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Near infra red laser stimulated gold nanorods as multifunctional theranostic carriers for combined chemo-photothermal therapy of hepatocellular carcinoma

Rida Fatima Saeed[1], Uzma Azeem Awan[1,2], Abida Raza[2], Shaukat Ali[3] and Nosheen Akhtar[1]

[1]*Department of Biological Sciences, National University of Medical Sciences (NUMS), Rawalpindi, Pakistan*

[2]*NILOP Nanomedicine Research Laboratories, National Institute of Lasers and Optronics College, (PIEAS), Islamabad, Pakistan*

[3]*Medical Toxicology Lab, Department of Zoology, Government College University Lahore, Lahore-54000, Pakistan*

Despite the exciting advances in cancer therapy, low efficacy and high dose-related side effects of anticancer drugs remains the dominant reason for cancer related mortality. The purpose of the current study was to fabricate biocompatible multifunctional drug loaded nano-moieties for co-therapy (chemo-photothermal therapy). Herein, we have developed an effective NIR-stimulus system, polyelectrolyte-poly (sodium-4-styrenesulfonate) coated gold nanorods (GNRs) containing doxorubicin (DOX) (PSS-GNRs-DOX) to enhance chemotherapy by combining with photothermal therapy. Near infra red (NIR 808 nm, power density = 1.5 W/cm2 for 2 min) laser irradiation cause hyperthermia due to GNRs, which enhanced drug release rate to the HepG2 cells. The PSS-GNRs nano-complexes were found to be biocompatible, thermo-stable and exhibited high drug loading capacity. Cumulative DOX release significantly increased after laser exposure compared to non-irradiated samples ($p<0.05$). In vitro cytotoxicity testing revealed that the PSS-GNRs DOX conjugated nano-complexes with NIR laser irradiation appear more efficient in cell inhibition than without laser exposure and doxorubicin alone. Thus, a combinatorial approach based on chemo and photothermal strategy appears to be a promising platform in cancer management.

rida.saeed@hotmail.co.uk