Fabrication and characterization of Agarwood extract-loaded nanocapsules and evaluation of their toxicity and anti-inflammatory activity on RAW 264.7 cells and in zebrafish embryos

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Abstract

Aquilaria malaccensis has been traditionally used to treat several medical disorders including inflammation. However, the traditional claims of this plant as an anti-inflammatory agent has not been substantially evaluated using modern scientific techniques. The main objective of this study was to evaluate the anti-inflammatory effect of Aquilaria malacensis leaf extract (ALEX-M) and potentiate its activity through nano-encapsulation. The extract-loaded nanocapsules were fabricated using water-in-oil-in-water (w/o/w) emulsion method and characterized via multiple techniques including DLS, TEM, FTIR, and TGA. The toxicity and the anti-inflammatory activity of ALEX-M and the extract-loaded nanocapsules (ALEX-M-PNCs) were evaluated in-vitro on RAW 264.7 macrophages and in-vivo on zebrafish embryos. The nanocapsules demonstrated spherical shape with mean particle diameter of 167.13 +/- 1.24 nm, narrow size distribution (PDI = 0.29 +/- 0.01), and high encapsulation efficiency (87.36 +/- 1.81%). ALEX-M demonstrated high viability at high concentrations in RAW 264.7 cells and zebrafish embryos, however, ALEX-M-PNCs showed relatively higher cytotoxicity. Both free and nanoencapsulated extract expressed anti-inflammatory effects through significant reduction of the pro-inflammatory mediator nitric oxide (NO) production in LPS/IFN gamma-stimulated RAW 264.7 macrophages and zebrafish embryos in a concentration-dependent manner. The findings highlight that ALEX-M can be recognized as a potential anti-inflammatory agent, and its anti-inflammatory activity can be potentiated by nano-encapsulation. Further studies are warranted toward investigation of the mechanistic and immunomodulatory roles of ALEX-M.

Keywords

Author Keywords: Aquilaria malaccensis; polymeric nanocapsules; anti-inflammatory; RAW 264; 7; zebrafish

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