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Peg-serine nanoparticles as novel nanostructures for attenuation of organophosphate poisoning: synthesis, characterization, in vitro and in vivo studies

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Objective: This study attempts to attach the amino acid serine to polyethyleneglycol (PEG) to form novel nanoparticles (NPs) for treatment of diazinon poisoning.

Methods: Serine and PEG were conjugated using a reductive amination reaction. NPs were purified by ultrafiltration. NP structure was analyzed by ^{1}H NMR, ^{13}C NMR, IR and DSC (expand).Particle size of NPs was determined by dynamic light scattering method. Blood hemolysis and cytotoxicity of NPs on $SKBR_3$ cell line were evaluated. Effectivness of NPs were evaluated in Albino poisoned mice. NPs at doses of (100, 200, 400 mg/kg) were administered (ip) 20 minutes after a single dose of diazinon (LD50 = 166 mg/kg). Atropine (20 mg/kg, ip) with pralidoxime (20 mg/kg, ip) or atropine alone was compared to the NP treatment LD50 decreasing, cholinesterase reactivation enzymes in brain, RBC and serum and oxidative damage in brain mitochondria were assessed in mice.

Results: According to NMR, IR and DSC data, conjugation of PEG-Serine was achieved succesfully. Average particle size of nanomicelle was found to be 142.4 nm. Amount of hemolytic activity of this NP was calculated to be 0.867 % and IC_{50} was calculated as 36 mg/ml. LD50 significantly decreased (25 %) by NPs when compared with conventional treatment cholinesterase enzymes activity, lipid peroxidation, protein carbonyl content, and mitochondrial function significantly improved by NPs when compared with conventional treatment.

Conclusion: NPs may be considered as a new combination therapy to successfully decrease the acute toxicity of diazinon