

Physicochemical, oxidative and anti-oxidant stabilities of kenaf seed oil-in-water nanoemulsions under different storage temperatures

ABSTRACT

Kenaf seed oil-in-water nanoemulsions stabilised by sodium caseinate, Tween 20 and β -cyclodextrin complexes were produced using high pressure homogeniser. This formulation has been shown to possess good lipid digestion and increased bioaccessibility of tocopherols and total phenolic contents. However, its physicochemical and oxidative stability during storage was unknown. Therefore, the main objectives of this study were to evaluate the effects of three storage temperatures ($4\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$, $25\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$ and $40\text{ }^{\circ}\text{C} \pm 2\text{ }^{\circ}\text{C}$) on the physicochemical, oxidative and antioxidant stability of formulated kenaf seed oil-in-water nanoemulsions. The results showed that nanoemulsions stored at $4\text{ }^{\circ}\text{C}$ had maintained the highest stability with the highest zeta-potential value (-36.6 mV), lowest changes of PDI and pH over 12 weeks of storage. It also presented the lowest reduction of polyunsaturated fatty acids (PUFA) over the course of storage period. In contrast, nanoemulsions that stored at $40\text{ }^{\circ}\text{C}$ exhibited lowest stability with the lowest zeta-potential (-27.3 mV). Sediment was observed in 8 weeks of storage and it had the highest reduction of PUFA. Total phenolic contents in nanoemulsions that stored at $4\text{ }^{\circ}\text{C}$ and $25\text{ }^{\circ}\text{C}$ showed decreasing trend during the storage period, except for nanoemulsions that stored at $40\text{ }^{\circ}\text{C}$ showed a significant increase ($p < 0.05$) in the first week of storage, but subsequently also displayed decreasing trend. The overall results showed that nanoemulsions that stored at $4\text{ }^{\circ}\text{C}$ and $25\text{ }^{\circ}\text{C}$ were stable for up to 8 weeks of storage. Nanoemulsions that stored under accelerated storage temperature of $40\text{ }^{\circ}\text{C}$ were stable for 1 week, which is equivalent to 28 days at room temperature (RT) based on Arrhenius equation. The results of this study could provide better understanding of the storage stability of kenaf seed oil-in-water nanoemulsions under different storage temperatures. It could be served as a predictive model to estimate its shelf-life.

Keyword: Kenaf seed (*Hibiscus cannabinus* L.) oil; Particle size; Polydispersity index (PDI); Zeta-potential; Fatty acid compositions; Total phenolic content