

## Evaluation of Antibacterial Activities of *Zataria multiflora* Boiss Nanoemulsion on *Escherichia coli* and *Staphylococcus aureus*

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### Abstract

**Introduction:** *Zataria multiflora* Boiss, a member of Labiatea family, grows in countries such as Pakistan, Afghanistan and Iran. The previous studies have been reported that *Zataria multiflora* Essenital Oil (ZEO) showed medical applications. In this study we have investigated the antimicrobial activity of ZEO nanoemulsion (ZEN) formulations on *Escherichia coli* and *Estaphylococcus aureus*. ZEN has been investigated as a potential strategy for improving their utilization stability and efficacy. To the best of our knowledge there is no previous study about antimicrobial effect of ZEO as a nanoemulsion in the literature.

**Methods and Results:** ZEN was prepared by high energy emulsification method. Distilled water was added dropwise into ZEO, surfactant and Oleic acid as oil phase while stirring. The prepared emulsion was sonicated by probe sonicator to obtain the appropriate size. Nanoemulsion size was evaluated by Malvern nano sizer. Thermodynamic stability tests were performed to select stable nanoemulsion formulations. ZEN were subjected to centrifugation. Then the stable formulations on centrifugation were subjected to heating-cooling and freeze-thaw cycles. Antimicrobial activities were evaluated by well-plate and microtiter methods. The selected ZEN formulation droplet size and PDI were found  $73.58 \pm 10.59$  and  $0.350 \pm 0.077$  nm respectively. Stability tests showed appropriate thermodynamic stability. Antibacterial activity showed that nanoemulsion of ZEO exhibited high antibacterial activity against *Escherichia coli* and *Estaphylococcus aureus*.

**Conclusions:** The enhanced stability and efficacy of ZEN described in the current investigation may have different industrial or medical applications. For instance they can be used as antibacterial medicines for vaginitis. They could also be used in food preservation as a biodegradable coating films.

**Key words:** *Zataria multiflora* Boiss, Nanoemulsion, Essential oil, Antibacterial activity, well-plate method, microtiter method

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