Nanoencapsulation of natural antimicrobials: understanding of molecular mechanisms

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The global demand to reduce the use of synthetic preservatives in food is increasing. In this regard, natural food antibacterial agents with strong antibacterial activity have received extensive attention as a new source of food preservatives. However, many natural antimicrobials, like essential oils (EOs), have a low water solubility and are very labile compounds which are prone to decomposition or evaporation during food processing. Recent advances in encapsulation technology have a potential to address these existing barriers for using EOs as preservatives in food systems. Meanwhile, a significantly large part of current literature focuses on the encapsulation of EOs in micrometric size capsules usually formed by drying nanoemulsions. Compared to the conventional emulsions, nanoemulsions would provide more surface area and a better dispersity in food matrices which may improve the passive cellular absorption mechanisms, thus increasing antimicrobial activity by releasing their contents inside microbial cells. Then, the ambition of this work is to formulate nanoemulsions by using different biopolymers in combination with antimicrobial EOs, to achieve the purpose of improving the antibacterial effect. The physical-chemistry properties and antibacterial activity of nanoemulsions through different combinations between EOs (trans-cinnamaldehyde (TC) and citral) and emulsifiers (sodium caseinate and lecithin) have been investigated. The results showed that the droplet size of four different nanoemulsions were all at the nanoscale (142.3 ~ 273.1 nm) with stable electrostatic repulsions at pH 7. Antibacterial evaluation revealed that TC nanoemulsions exhibited significantly higher antimicrobial activities against *Escherichia coli* and *Listeria innocua* and better stability compared to TC conventional emulsions.