

Curcumin Nanoemulsion for Pancreatic Cancer Stem Cells—Targeted Treatment Part II: Formulation Development, Characterization, and Anti-proliferation Study

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Purpose

To characterize and evaluate anti-proliferative efficacy of curcumin nanoemulsion as a potential approach for pancreatic cancer stem cells-targeted treatment

Methods

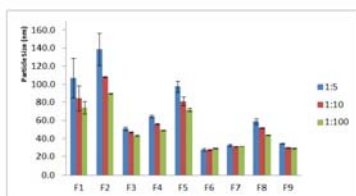
With Capmul PG-8 NF & Captex 200P (1:1, w/w), Kolliphor EL, and PEG 400 as the oil phase, surfactant, and cosurfactant respectively, nine self-nanoemulsifying pre-concentrates (F1-F9) were formulated from pseudo-ternary phase diagram study. Formulation characterization included maximum drug payload, globule size and polydispersity index, effect of dilution factor (mass ratio of SNEDDS and pH 7.4 PBS) on the particle size, stability of the nanoemulsion generated from the pre-concentrates (dilution Factor 1:5), and stability of curcumin in the nanoemulsions. The anti-proliferation study of curcumin-loaded nanoemulsion from F7 against Human Pancreatic Cancer Stem Cells (HPCSCs, purchased from Celprogen Inc.) and normal pancreatic cancer cell line BxPC-3 was also evaluated

Results

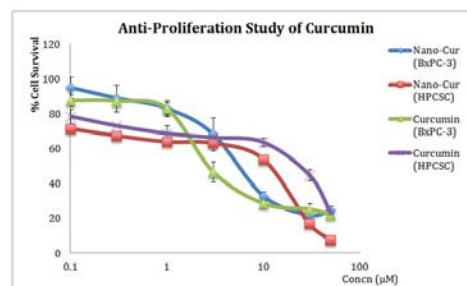
The maximum payload of the nine formulations was ranged from 22.52 to 51.37 mg/g. The droplet size varied from 27.6 nm to 138.4 nm and polydispersity index of all nine formulations was below 0.300 when dilution factor was 1:5. However, only F3, F6, F7, and F9 showed constant droplet size with various dilution factors from 1:5 to 1:100. F6, F7, and F9 were selected when considering loading capacity, particle size and resistance to dilution for further studies. Nanoemulsion from F7 showed better stability than F6 and F9; besides, curcumin was also stable in F7 for at least 72 hours while free curcumin aqueous solution showed significant degradation at different pH conditions. The IC₅₀ of curcumin nanoemulsion against BxPC-3 and HPCSCs were 5.69±0.41 μM and 11.24±0.62 μM respectively, while the free solution had an IC₅₀ of 2.84±0.08 μM and 24.75±0.82 μM against BxPC-3 and HPCSCs, respectively

Conclusion

Curcumin nanoemulsion was successfully developed and characterized and it showed improved efficacy against pancreatic cancer stem cells in vitro



The effect of dilution factor on the particle size of different formula. Data are expressed as mean ± S.D. (n=3)



Anti-proliferation study of curcumin and curcumin nanoemulsion (Nano-Cur) against Human Pancreatic Cancer Stem Cell line (HPCSC) and BxPC-3 cell line. Data are expressed as mean ± S.D. (n=6)