Lemongrass agro-industrial by-product as a source of essential oil and carbohydrates with potential biological activities

Elisabete Coelho[1], Luís Rodrigues[1], Isabel Henriques[2], and Manuel A. Coimbra[1]

[1] QOPNA & LAQV-REQUIMTE, Department of Chemistry, University of Aveiro, Aveiro, Portugal
[2] Department of Life Sciences and CESAM, Faculty of Science and Technology, University of Coimbra, Coimbra, Portugal

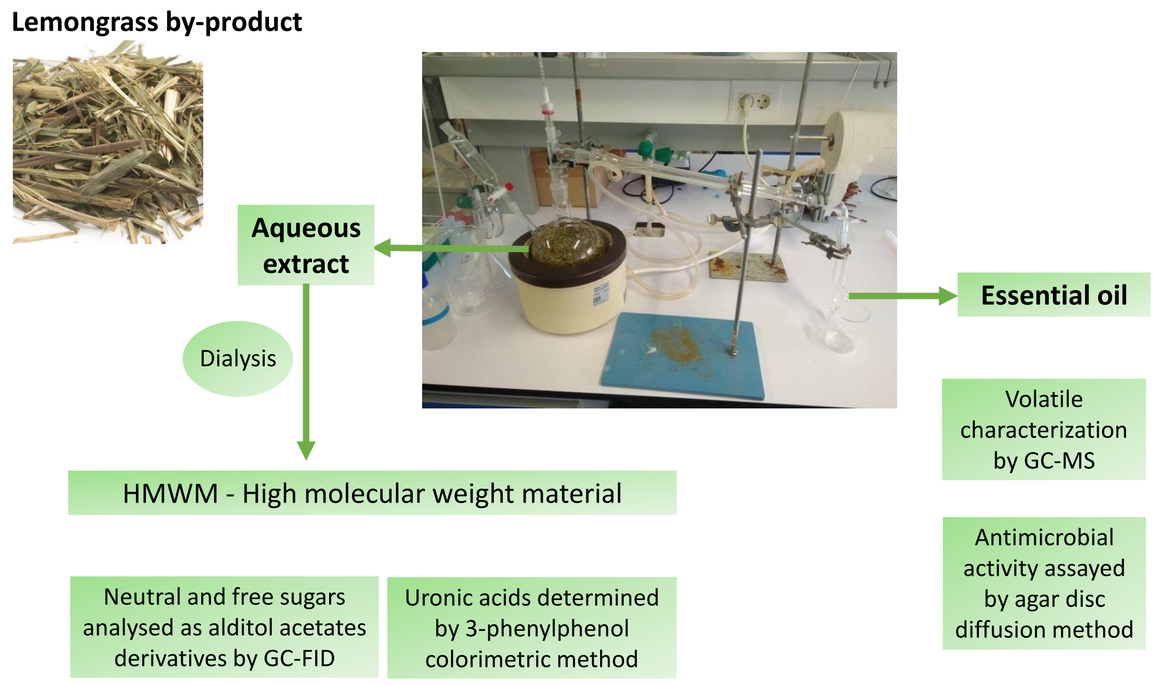
Introduction

Herbal preparations of lemongrass (*Cymbopogon citratus*) contains several bioactive compounds in its decoction, infusion, and essential oil extracts [1]. Hydrodistillation of lemongrass essential oil produces an aqueous waste which is usually discarded. A comparative study between this aqueous waste and an infusion was shown a similar phenolic compounds profile with antioxidant and anti-inflammatory potential [2]. The aromatic plants industry only commercialized the leaves with high quality standard. In the beginning of the season a first harvest is performed, cutting the leaves and discarded them as by-product because they present some parts dried/brownish. After this practice, lemongrass plant develops leaves with high quality for infusions. It is possible that the essential oils (EOs) present in these by-products represent a source of valuable compounds with antimicrobial activity [1], as observed for the leaves used for infusion. In a circular economy concept, the aqueous waste produced during the hydrodistillation was also recovered as a decoction extract.

Objectives

The aim of this work was to study and characterize the structure of hot water soluble polysaccharides present on lemongrass by-products as well as essential oil composition, in order to disclose its usefulness as source of food bioactive compounds with antimicrobial activity.

