

Photosensitive tetraether lipid-based liposomes for temoporfin mediated photodynamic therapy to cancer cells

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Photodynamic therapy (PDT) is a minimally-invasive therapeutic approach that is being widely used for the treatment of large number of medical conditions. The principal of PDT is based on the combination of a light sensitive molecule (a photosensitizing agent) and light. After being administered, the photosensitizer compound can be illuminated by specific wavelength of light to activate the drug molecule (photosensitization). After absorption of light energy of particular wavelength, the photoactivated sensitizer interacts with molecular oxygen to generate free radicals and singlet oxygen species. These highly reactive oxygen species (ROS) then induce cellular apoptosis or necrosis leading to tumor destruction. These species are very short lived; therefore, the resultant tissue damage occurs very close to production site. Temoporfin loaded liposomes are prepared by thin film hydration and filter extrusion technique using stable tetraether lipid combinations. These liposomes were extruded to get uni-dispersed liposomal population. These processed liposomes were characterized for size distribution parameters, encapsulation efficiency and morphological studies using dynamic light scattering, laser doppler velocimetry, ultracentrifugation and atomic force microscopy. These liposomes were further evaluated for in-vitro phototoxicity and intracellular localization with CLSM in SK-OV-3 cell line. The safety profile of these formulations was also tested using haemocompatibility assay and in-vitro CAM model. All liposomal formulations ranged from

109 nm to 140 nm in size with a PDI less than 0.2 and surface charge from -6 to +35mV. Photodynamic studies showed a dose dependent effect with no cytotoxicity in unirradiated formulations. Intracellular uptake studies confirmed the temoporfin localization into the nuclear region. In vivo CAM model showed a strong occlusion of blood vessel while haemocompatibility studies showed no toxicity to the blood cells. Present study concludes that stable liposomes containing temoporfin can be formulated using different lipid combinations. These formulations are superior to free temoporfin in terms of safety and efficacy as well as very effective against different cancer and bacterial strains.

Recent Publications

1. Mahmoud, G., et al., Stabilized tetraether lipids-based particles guided porphyrins photodynamic therapy. *Drug delivery*, 2018. 25(1): p. 1526-1536.
2. Duse, L., et al., Low level LED photodynamic therapy using curcumin loaded tetraether liposomes. *European Journal of Pharmaceutics and Biopharmaceutics*, 2018. 126: p. 233-241.
3. Plenagl, N., et al., Hypericin Loaded Liposomes for Anti Microbial Photodynamic Therapy of Gram Positive Bacteria. *physica status solidi (a)*, 2018. 215(15): p. 1700837.

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