

ABSTRACT

The widespread awareness of green consumerism has led to an increased interest in safe and biodegradable alternatives like essential oil for food preservation. The essential oil is a naturally occurring secondary metabolite of plants having various bioactive phytochemicals mainly monoterpenes, sesquiterpenes, their oxygenated derivatives etc. Betel leaf (*Piper betle* L. cv. Tamluk Mitha) is a rich source of essential oil which remained unexplored as food preservative. The present study was focussed on describing the efficacy of betel leaf essential oil (BLEO) against two predominant food spoilage fungi viz. *Aspergillus flavus* and *Penicillium expansum* using the existing predictive microbiological tools, and the potential of essential oil of betel leaf as food preservative. Chemical characterization of BLEO revealed the presence of chavibetol, estragole, β -cubebene, chavicol, and caryophyllene as major phytochemicals. To provide uniform distribution and enhanced bioavailability of the essential oil in the food system, a BLEO based microemulsion was formulated. The microemulsified BLEO had droplet diameter in nano-range with extended kinetic as well as thermodynamic stability. Prediction and validation of antifungal effect of BLEO on *A. flavus* and *P. expansum* was performed on potato dextrose agar, apple juice agar (AJA) and tomato paste. Re-parameterized Monod type equation estimated minimum inhibitory concentration of 3.55 ± 0.35 mg/g and 0.74 ± 0.06 μ l/ml of BLEO against *A. flavus* and *P. expansum* growth on tomato paste and AJA medium, respectively. The present study also described the effect of BLEO on spore germination, inactivation and cell viability of *A. flavus* and *P. expansum* using various predictive models. Modified Weibull model estimated that sporicidal concentration of BLEO could achieve 1 log₁₀ reduction of *A. flavus* and *P. expansum* spores in 69.1 ± 4.85 and 60.7 ± 6.95 hours, respectively. Evaluation of food preservative potential of BLEO was also attempted to find out an organoleptically acceptable concentration of BLEO that can be employed in tomato paste and raw apple juice. This was followed by determination of the effect of the acceptable concentration of BLEO on tomato paste and raw apple juice for enhancing shelf life under accelerated ($89 \pm 1.2\%$ RH at 39 ± 1 °C) as well as refrigerated (4 °C) conditions, respectively. The organoleptically acceptable concentration of BLEO could efficiently extend the shelf life of treated tomato paste and raw apple juice by 14 and 6 days, respectively, as compared to their untreated samples without hampering organoleptic properties of the food products.

Keywords: *Betel leaf essential oil; Microemulsion; Antifungal; Predictive mycology; Sensory; Tomato paste; Raw apple juice; Food preservative*