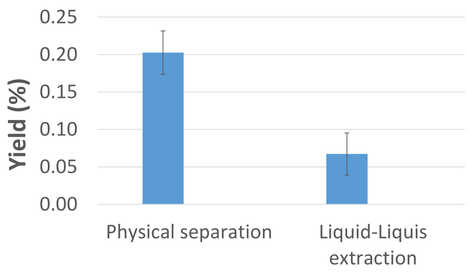
Methods



Results and Discussion

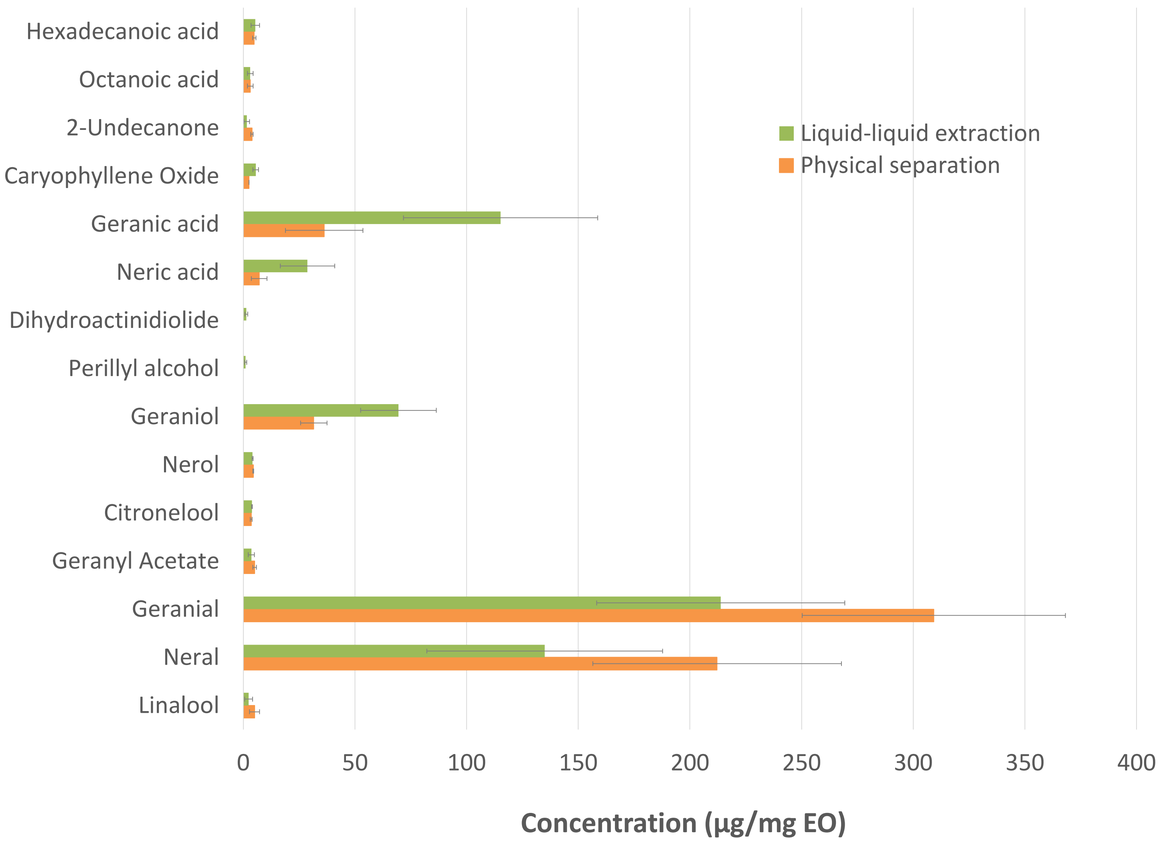
Essential oils

Yield



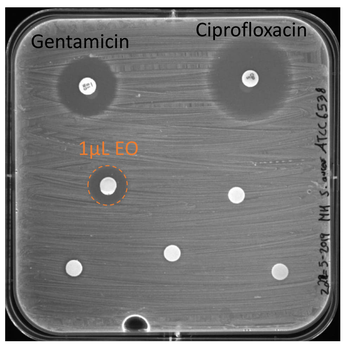
- EO global yield was 0.28%.
- The composition of EO obtained by physical separation was enriched in geranial and neral.
- The composition of EO obtained by liquid-liquid extraction was enriched in geranic acid, neric acid, and geraniol.

