Antimicrobial activity of *Satureja montana* byproducts' essential oils as possible feed ingredients

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Introduction

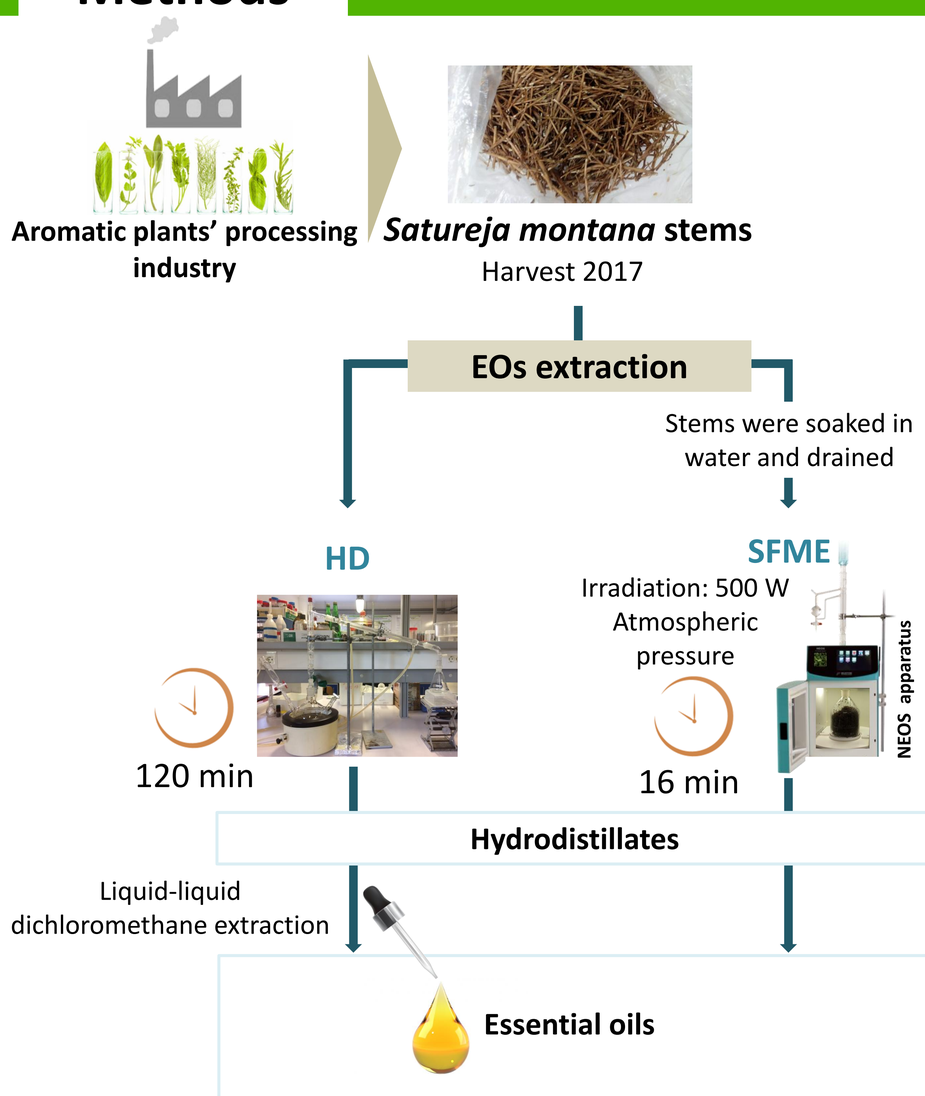
A wide range of antibiotics are used to sustain worldwide poultry industry large productions. The drawback of their dietary extensive use is the antibiotic resistance promotion. To overcome this threat, it is urgent to look for alternative substances that benefit health and animal growth [1]. Possible alternatives are the phytobiotics, compounds with antimicrobial, antioxidant and/or immunomodulatory properties and naturally available in plants [1].

Satureja montana is an aromatic plant whose leaves are marketed as spice by food industry, generating a large amount of stems as byproducts (50–60% of the plant dry weight) [2]. Although *Satureja* essential oils (EOs) have already been recognized as phytobiotics due to their antimicrobial properties [3], the by-products were studied by the first time as a possible source of these active compounds [2].

Objectives

The aim of this work was to evaluate the possibility of using *S. montana* stems as a source of compounds with antimicrobial activity. To fulfill this objective, EOs were obtained from these by-products using hydrodistilation (HD) and solvent-free microwave extraction (SFME) and their volatile composition and antimicrobial potential was studied.

