ABSTRACT

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Photodynamic therapy (PDT) is minimally invassive treatment modality that employs the photochemical interaction of three components. These are light of suitable wavelength, photosensitizer, and singlet oxygen. The main essence of current project is the assessment of pharmacokinetics of various drugs after laser irradiation in different biological models like cell lines and tissues to improve the efficacy of PDT. Present study analyzes the dynamic behaviour of different photosensitizers under laser irradiation e. g. (a) Biodistribution of Photofrin® (b) Laser induced effects (c) Depth of necrosis under exposure of different wavelengths of light sources (d) Synergistic effect of toxicity of ZnO nanostructures bare and conjugated with photosensitizers like Aminolevulinic acid (5-ALA), Photofrin® and protoporphyrin dimethyl ester (PPDME) determined for the treatment of localized cancer cells.

Firstly, Biodistribution of Photofrin® into Sprague Dawley rats has been investigated by methodology for Radiolabelleing of Photofrin® with ^{99m}Tc. In addition, it was explored that labelling efficiency of Photofrin® with ^{99m}Tc is more than 95%. The current technique is more simple and efficient as compared to the earlier published protocol. In the second part of this experimental study, different photosensitizer‟s uptake was explored in the *in vitro* model e. g. different cell lines (HepG2, RD, Hep2C, foreskin fibroblast, melanocytes). Study of required dose of laser, cytotoxicity and phototoxicity along with biological changes of cells were also the part of our

experimental technique. The third aspect of study relates to *in vivo* study, normal rat liver were treated as biological sample, PDT under illumination of different wavelengths of light (630nm, 660nm, 600nm and its alternate combinations) has been performed and proved that effectiveness of 630nm of wavelength is more efficient for depth of necrosis as compare to other wavelengths of light sources. Finally, the synergistic effect of toxicity of zinc oxide nanorods (ZnO NRs) conjugated with 5-ALA, Photofrin® and PPDME was determined for the treatment of localized cancer cells. Cell toxicity due to microinjection and free standing drug delivery was observed by detection of reactive oxygen species (ROS) liberation, and verified by MTT assy. It is successfully demonstrated that UV-A irradiation increased toxicity and caused significant liberation of ROS which lead to cell necrosis within few minutes. Zinc oxide nanorods are toxic for both normal as well as malignant cells under exposure of UV containing 240 nm of wavelength.