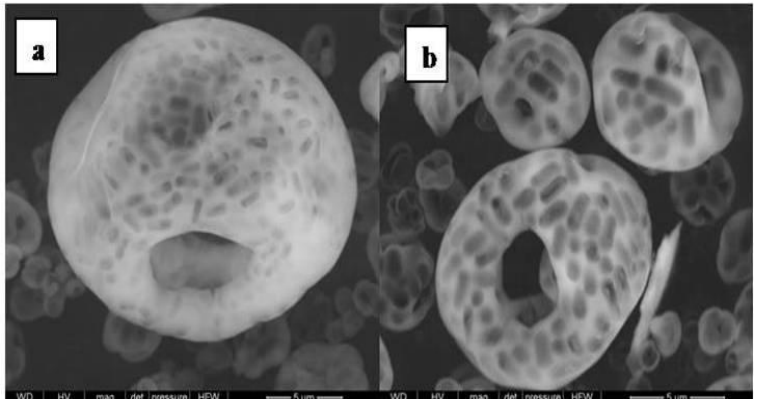
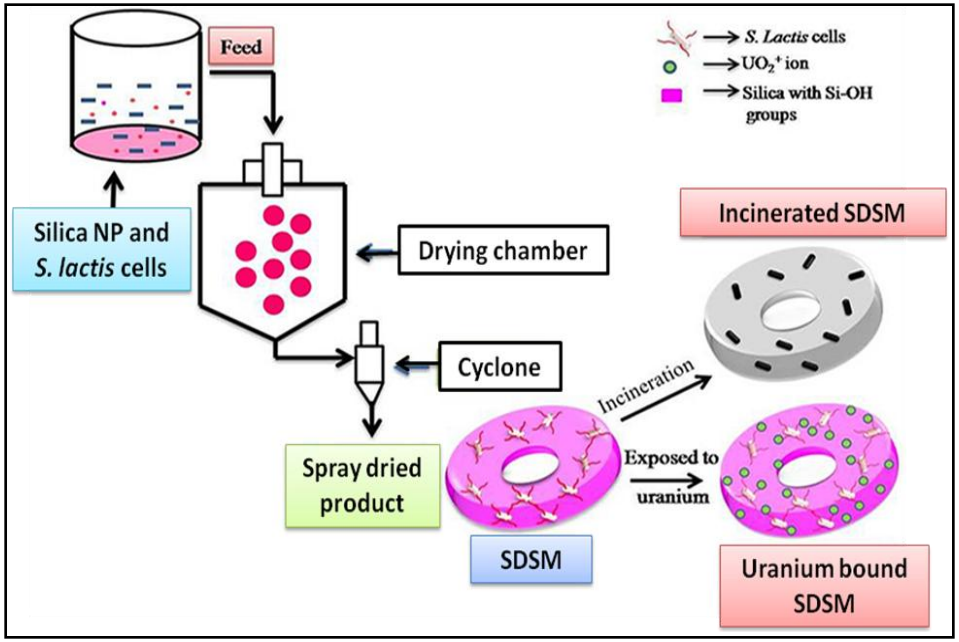
Bio-hybrids comprising nano-silica and microorganism as efficient sorbent for uranium remediation

Silica + *S. lactis* ⟹ SDSM

Spray dried **D**oughnut **S**haped **M**icrostructures

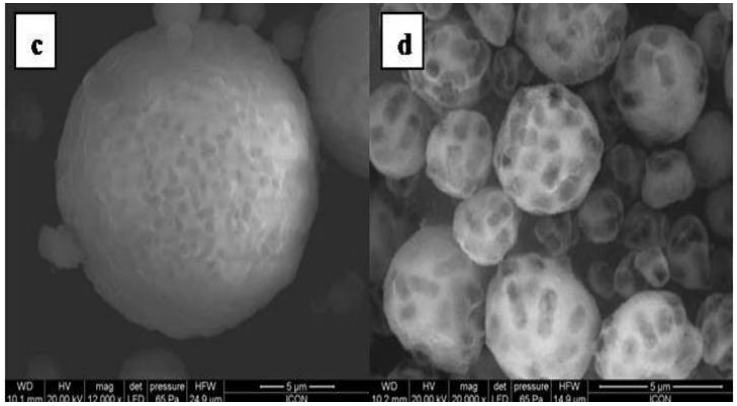


SDSM I-SDSM (673K)



Silica + PEI treated *S. lactis* ⟹ SSSM

Spray dried **S**phere **S**haped **M**icrostructures



SSSM I-SSSM (673K)

An assembled microstructure of silica nanoparticles and *Streptococcus lactis* (S. lactis) cells were synthesized by evaporation induced self assembly, with the objective of its application in remediation. Different morphologies were realized by tuning the physico-chemical conditions of the assembly process and applied for U (VI) uptake. Morphology dependent uptake was demonstrated and maximum uptake was found for the spray dried doughnut shaped microstructure (SDSM).

The U (VI) removal was significantly rapid with more than 85 ± 2% of total uptake in 10 min and maximum sorption capacity (q_{max}) at pH 5.0 and temperature 298 K was 169.5 mg/g using SDSM as sorbent. Thermodynamic studies indicated endothermic and spontaneous uranium adsorption process. The present work opens up the possibility of a means for the functionalization of silica microstructures through the incorporation of micro-organism and the potential for the use of these functionalized materials for bioremediation.

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