Modified atmosphere packaging (MAP) and essential oil from thyme

INTERVENTION SUMMARY	
Status	Currently available
Location	Packaging/retail
Intervention type	Surface treatment or mixed into product, or impregnated into product packaging
Treatment time	Storage life of product
Regulations	The United States Food and Drug Administration (FDA) classifies these substances as generally recognized as safe (GRAS). Accepted by the European Commission for their intended use as flavourings in food products.
Effectiveness	Difficult to ascertain
Likely cost	Difficult to ascertain
Value for money	Cost of extraction may be too expensive
Plant or process changes	High pressure processing system required
Environmental impact	Minimal
OH&S	High CO2 levels can cause suffocation, the area would need to be well ventilated
Advantages	Thyme oil extracts may add a flavour benefit to the meat product
Disadvantages or limitations	Cost of extraction of some antimicrobials may be too expensive for some applications. May limit markets due to changing product characteristic eg. flavour.

Modified atmosphere packaging (MAP) and essential oil from thyme

Modified atmosphere packaging (MAP) is well-known as a method for extending the shelf-life of a variety of foods, including fresh meat and poultry. Common gases used in MAP, applied individually or in combination depending on the food, are carbon dioxide (to inhibit bacterial growth), oxygen (to prevent anaerobic growth and to retain meat colour) and nitrogen (to avoid oxidation of fats and pack collapse) (1).

Extracts and essential oils of certain plants have been shown to have antioxidant and antimicrobial effects, as well as imparting flavour to foods. In recent reports, different plant extracts and essential oils have been used in combination with MAP to increase the shelf-life of various foods. Thymol is one of the major constituents of thyme oil. The primary mode of antibacterial action of thymol is not fully known, but is believed to involve outer- and inner membrane disruption, and interaction with membrane proteins and intracellular targets (2). Karabagias et al. (2011) noticed a significant reduction (2.8 logs) in microbial population on day 9 of storage in lamb meat, by deploying a combination of MAP (80% CO_2/20% N_2) and 0.1 % essential oil extracted from thyme (3). Product shelf life was also extended by 14–15 days using the combination of MAP (80% CO_2/20% N_2) plus thyme oil (3). Similarly, based primarily on sensory data, the shelf-life of fresh refrigerated Mediterranean swordfish was extended by approximately 7½ days by MAP (5% O_2/50% CO_2/45% N_2) and 0.1% v/w thyme oil (4). In addition, in regards to sensory evaluation, the shelf-life of sea bass fillets increased from 6 days to 17 days in the presence of thyme oil in combination with 60% CO_2/30% N_2/10% O_2 (5).

References

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2. Hyldgaard, M., Mygind, T., and Meyer, R. L. (2012) Essential oils in food preservation: mode of action, synergies, and interactions with food matrix components. *Front. Microbiol.* 3, 12

3. Karabagias, I., Badeka, A., and Kontominas, M. G. (2011) Shelf life extension of lamb meat using thyme or oregano essential oils and modified atmosphere packaging. *Meat Sci* 88, 109-116

4. Kykkidou, S., Giatrakou, V., Papavergou, A., Kontominas, M. G., and Savvaidis, I. N. (2009) Effect of thyme essential oil and packaging treatments on fresh Mediterranean swordfish fillets during storage at 4 °C. *Food Chem* 115, 169-175

5. Kostaki, M., Giatrakou, V., Savvaidis, I. N., and Kontominas, M. G. (2009) Combined effect of MAP and thyme essential oil on the microbiological, chemical and sensory attributes of organically aquacultured sea bass (*Dicentrarchus labrax*) fillets. *Food Microbiol.* 26, 475-482