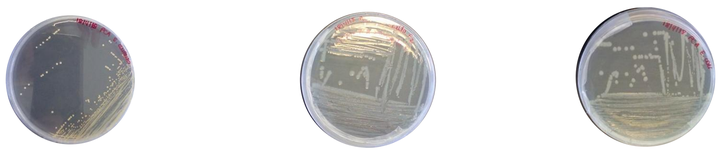
Methods



Characterization of EOs volatile composition by GC-MS

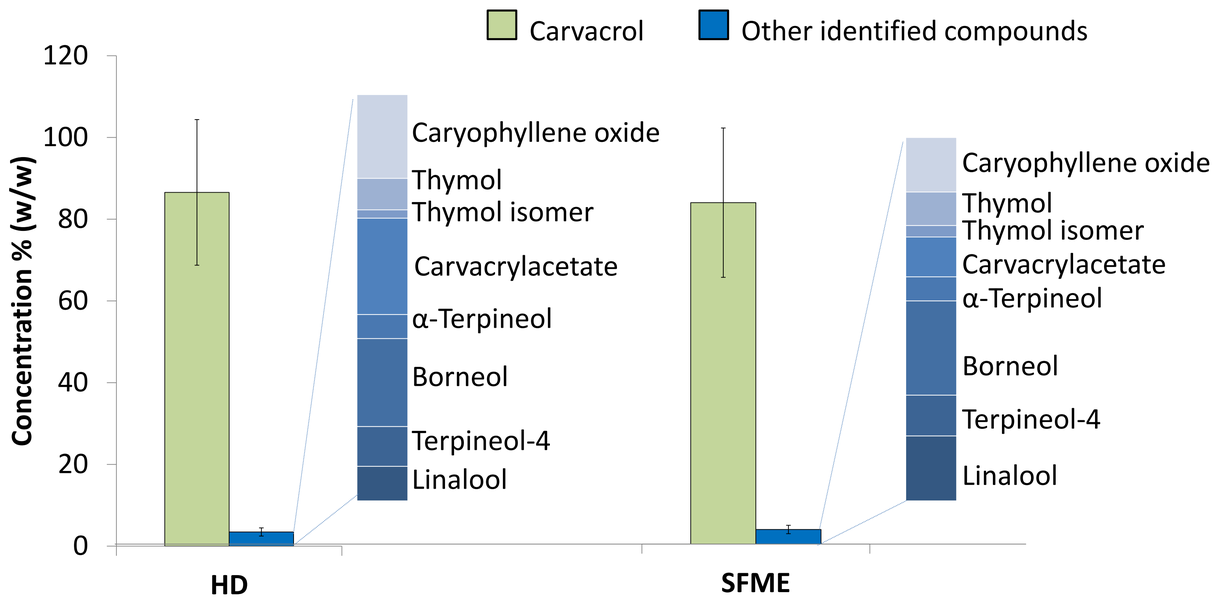
Evaluation of *in vitro* antimicrobial activity by disc diffusion method and broth microdilution assay

Staphylococcus aureus ATCC 6538 | *Salmonella enterica* sv Anatum SF2 | *Escherichia coli* ATCC 25922



Results

Yield and volatile composition

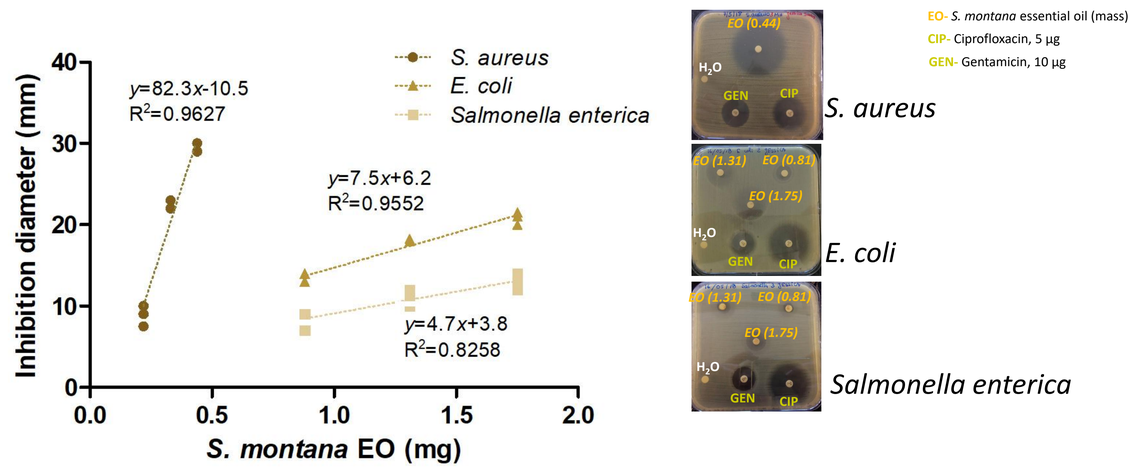


Yield: 0.14 ± 0.07 mg/g | 0.10 ± 0.01 mg/g

- ✓**HD and SFME had similar yields of EOs extraction.**
- ✓**A total of 9 compounds were identified and quantified.**
- ✓**EOs obtained from HD and SFME had similar composition.**
- ✓**Monoterpenoids account for about 84.4-89.6% and sesquiterpenoids represent only 0.5-0.8%.**
- ✓**Carvacrol, monoterpenoid with described antimicrobial effect [2], is the most abundant component (84.4-89.6 µg/mg).**

Antimicrobial activity

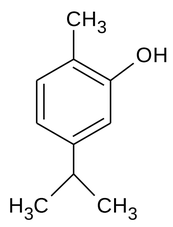
Zones of growth inhibition (mm) of EOs using agar disc diffusion method



- ✓**All strains were susceptible to EOs.**
- ✓**The total inhibition diameter had a linear relationship to the amount of *S. montana* EO impregnated in each test disc.**
- ✓**Gram-positive bacteria (*S. aureus)* are much more susceptible than gram-negative (*S. enterica* and *E. coli) which is* reflected in the value of slope.**

Minimal inhibition concentration (MIC) µg/mL

Microorganisms	*S. montana* L. EO	Carvacrol
E. coli ATCC 25922	225	250 [4]
S. enterica sv Anatum SF2	250	No reported
S. *aureus* ATCC 6538	150	175 [5]



- ✓**The MICs of carvacrol for the same strains are slightly above the MIC values of the tested EOs, supporting the hypothesis that carvacrol is the active principal of *S. montana byproducts* EOs.**

Conclusions

***S. montana* by-products' EOs exhibited antimicrobial activity against representative pathogenic species within the poultry industry and, therefore, they have potential to be exploited as possible alternatives to the antibiotics, while promoting a circular economy.**

References

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