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Microneedle-Based Generation of Microbubbles in Cancer Tumors to Improve Ultrasound-Assisted Drug Delivery.

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Production of local microbubbles (MBs) with dense distribution in tumor environment is achieved by developing an integrated electrochemical stimulator on a microfabricated silicon needle covered by zinc-oxide nanowires (ZnONWs). MBs are then exploded by external ultrasonic actuation, which induce microcavitations in tumor cells followed by direct entrance of anticancer drugs into cancer cells. This system, named ZnO nanowire-based microbubble generator probe (ZnONW-MGP), is tested on tumorized mice models (by MC4L2 breast cell lines). Mice treated by ZnONW-MGP have ≈82% reduction in tumor size within 10 days with just 25% of conventional dose of paclitaxel while in the absence of the system, they have just a 15% reduction in tumor size. Presence of ZnO nanostructures on microneedles strongly reduces the size of MBs and enhances the efficacy of the sonoporation.

Keywords: Cancer, Microbubbles, Sonoporation, ZnO nanowires, Drug Delivery

Biography:

Mohammad Ali Khayamian was born in Kerman, Iran, in 1988. He received his PhD in mechanical engineering at University of Tehran and currently is a postdoc researcher at Nano Bio Electronics Lab (NBEL). His thesis was a joint program between schools of mechanical and electrical engineering and was about the effect of ultrasonic stimulation on normal and cancerous cells. He is involved and interested in the electrical approaches on cancer and COVID-19 diagnosis and treatment..