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Microencapsulation of eucalyptol in polymeric composites using supercritical carbon dioxide

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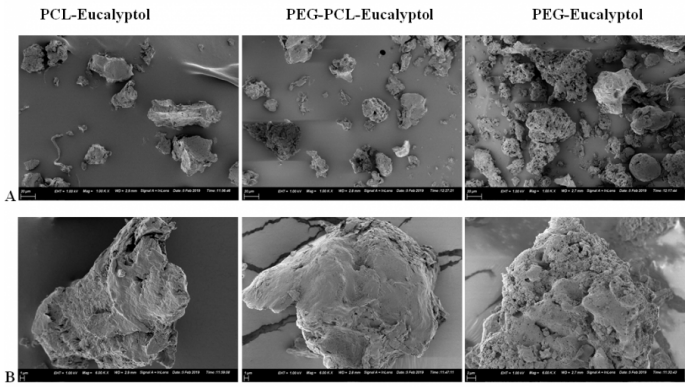
PURPOSE OF THE ABSTRACT

Eucalyptol is the natural cyclic ether that constitutes the bulk of terpenoids found in essential oils of Eucalyptus sp. It is used in aromatherapy for treatment of migraine, sinusitis, asthma and stress. It acts by inhibiting arachidonic acid metabolism and cytokine production. Chemical instability and volatility of eucalyptol restrict its therapeutic application and necessitate the need to develop appropriate delivery system to achieve extended release and enhance its bioactivity. In this study, supercritical carbon dioxide (scCO2) was explored as an alternative greener solvent for encapsulation and co-precipitation of eucalyptol with polyethylene glycol (PEG) and/or polycaprolactone (PCL) using the particles from gas saturated solution (PGSS) process. Polymers and eucalyptol were pre-mixed and then processed in PGSS autoclave at 45 ºC and 80 bar for 1 h. The mixture in scCO2 was micronized and characterized. Presence of eucalyptol in precipitated particles was confirmed by infrared spectroscopy, gas chromatography and mass spectrometry. Weight ratios of PEG-PCL blend significantly influenced loading capacity and encapsulation efficiency; 77% of eucalyptol was encapsulated in a blend of PEG-PCL (4:1) composites. Particle size distribution of the PGSS-micronized particles ranged from 30 ? 260 µm. Loss of the volatile drug during a 2 h vaporization study and addition of PCL extended mean release time in simulated physiological fluids. Free radical scavenging activity of eucalyptol formulated in polymeric microparticles with PGSS was sustained. Findings from this study showed that the scCO2-assisted micronization can be used for encapsulation of volatile drugs in polymeric microparticles without affecting bioactivity of the drug.

FIGURES



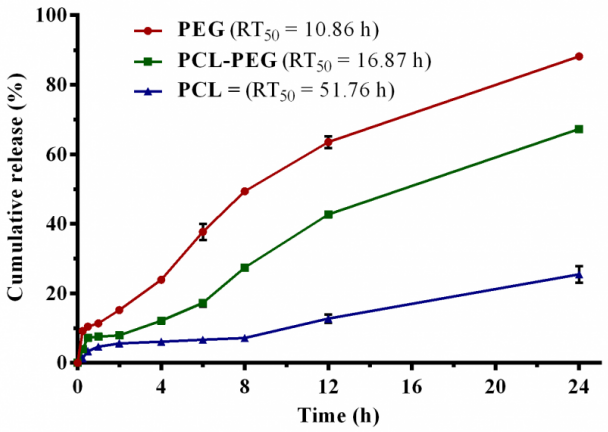


FIGURE 1

FIGURE 1

Size and morphology of polyethylene glycol (PEG) and polycaprolactone (PCL) microparticles co-precipitated with eucalyptol using supercritical carbon dioxide

*A = ×1000 and B = ×6000

FIGURE 2

FIGURE 2

Cumulative release of eucalyptol from polyethylene glycol (PEG) and polycaprolactone (PCL) microparticles formulated using supercritical carbon dioxide in physiological fluids (0 – 2 h in simulated gastric fluid; 2 – 8 h in simulated intestinal fluid; 8 –

KEYWORDS

drug delivery | microencapsulation | essential oils | supercritical fluids

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