Optimization of mesoporous silica synthesis to enhance their potential as nanocarrier for large molecules delivery to brain

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Alzheimer's disease (AD) and Parkinson's disease (PD) are brain disorder with confirmed role of congenital genetic mutations in their early stages of progression.[1] The difficulty in curing brain disorders are mainly related to the complexity of the blood-brain barrier (BBB) that limits access of therapeutical agents, especially large biomolecules to the brain cells. Although the development of various nano-delivery systems offers a promising solution to this challenge, the size limitation of nanocarriers (<100 nm) conjugated with large biomolecules that can efficiently pass through the BBB still makes curing brain disorders difficult.[2] Among nanocarriers, mesoporous silica nanoparticles (MSNs) with unique properties such as high surface area, easy control of internal and external surface properties, tuneable pore size, the ability of surface functionalization with targeting ligands, biocompatibility, and the ability to cross the BBB are desirable nanocarriers for loading and delivering of large quantities of therapeutic agents to the damaged brain cells.[2,3] This study aimed to develop a suitable synthesis procedure for MSNs with large pores to potentially accommodate large biomolecules while preserving overall dimensions <100 nm. In addition, dye labelling of MSNs is also important to track them within a biological system. To achieve this, various methodologies were utilized to synthesize dye-labeled MSNs smaller than 100 nm and compare their ability to encapsulate PARK7. The PARK7 gene (962 nt) is associated with mutations that can lead to familial PD and AD.[4] The results confirm the ability of one type of synthesised MSN to successfully load PARK7, highlighting their potential as nanocarriers for further study as nanoplatforms for delivering large biomolecules to the brain.

References:

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