

Evaluation of the applicability of *Cistus ladanifer* essential oil as a cosmetic ingredient: determination of antimicrobial and antioxidant activities

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INTRODUCTION

- The bioactivities of plant extracts are particularly relevant for the formulation of all-natural cosmetics, which are increasingly gaining interest among the beauty industry and the consumers. In this context, essential oils are particularly interesting, due to their natural antimicrobial and antioxidant activities;
- The essential oil obtained from *Cistus ladanifer*, rich in flavonoids, terpenes and phenolic compounds in its composition, has potential bioactive properties which might be of interest.
- Extracts of this plant has shown to have antimicrobial and antioxidant activity; however, its bioactivity has never been tested in essential oils.

Aim: This study intends to analyze the applicability of the *Cistus ladanifer* essential oil (CLEO), from Aromas do Valado[®], Portugal, as a cosmetic ingredient, either as a preservative or an active ingredient in the formulation, thus contributing to the development of 100% natural formulations.

EXPERIMENTAL DESIGN

Antimicrobial activity

Microdilution method: MIC and MLC

- The CLEO was serially diluted (64 – 1 µl/ml) in medium (MHB for bacteria and RPMI-1640 for fungi and yeast), on a 96 well plate, and incubated for 24h;
- The minimum inhibitory concentration (MIC) of CLEO was determined by visual observation and the minimum lethal concentration (MLC) of CLEO was determined by plating, to Tryptic soy agar (bacteria) or Sabouraud dextrose agar (fungi and yeast), 10 µl of all the wells that exhibited absence of microorganisms growth.

Antioxidant activity

DPPH Assay

- The CLEO was serially diluted (100 - 1 µl/ml) in methanol, on a 96 well plate, and incubated, for 1 h, at room temperature in the dark with DPPH (50 mM);
- Ascorbic acid (50 mM aqueous solution) was used as the validation control;
- EC50 was calculated as the amount of oil able to reduce at least 50% of DPPH initial concentration by the trend curve.

RESULTS

Antimicrobial activity

Table 1. MIC and MLC values for the essential oil under study regarding the five species included in the test.

Species	MIC (µl/ml)	MLC (µl/ml)
<i>S. aureus</i> ATCC 6538	16	16
<i>E. coli</i> ATCC 8739	16	16
<i>P. aeruginosa</i> ATCC 9027	8	16
<i>C. albicans</i> ATCC 10231	4	8
<i>A. brasiliensis</i> ATCC 16404	16	>64

- The antimicrobial activity corresponds to a bactericidal effect for *S. aureus* and *E. coli* as MIC and MLC are the same;
- For *P. aeruginosa* the MLC value is the same for the other bacteria but in a lower concentration the oil seems to be able to inhibit its growth;
- The effect of the CLEO against *C. albicans* seems to be more evident as both the MIC and MLC values are below the ones achieved for the bacteria;
- For the *A. brasiliensis* as for the tested conditions the activity achieved was fungistatic and not fungicidal (no MLC determined).

