.

Microorganisms	*Lippia javanica* (mg/mL)
E.coli	-
S.aureus	0.15
MRSA	5.00
B.cereus	0.15
E.faecalis	0.31
C.albicans	> 10

Anti-inflammatory capacity was assessed by COX-2 inhibition, measuring PGF2α via ELISA. *L. javanica* did not show COX-2 inhibition, but previous studies indicate a reduction in inflammatory cells in bronchoalveolar fluid, suggesting a potential alternative anti-inflammatory effect.

Table 3. Results of the anti-inflammatory activity assay of *Lippia Javanica*

Extract	%B/B0	PGF2α concentration (pg/mL)	% inhibition	Anti-inflammatory
L. javanica	12.4	160609,9	0	No

CONCLUSION

The use of plants with recognized biological activity contributes not only to the safety of cosmetic products, but also to the development of more sustainable formulations, in line with consumer preferences for natural ingredients. The results obtained in this study reveal that *L. javanica extract* has promising properties for use as an active ingredient in formulations and, thanks to its antimicrobial capacity against the main pathogens, it can play a crucial role in the cosmetics and pharmaceutical industry.

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