INFLUENCE OF ULTRASONICATION AND PROCESSING PARAMETERS ON STABILITY OF CARVACROL LOADED EMULSIONS

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OBJECTIVES

Emulsion stability is one of the vital factors that determine its food applications. In this study, carvacrol loaded emulsions were prepared through ultrasonication technique.

- The Influence of concentration of the emulsifier (1%, 1.25% and 1.5%) on the emulsion formation was determined.
- The effect of sonication amplitude (45%, 60% and 75%) on the emulsion formulations was investigated.
- Similarly, the influence of sonication time (3 min, 6min and 12 min) on the emulsion droplet size and ζ-potential was found out.

INTRODUCTION

- Human Health
- Outbreaks
- Use of synthetic preservatives
- Chemical treatments.
- Ultrasonication
- Cavitation phenomenon
- Size reduction

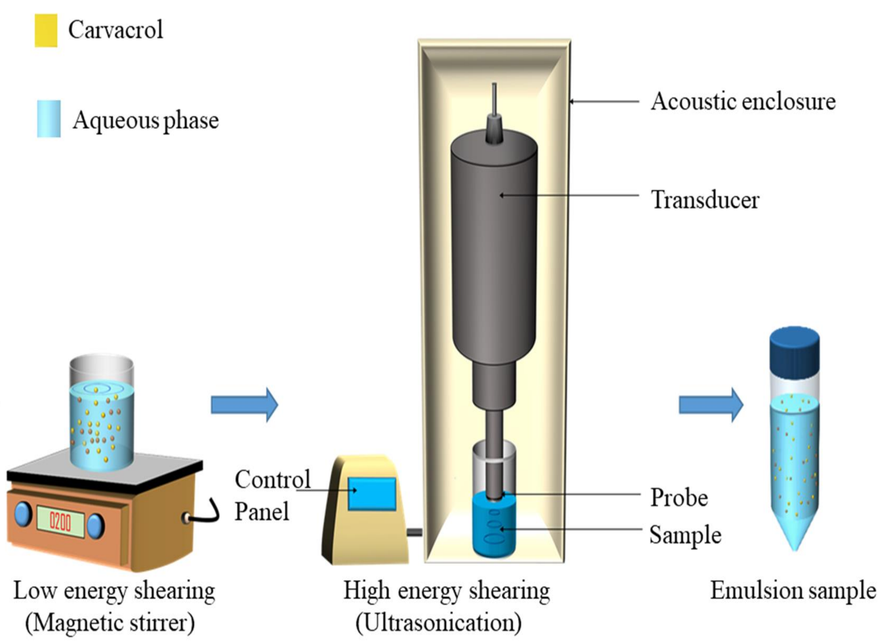

Fig. 1 Schematic diagram of probe ultra sonicator and emulsification process

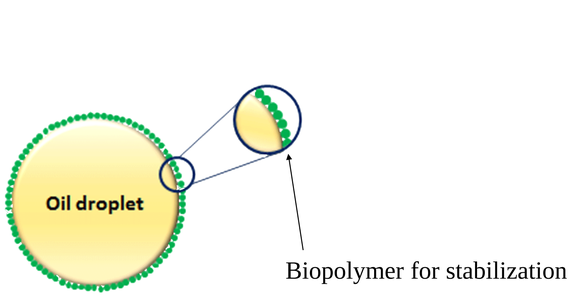

Fig 2. Oil-water interface in emulsion

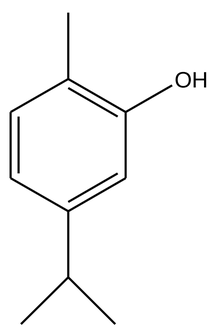

Fig. 3 Chemical structure of carvacrol

MATERIALS AND METHODS

- The key aspect of this research is to formulate and characterize essential oil loaded emulsions stabilized with biopolymer (1% w/v).
- The oil-in-water emulsions containing different amounts of carvacrol in the oil phase were produced.
