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Optimization of water in olive oil nano-emulsions composition with bioactive compounds by response surface methodology

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Introduction:

Emulsions are thermodynamically unstable colloidal dispersions comprised of two immiscible liquids and typically consist of oil, surfactant, and water. Recently, they are gaining increasing interest in the food industry as delivery systems of sensitive bioactive compounds. However, the production of such systems is challenging, due to their tendency to be subjected to destabilization during storage. Emulsion stability can be defined as the ability of a certain emulsion to resist to any structural changes through time. Emulsion instability can be a result of several physical and chemical mechanisms. Types of physical instability mechanisms are: creaming, coalescence, flocculation, phase inversion, partial coalescence, and Ostwald ripening. Nevertheless, nano-emulsions, which are characterized by a mean droplet diameter lower than 500 nm, tend to have better stability than the conventional macro-emulsions due to their small particle size (Ghosh, Mukherjee, & Chandrasekaran, 2013; Rashidi & Khosravi-Darani, 2011; Tang, Sivakumar, Ng, & Shridharan, 2012). Nano-emulsions are also characterized by high optical clarity (ranging from transparent to slightly turbid) and are excellent delivery systems with high oral bioavailability (Aboalnaja, Yaghmoor, Kumosani, & McClements, 2016).

Incorporation of antioxidants and especially polyphenols in emulsions, is a common approach used in pharmaceutical, food and cosmetic industries (Sessa et al., 2013). The effectiveness of these emulsions depends on their ability to preserve the bioactivity and bioavailability of the incorporated active compounds. Plant polyphenols present particular biological activity; antioxidant, anticancer, cardio-protective, antiaging, antimicrobial and anti-inflammation properties. In particular, gallic acid, is well known for its remarkable antioxidant activity in emulsion or lipid systems, inhibiting interaction of radicals to health beneficial compounds, by donating H-atoms from phenol groups to radicals (Lindberg Madsen & Bertelsen, 1995). It is commonly used in processed food and cosmetics in order to prevent rancidity, induced by lipid peroxidation.