Antioxidant activity

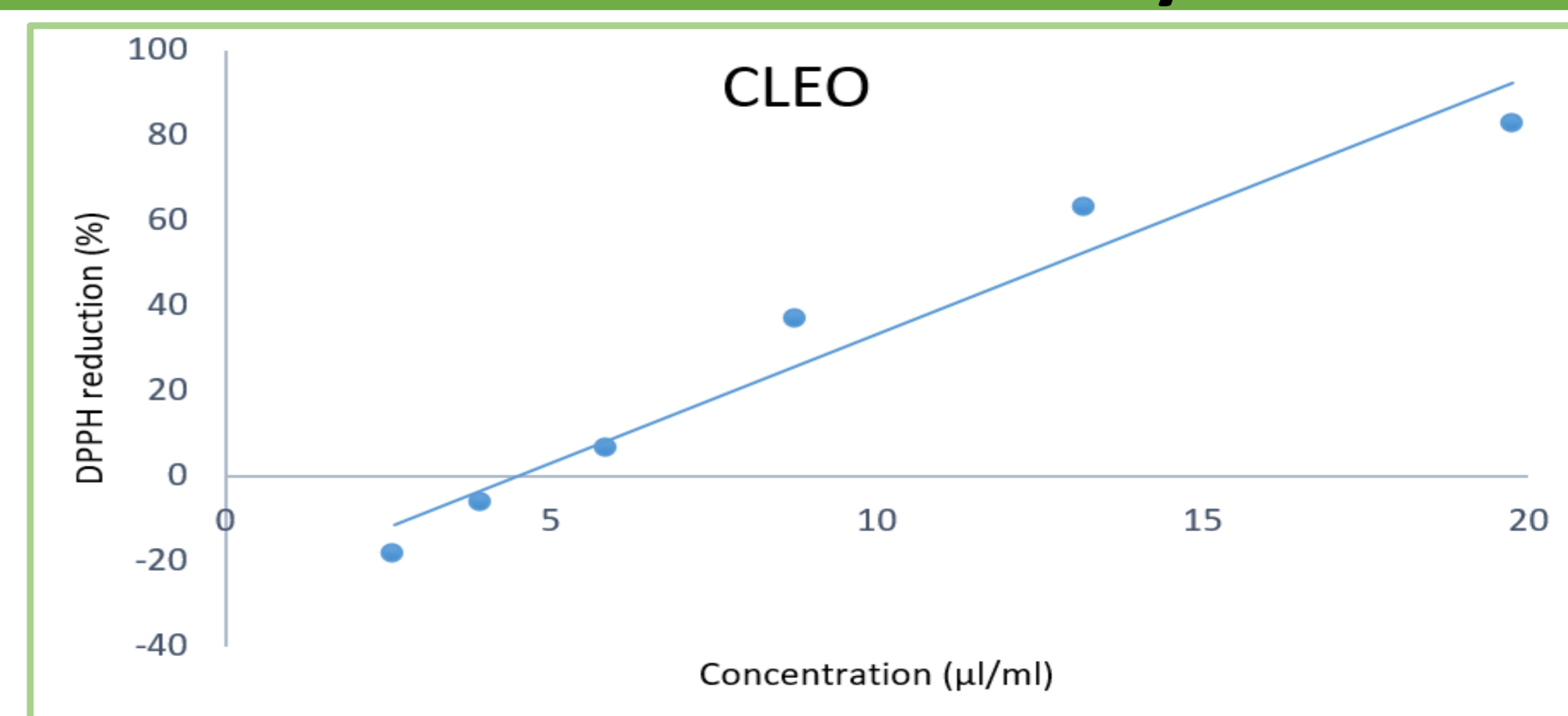


Figure 1. Trend curve of reduction of DPPH (%) by the CLEO (µl/ml) after the DPPH assay, compared with the ascorbic acid control. $y = 6,0525x - 27,073$ with $R^2 = 0,9539$.

- 50% of DPPH reduction was achieved in the presence of an CLEO concentration of 12.73 µl/ml (EC50).
- In addition, CLEO was able to reduce DPPH linearly, according with increased concentrations of oil ($R^2 > 0.95$, Figure 1), evidencing its potent antioxidant activity.

CONCLUSION

Regarding the antimicrobial activity, our results indicate that CLEO may be used as a natural preservative in cosmetic formulations by preventing microorganism's growth, in particular the ones that are recognized by international guidelines as pathogenic in cosmetic formulations.

Regarding the antioxidant activity, the finding that CLEO has this relevant activity increases its value as a potential cosmetic/pharmaceutical ingredient.

Acknowledgements: This work was supported by FEDER funds through the POCI-COMPETE 2020 - Operational Programme Competitiveness and Internationalisation Axis I - Strengthening research, technological development and innovation (Project No. 007491) and National Funds by FCT-Foundation for Science and Technology (Project UID/Multi/00709). Palmeira de Oliveira, R. acknowledges a Post-Doctoral Fellowship from FCT (Reference SFRH/BPD/124437/2016)