- 50 mM sodium acetate buffer, pH 5.5 was used as aqueous phase.
- Mean droplet size, polydispersity index and ζ-Potential of Emulsion: Malvern Zetasizer Nano ZS dynamic light scattering particle size analyser.
- Storage stability and creaming stability: The stability of the emulsions to droplet aggregation and creaming was studied.
- Microstructural properties: Confocal laser scanning microscopy (CLSM) and transmission electron microscopy (TEM) were used for studying the morphology of emulsion droplets.
- The antimicrobial efficacy of model antimicrobials geraniol and carvacrol was tested alone and in combination against pathogens *Bacillus cereus* MTCC 430 and *Escherichia coli* MTCC 443 on BHI broth as a model testing system.
- Time-kill assay was performed

RESULTS AND DISCUSSION

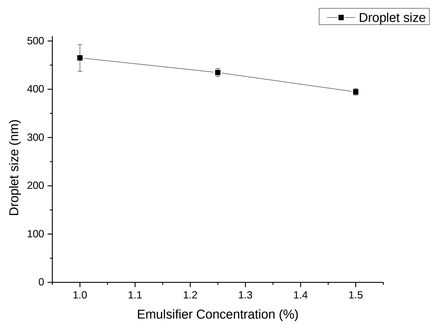

Fig 4: Influence of emulsifier concentration on the droplet size of the emulsion

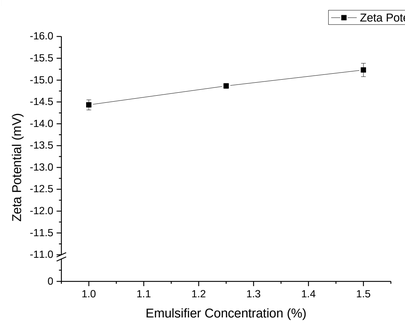

Fig 5: Influence of emulsifier concentration on the ζ-potential of the emulsion

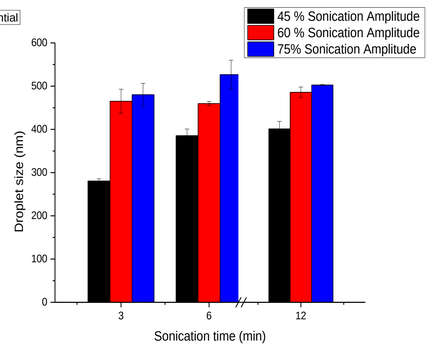

Fig 6: Influence of sonication parameters on the droplet size of the emulsion

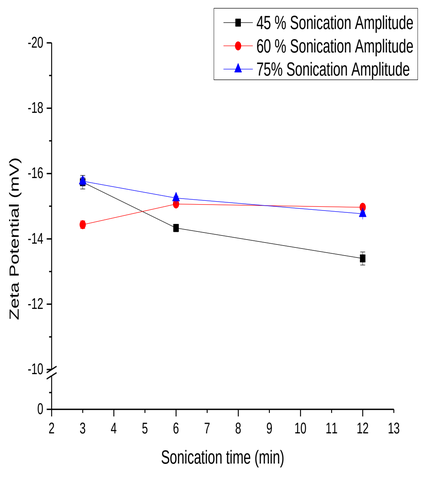

Fig 7. Influence of sonication parameters on the ζ-potential of the emulsion

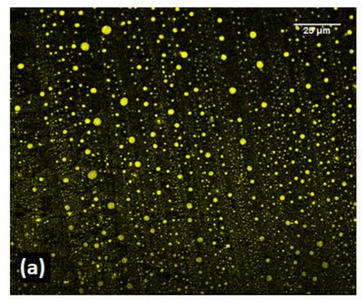

Fig. 8. Confocal images of emulsions prepared from carvacrol emulsion. *Scale bar* 8 µm.

