

Study of antimicrobial properties of *Zataria multiflora* extract and timol on durability and stability of edible mushroom (*Agaricus bisporus*)

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Introduction: White button mushroom (*Agaricus bisporus*) has a high moisture content (~90%) which makes it more vulnerable to the germs and chemical reactions. The contents of fungus coating are beneficial for shelf-life extension of mushroom. Coated mushrooms loss less moisture and have firmness, better appearance and color features than uncoated mushrooms (Zahedi et al., 1390). Application of food coatings is widely used in order to extend the shelf-life of foods including mushrooms. These methods include improved packaging methods, coated treatment with a solution of anti-microbial, plant extracts and anti-browning agents. The essential oil of thyme plant (*Zataria multiflora*) contains derivatives of phenol such as carvacrol and thymol (Aligiannis et al., 2001). The interaction of essential components with each other plays an important role in determining antimicrobial effect. Therefore, the synergistic antimicrobial effects of thymol and carvacrol are enhanced (Didry et al., 1994). It is worth noting that carvacrol through changes in permeability of H⁺/K⁺ ion channel in the cell membrane leads to the suppression of cell dysfunction and ultimately death (Ultee et al., 1999).

Materials and methods: Cap of button mushroom was coated by carboxymethyl cellulose, glycerol and thyme extract. In order to identify the thyme components, GC Mass model VARIAN CP3800 and VF5MS column was used. Also to measure the amount of thymol in thyme extract, HPLC method was used. The cap of button mushroom was sampled in three days (first day, seventh and fourteenth) and cultured in the food culture of PDA and NA.

Results and discussion: The results showed that the bacteria *Pseudomonas* sp. and the mold *Aspergillus* sp. in various stages of maintenance of the control samples are observed in the warheads. The coating with thyme extract reduced the population of bacteria and mold. The results also showed that the medium level of microbial density was reduced with increasing concentrations of thyme extract. Therefore, the bacteria and mold did not grow in the extract concentration of 5.187 mgL⁻¹. Thymol in a concentration of 70 and 105 ppm inhibited the growth of bacteria and mold, respectively. According to the results, 5.187 ppm thyme extract and 105 ppm thymol are suitable for coating and prevent the growth of bacteria and mold. The population of bacteria and mold in the treated and untreated samples of mushroom cap were identical. It was much more in the control sample with increasing storage time and was maximum at the end of the fourteenth day. The population of bacteria and mold in the coated samples and thyme extracts was lower than control samples. The direct relationship was observed with increasing storage time in the population growth of bacteria and mold. Lyzhyans et al. (2001) showed that the amount of phenolic oil is higher, the more antibacterial activity. The extract of thyme also contain phenolic compounds of thymol and carvacrol which have the most important role in creating antioxidant properties.

Key Words: *Agaricus bisporus*, carboxymethyl cellulose, *Pseudomonas*, *Zataria multiflora*.

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