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SYNTHESIS AND POTENTIAL APPLICATION OF MnO_2 NANOPARTICLES FOR PHOTODYNAMIC THERAPY IN CANCER TREATMENT

Firdaus Adeola Adegboye, Eduardo Rodrigues da silva, Juliana Cristina Biazzotto Moraes, Roberto Santana da Silva

Faculty of Pharmaceutical Sciences, University of São Paulo, Ribeirão Preto, Brazil

E-mail: adegboyefirdaus@usp.br

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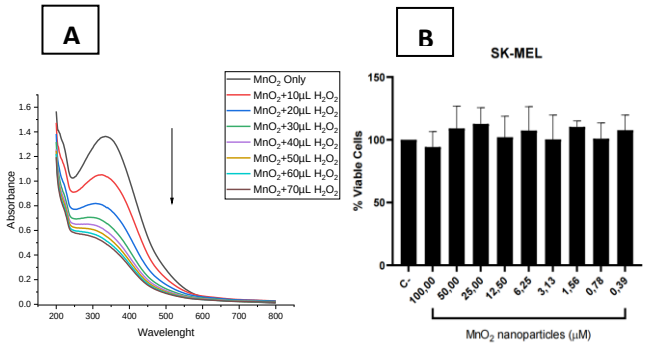
Cancer remains a pressing global health challenge, necessitating the development of innovative, effective and safer therapeutic strategies. In this study, we embarked on the synthesis of manganese dioxide (MnO_2) nanoparticles with a focus on characterizing their properties for potential application in cancer photodynamic therapy (PDT). Our synthesis method yielded MnO_2 nanoparticles suspended in solution, with sizes consistently <100 nm over a period of four days. Notably, this approach proved to be both facile and cost-effective, utilizing readily available and inexpensive reactants compared to other methods. The synthesized MnO_2 nanoparticles exhibit promising attributes for PDT applications. It demonstrate the ability to react with hydrogen peroxide (H_2O_2), resulting in the generation of manganese ions (Mn^{2+}), water (H_2O), and oxygen (O_2). This property holds particular significance for cancer treatment, given that cancer cells overproduce H_2O_2. Additionally, MnO_2 nanoparticles (MnO_2-NP) effectively generate singlet oxygen ($^1O_2$) when combined with photosensitizers such as methylene blue, in both buffer and aqueous environments. To evaluate it potential clinical utility, we assessed the biocompatibility and cytotoxicity of the MnO_2-NP on SK-MEL melanoma cells. Encouragingly, our findings reveal no discernible cytotoxic effects, underscoring the potential of these NP as safe and promising agents for cancer therapy. In summary, our study presents a straightforward and economical method for synthesizingMnO_2-NP with favorable characteristics for PDT applications.



Solution System	Quantum $^1O_2$ Yield with Nanoparticle (ϕ)
Water	0.8
Tris Buffer	0.44
PBS – pH = 7.4	0.29

Figure 1: **A)** UV visible spectrum of MnO_2 under reaction with H_2O_2 in PBS pH = 7.4; **B)** Cell viability studies of MnO_2 in SK-MEL cancer cells; **C)** Effect of the MnO_2-NP in the singlet oxygen quantum yield in different medium.

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