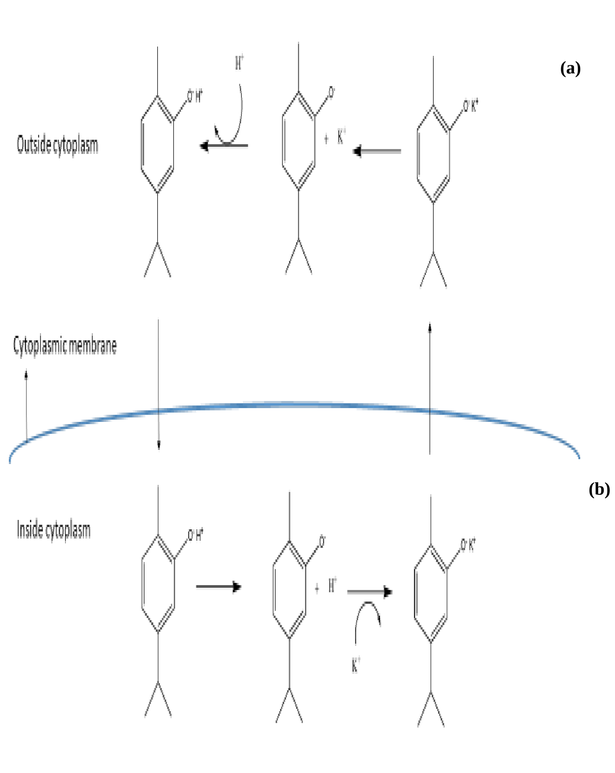

Fig 10. Schematic representation of mode of antimicrobial action of carvacrol through proton exchange mechanism (efflux of K^+ and influx of H^+ **)**

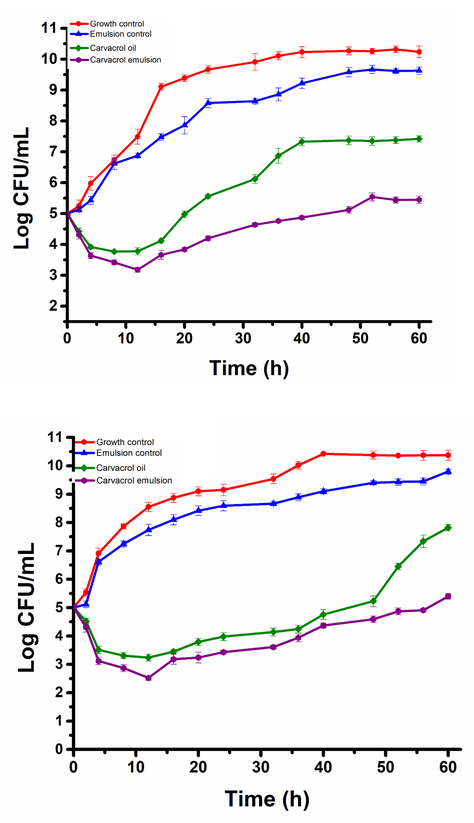

Fig 11. Time-kill curve of **(a)** *Bacillus cereus* MTCC 430 and **(b)** *Escherichia coli* MTCC 443 treated with carvacrol oils in broth as a model testing system. Mean values are shown with error bars of standard deviation (n=3).

CONCLUSION

- Creaming stability studies demonstrated no visible separation of cream and serum layers. The microstructural analysis of the emulsion with CLSM and TEM indicated formation of stable emulsion. Antimicrobial studies demonstrated lower MIC values for antimicrobial compounds protected through emulsion based delivery system compared with their essential oil-only based counterparts
- These results demonstrate that an oil-in-water emulsion system can be used to incorporate plant based antimicrobial compounds for the prolonged protection of food systems.

REFERENCES

Burt S (2004) Essential oils: their antibacterial properties and potential applications in foods—a review. International journal of food microbiology 94:223-253 doi:https://doi.org/10.1016/j.ijfoodmicro.2004.03.022

Devi KP, Nisha SA, Sakthivel R, Pandian SK (2010) Eugenol (an essential oil of clove) acts as an antibacterial agent against Salmonella typhi by disrupting the cellular membrane. Journal of ethnopharmacology 130:107-115 doi:https://doi.org/10.1016/j.jep.2010.04.025