Antimicrobial Properties of Combinations of Essential Oils

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Effects of Combinations of EOs

Essential oils (EOs) and spices that contain functional constituents such as terpenes, terpenoids, phenyl propenes, and others (carvacrol, thymol etc.), have been observed to have antimicrobial properties due to the deleterious effects of these constituents on the cell membranes of microorganisms. These properties have been aggressively researched over the recent past because of the demand for a new and natural solution to the increasing drug resistance observed in hazardous micro-organisms. The antimicrobial properties of these natural extracts can be attributed majorly to the above mentioned constituents [1, 2], their proportions and the interactions between them. Different combinations of isolated constituents, upon being tested for antimicrobial properties, have shown varying results which can be classified as additive, synergistic and antagonistic with respect to those of their pure oil extract. When the combined effect is equal to the sum of the individual effects, the phenomenon is called additive effect. Antagonism is observed when the effect of a combination of two compounds is less than that of their individual application. An example of this effect is superior antimicrobial effect of carvacrol when compared to oregano oil [3]. Synergism is observed when a combination of substances is quantitatively more effective than the sum of their individual effects [4]. Synergisms from smaller components (p-cymene) in certain EOs have been observed to make the pure oil more efficient than their phenolic constituents (carvacrol) [5]. Another example of synergism of essential oil components is the inhibitory property of a mixture of cinnamaldehyde and eugenol against Staphylococcus sp., Micrococcus sp., Bacillus sp. and Enterobacter sp., while the constituents failed to inhibit growth when applied individually [6].

Similar results were obtained when different EOs was combined, due to the interaction of constituents. Methods including, but not limited to the checkerboard method using FIC, were used to test for these properties, and are reported in publications. A synergistic relation was observed against Y. enterocolitica for a mixture of eucalyptus and cilantro oil while additive and antagonistic effects were observed against other antimicrobial strains [7]. Clove and rosemary essential oil combinations were synergistic, additive or antagonistic based on the organism they were acting on [8]. A vapour phase combination of clove and cinnamon EOs showed concentration dependence for their interaction. The vapours of the combination of essential oils exerted an antagonistic effect on the growth of E. coli at minimum inhibitory concentrations, while they yielded a synergistic effect for the inhibition of L. monocytogenes, B. cereus and Y. enterocolitica at concentrations of maximal inhibition [9]. More recent studies evaluated combinations of basil, lemon balm, marjoram, oregano, rosemary, sage and thyme [10], EOs of C. citratus, O. gratissimum and T. vulgare [11], Chinese cinnamon and cinnamon bark EOs (additive) [12], oregano and rosemary (synergistic) [13], coriander and cumin (synergistic) [14] and majoram and thyme (synergistic) [15]. Synergistic and additive effect amongst different EOs have the potential to reduce EO concentrations which were raising organoleptic concerns.

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and identifying antagonistic combinations can help in isolating and avoiding them for future applications. Hence further research should be conducted in this field.

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References


