Nano LDL drug delivery systems: synthesis, characterization, insilico investigation, and anticancer evaluation

Laila Jaragh-Alhadad

Department of Chemistry, Faculty of Science, Kuwait University, Kuwait, 13060.

Abstract

The encapsulation of therapeutic agents into nano LDL particles for cancer treatment has received considerable attention these days. Nano LDL particles allow cancer-specific drug delivery by active targeting strategy and improve the pharmacokinetics and bioavailability of the loaded drugs. A series of 1,2,4-triazole derivatives were synthesized in good yields, and characterized by mass spectroscopy, proton NMR, carbon NMR, melting point, FTIR, x-ray single crystal, particles' morphologies, particle size measurements before and after LDL encapsulation, and TGA. The molecular docking technique was used to predict the potent β-tubulin inhibitor, and the scores of eight synthesized compounds were investigated. The experimental results using an x-ray single crystal confirmed the structure of agent 4f. Docking scores revealed that agent 4f has an outstanding score with a value of -5.9 kcal/mol compared with doxorubicin (calc. -6.8 kcal/mol). The derivatives showed nano-size particles, sheets, and rods with uniform morphologies. 1,2,4-triazole derivatives were encapsulated into nano LDL particles and the particle sizes increased. The biological assessment revealed that 1,2,4-triazole derivatives have anticancer activity toward both breast (MDA468) and prostate (DU145) cancer cell lines. The insilico investigations and the biological evaluation results were parallel and showed that agent 4f was the potent triazole derivative with chlorine substituent that possesses the activity toward both cancer cell lines in the range of 1.23±0.18 and 1.20±0.78 µM, respectively. Hence the present study proved that nano LDL particles can considered active drug-delivery vehicles for cancer therapy.