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MODELLING THE FUTURE

Optimization of molybdenum disulfide for cancer phototherapy and of a drug concentration for selective anti-cancer effect

Nanotechnologies

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Abstract

Skin cancer is one the most common forms of cancer reported around the world, regardless of its low mortality, the increasing incidence and the nefarious side effects of the current treatments increase the need for better therapeutic approaches [1,2,]. Photothermal therapy (PTT), has various beneficial properties, including low invasiveness and toxicity for healthy cells, this technique is based on the irradiation of light-responsive phototherapy agents that can efficiently convert the incident radiation into heat [2]. 2D inorganic nanomaterials, such as MoS_2 nanosheets possess unique properties, such as large surface area, nanometric lateral size, water stability, high near-infrared (NIR) absorption, and biocompatibility, these characteristics make them ideal PTT agents [2].

Methodology and Results

MoS_2 was produced through a liquid-based exfoliation and intercalation method using polyvinylpyrrolidone (PVP), followed by recirculation through a custom-built high-power ultrasonication probe. The particles ultrasonicated for 6 hours had an average size of 164 nm (Figure 1). Also, when irradiated with our custom-built LED-NIR systems, MoS_2 dispersions increased their temperature to values within PTT range (Figure 2).

The concentrations of the anticancer drug (ACD) were optimized to selectively kill skin cancer cells (A-431), while not affecting normal skin cells (HFF-1). It was concluded that a concentration of 50 µg mL^{-1} did not cause any toxicity towards HFF-1 cells (Figure 3), while it was toxic towards A-431 cells, decreasing their biocompatibility to 62.7%, below the 70% limit defined by ISO 10993-5:2009(E) (Figure 4).

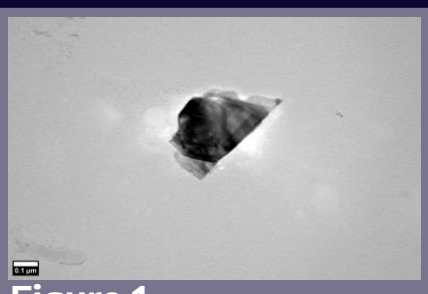

Figure 1

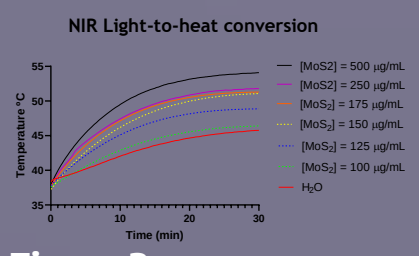

Figure 2

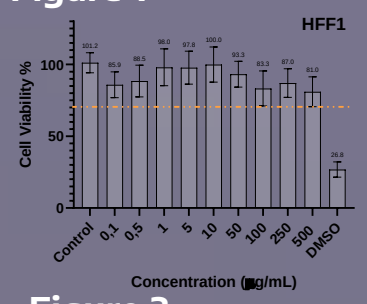

Figure 3

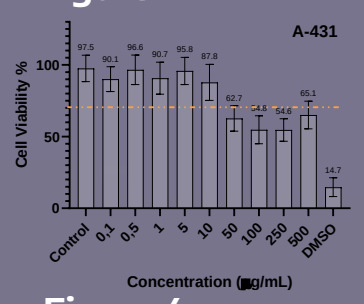

Figure 4

References

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2. Amaral, S. I., Costa-Almeida, R., Goncalves, I. C., Magalhaes, F. D., & Pinto, A. M. (2022). Carbon nanomaterials for phototherapy of cancer and microbial infections. *Carbon*, *190*, 194-244.

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