Synthesis of Periodic Mesoporous Organosilicas (PMOs) for Radiotherapeutic and Chemotherapeutic Treatments

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This project aimed to synthesize periodic mesoporous organosilica (PMO) nanoparticles with a wrinkle pore structure to use as a delivery system for chemotherapeutic and radiotherapeutic agents. PMOs are silica based mesoporous materials with both organic and inorganic groups contained in the channel walls. Benefits of such a structure include high surface area, easily tunable surface, high chemical and thermal stability, and biocompatibility. The incorporation of the organic groups into the walls versus deposition in the channels allows for maximum loading capacity. Furthermore, the wrinkle pore structure enhances the surface area and improves drug release. The PMO incorporates functionality that binds metal cations such as Holmium (III). The Holmium ion will be neutron activated to generate beta and gamma radiation therapy and imaging. The functional groups in the pore walls load both the radio isotopes and oxaliplatin. Surfactant mediated synthesis was used to create the PMOs. Using SEM and TEM, it was determined that the silica formed properly and exhibited a uniform sphere size of approximately 100 nm, with wrinkle pore structure appropriate for drug storage. The PMOs were also studied under in vitro for drug release and the data shows that the PMOs released the loaded platinum based anti-cancer drug, oxaliplatin. To enable the PMO for radiotherapeutic treatment, holmium was incorporated. In conclusion, we have successfully synthesized wrinkle PMOs capable of storage for radiotherapeutic and chemotherapeutic agents.

Awards Won:
Second Award of $2,000