



Pulmonary delivery of curcumin and quercetin nanoparticles for lung cancer–Part 1: Aerosol performance characterization

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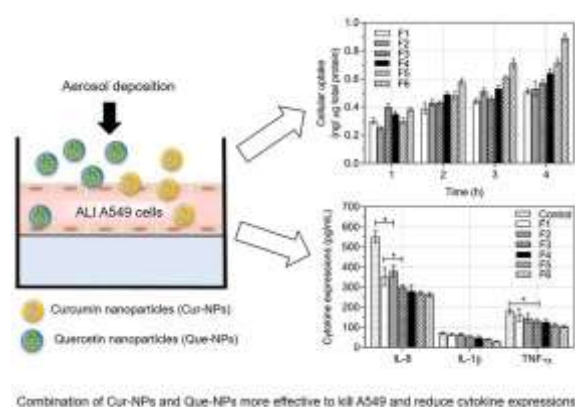
Highlights

- Negatively-charged Cur-NPs and Que-NPs remained stable for over 3 months.
- Cur-NPs were more effective to reduce proliferation of A549 compared to Que-NPs.
- Combination of Cur-NPs (< 10µm) and Que-NPs (< 20µm) is synergistic towards A549.
- Cur-NPs and Que-NPs can be delivered via nebulization with satisfactory performance.

Abstract

Pulmonary delivery could be an effective method to provide higher dose of chemotherapeutic drugs onto the lung as well as minimize systemic toxicity. In this study, curcumin (Cur) and quercetin (Que) nanoparticles formulated via solvent-antisolvent method were investigated for their synergistic effect when deposited directly onto air-liquid interface (ALI) culture of lung carcinoma (A549) cells. The particle size, polydispersity index and zeta potential value for both NP formulations were stable after three months of storage (25 °C/60% RH). For Cur-NPs, the particle size, polydispersity index and zeta potential value remained at 60.0nm, 0.053 and −19.9mV, respectively. Meanwhile, the corresponding values for Que-NPs were 60.0nm, 0.064 and −24.7mV, respectively. The aerosol performance for the formulations was also not statistically affected after storage for 3 months. In general, the combination of Que-NPs and Cur-NPs was synergistic against A549 cells, presumably due to the higher uptake of drugs compared to single Que-NPs or Cur-NPs alone. The combination of Cur-NPs/Que-NPs at the ratio of 1:4 resulted in the highest internalization and subsequent anti-inflammatory effect against IL-1 β , IL-8 and TNF- α in ALI-culture A549. In conclusion, the fabrication of Cur-NPs and Que-NPs could maintain the stability, aerosol performance and anti-cancer activities after 3 months of storage. The combination aerosolization of NPs resulted in synergistic effects to suppress inflammation and kill A549 cells. This study suggests that the combination of Cur-NPs and Que-NPs could be used as an alternative approach to achieve synergistic killing of lung cancer cells via inhalation without compromising the proliferation of healthy lung cells.

Graphical abstract



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Introduction