ANTIBACTERIAL ACTIVITY OF FOUR ESSENTIAL OILS IN THE BROTH DILUTION TEST

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ABSTRACT

Recently essential oils sprays were recommended as a new approach to reduce airborne micro-organisms in animal houses. The antibacterial activity of such oils from *Mentha arvensis (Mea), Malaleuca alternifolia (Ma), Cymbopogon citrarus (Cc), Zingibe officinales (Cc)* was tested on *2 Gram + (S. aureus, E. faecium), 3 Gram - (Ps. aeruginosa, E. coli, P. mirabilis)* species and the yeast *C. albicans* using the broth dilution method. Standard bacterial broth cultures were mixed with different concentrations of essential oils in steps from 0.5 to 50 % in order to determine the lowest effective antibacterial concentration. The oils showed a very wide spectrum of antibacterial activity. Concentrations of 0.5 % of *Ma* reduced total bacterial counts of *E. coli* and *P. mirabilis* to below 1 %, 5 % inactivated *Ps. aeruginosa* and *E. faecium* for *Staph. Aureus* 8 % were necessary. High antibacterial activity was also revealed for *Cc* with bactericidal concentrations of 0.8 % (*E. coli*); 0.5 % (*P. mirabilis*); 0.2 % (*E. faecium*); 5 % (*Ps. aeruginosa*) and 8 % (*S. aureus*). *C. albicans* is highly sensitive for *Ma* (0.5 %), *Cc* (0.5 %) and *Mea* (0.8 %). It seems that essential oil-water mixtures may be a promising alternative to air disinfection. More experiments are necessary to verify the effectivenes and to assess occupational and animal health aspects.

Keywords: essential oil, disinfection, micro-organisms.

INTRODUCTION

Control of micro-organisms in indoor environments has traditionally focused on source control, ventilation, and air cleaning [5, 6]. Various industries are now searching for sources of alternative, more natural and environmentally friendly antimicrobials and antibiotics as protection agents. The antimicrobial effects of essential oils have been widely described in several studies [3, 1].
The aim of this study was to evaluate the sensitivity profile of *2 Gram +, 3 Gram -* species, and the yeast *C. albicans* using the broth dilution method to some essential oils with emphasis for a possible future use of the ones as alternative to air disinfection.

MATERIALS AND METHODS

The antibacterial activity of such oils from *Mentha arvensis (Mea), Malaleuca alternifolia (Ma), Cymbopogon citrarus (Cc), Zingibe officinales (Cc)*, was tested on *2 Gram + (S. aureus, E. faecium), 3 Gram - (Ps. aeruginosa, E. coli, P. mirabilis)* species and the yeast *C. albicans* using the broth dilution method.
Essential oils of *Mentha arvensis, Malaleuca alternifolia, Cymbopogon citrarus, Zingibe officinales* were obtained from a commercial source (Germany) and used different concentrations in steps from 0.5 to 50 %.
Test organisms: *Staphylococcus aureus* DSM-No. 799, *Enterococcus faecium* DSM-No. 2918, *Pseudomonas aeruginosa* DSM-No. 939, *Escherichia coli*, *Proteus mirabilis* DSM-No. 788, *Candida albicans* DSM-No. 1386 were obtained from the Deutsche Sammlung von Mikroorganismen und Zellkulturen GmbH.
C. albicans were cultivated on Malzextrakt-Agar at 25 °C for 48 h. Bacteria were cultivated on Blutagar-Basis Nr. 2 37 °C for 24 h.

RESULTS

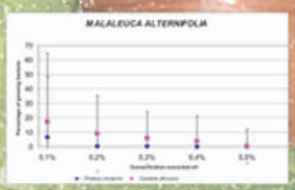

Figure 1. Effects of *Malaleuca alternifolia* on *P. mirabilis*, *C. albicans*

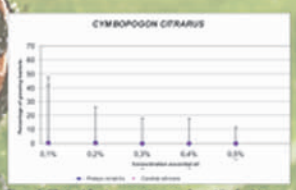

Figure 2. Effects of *Cymbopogon citrarus* on *P. mirabilis*, *C. albicans*

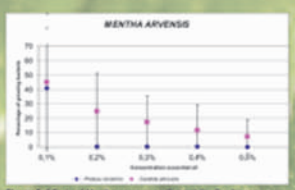

Figure 3. Effects of *Mentha arvensis* on *P. mirabilis*, *C. albicans*

Figure 4. Effects of *Malaleuca alternifolia* on *E. faecium*, *Staph. aureus*, *Ps. aeruginosa*, *E. coli*

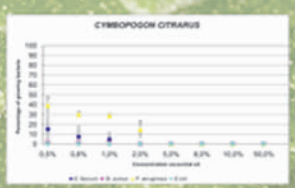

Figure 5. Effects of *Cymbopogon citrarus* on *E. faecium*, *Staph. aureus*, *Ps. aeruginosa*, *E. coli*

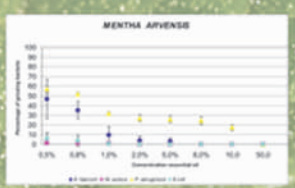

Figure 6. Effects of *Mentha arvensis* on *E. faecium*, *Staph. aureus*, *Ps. aeruginosa*, *E. coli*

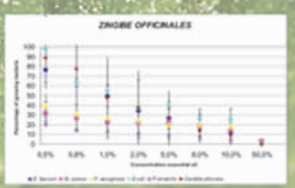

Figure 7. Effects of *Zingibe officinales* on *E. faecium*, *Staph. aureus*, *Ps. aeruginosa*, *E. coli*, *P. mirabilis*, *C. albicans*

DISCUSSION AND CONCLUSIONS

This study demonstrates that the four aroma chemicals - *Mentha arvensis, Malaleuca alternifolia, Cymbopogon citrarus, Zingibe officinales* - definitely show antimicrobial effects on airborne bacteria, yeasts. *Gram-positive* bacteria are known to be more susceptible to essential oils than *Gram-negative* bacteria [2, 7]. The weak antibacterial activity against *Gram*-negative bacteria was ascribed to the presence of an outer membrane, which possessed hydrophilic polysaccharide chains as a barrier to hydrophobic essential oils [4, 8]. As a conclusion, it can be stated that the tested essential oils, can be used for air disinfection as an alternative to established air disinfectants.

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