

ABSTRACT

Betel leaf (*Piper betle* L.) is a popular plant having several ethnomedicinal claims in Southeast Asian countries. Betel leaf contains essential oil (2% dry basis) which has many beneficial properties as it consists of several bioactive compounds, such as estragole, eugenol, chavicol, chavibetol etc. The essential oil of betel leaf (BLEO) was used in synthesis of nanoemulsions.

Two different types of nanoemulsions were prepared. The single component nanoemulsions (SCN) was constituted of BLEO, distilled water and Tween-20 emulsifier at different proportions (1:1 – 1:6). On the other hand, another plant polyphenol, ‘quercetin’ of varying concentrations (25 – 400 µg/ml) was added to SCN to prepare dual component nanoemulsions (DCN) for better effectiveness.

The DLS study and SEM image analysis confirmed the emulsification to the nano-sized and spherical-shaped droplets. The FTIR analysis of the obtained nanoemulsions also revealed that there was almost no change in the functional groups of BLEO even after emulsification. The nanoemulsions were thermodynamically unstable but the kinetic stability ranged from 70 – 150 days.

The *in-vitro* antimicrobial activity against five selected food-borne pathogens and antioxidant effectiveness of the prepared nanoemulsions was performed. All of the twelve nanoemulsion formulations exhibited potential antimicrobial activity in terms of their MIC and MBC at a very low dose (0.5 – 2.5 µl/ml). They also exhibited potential antioxidant effectiveness depending on its total polyphenol content, total flavonoid content, total antioxidant capacity and DPPH free radical scavenging activity.

The antimicrobial effectiveness of the nanoemulsions in surface sanitization of fresh vegetables was evaluated in terms of microbial log cycle reduction (log CFU/ml). The formulated nanoemulsions were also used for fortification of cupcakes to observe their effectiveness in storage study and sensory quality in terms of moisture absorption, free fatty acid formation and peroxide value determination. Both the emulsions exhibited effectiveness for enhancing shelf-life of the cupcakes with appreciable inhibition of microbial growth over control (unfortified) samples.

Thus, the current study indicates that the betel leaf essential oil nanoemulsion (SCN) is a potential antimicrobial and antioxidant substance for functional food applications. Besides, use of quercetin in preparation of DCN slightly increased the effectiveness.

Keywords: Betel leaf, essential oil, plant polyphenol, nanoemulsions, antimicrobial, antioxidant, functional food.