Volatile characterization

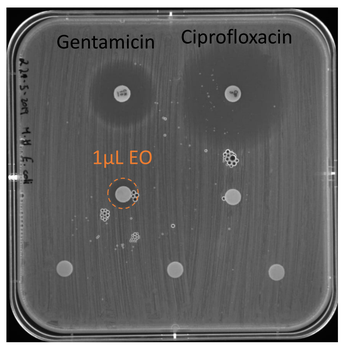


- A total of 13 and 15 compounds were identified and quantified by GC-MS in EOs by physical separation and liquid-liquid extraction, respectively.
- Geranial and neral are the major compounds present in both EOs with 214 - 309 and 135 - 212 µg/mg, respectively.

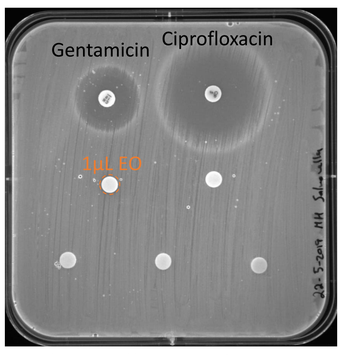
Antimicrobial activity



Staphylococcus aureus ATCC 6538



Escherichia coli ATCC 6538

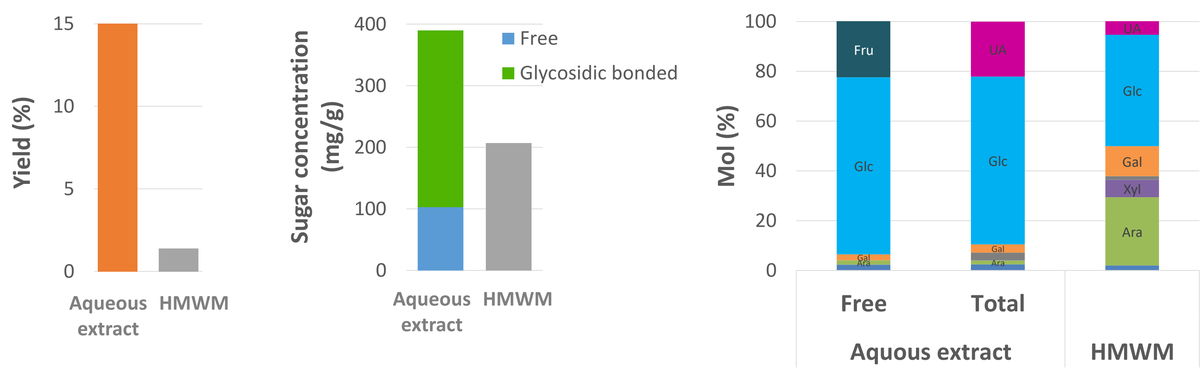


Salmonella enterica anatum SF3

1 µL (0.91mg) of EO containing 0.52g of citral isomers (geranial and neral) present an inhibition zone of 1.27 and 0.33 cm for *S. aureus* and *E. coli*, respectively.

Water extract

Yield and Sugars composition



- An aqueous extract was obtained and recovered, yielding 15% from the by-products, showing that aqueous extract displays a potential source of bioactive molecules, industrially discarded as a waste.
- The high molecular weight material (HMWM) were obtained from dialysis (cut-off 12-14 kDa) of the aqueous extract, yielding only 1.4%, showing that the decoction is mostly constituted by low molecular weight compounds.
- The aqueous extract of lemongrass exhibits a high content in free sugars (103 mg/g). The polymeric material (HMWM) is composed of 207 mg/g of sugars.

Conclusion

- **The composition of the decoction obtained during hydrodistillation contains 39% of carbohydrates, mainly composed of glucose (67%) and pectic polysaccharides.**
- **Lemongrass by-products can be a profitable source of EO due to their high content of geranial and neral, showing potential to be incorporated as antimicrobial compounds.**

References

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