

Radiation Skin Decontamination Formulation

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Abstract : Radio-nuclides decontamination is an important task because any extra second of deposition leads to deleterious health effects. We had developed and characterise nanoemulsion of p-tertbutylcalix[4]arens using phase inversion temperature (PIT) method and evaluate its decontamination efficacy (DE). The solubility of the drug was determined in various oils and surfactants. Nanoemulsion developed with an HLB value of 11 and different ratios of the surfactants 10% (7:3, w/w), oil (20%, w/w), and double distilled water (70%) were selected. Formulation was characterised by multi-photon spectroscopy and parameters like viscosity, droplet size distribution, zeta potential and stability were optimised. In vitro and Ex vivo decontamination efficacy (DE) was evaluated against Technetium-99m, Iodine-131, and Thallium-201 as radio-contaminants applied over skin of Sprague-Dawley rat and human tissue equivalent model. Contaminants were removed using formulation soaked in cotton swabs at different time intervals and whole body imaging and static counts were recorded using SPECT gamma camera before and after decontamination attempt. Data were analysed using one-way analysis of variance (ANOVA) and was found to be significant ($p < 0.05$). DE of the nanoemulsion loaded with p-tertbutylcalix[4]arens was compared with placebo and recorded to be $88 \pm 5\%$, $90 \pm 3\%$ and $89 \pm 3\%$ for ^{99m}Tc , ^{131}I and ^{201}Tl respectively. Ex-vivo complexation study of p-tertbutylcalix[4]arene nanoemulsion with surrogate nuclides of radioactive thallium and Iodine, were performed on rat skin mounted on Franz diffusion cell using high-resolution sector field inductively coupled plasma mass spectroscopy (HR-SF-ICPMS). More than 90% complexation of the formulation with these nuclides was observed. Results demonstrate that the prepared nanoemulsion formulation was found efficacious for the decontamination of radionuclides from a large contaminated population.

Keywords : p-tertbutylcalix[4]arens, skin decontamination, radiological emergencies, nanoemulsion, iodine-131, thallium-201

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