EFFECT OF SURFACTANTS ON THE CHARACTERISTICS OF MESOPOROUS SILICA DURING SYNTHESIS

May Kyaw Oo [1], Bappaditya Chatterjee [2], Almonem Doolaanea[1], Farahidah Mohamed [1,*]

[1] Department of Pharmaceutical Technology, Faculty of Pharmacy, International Islamic University Malaysia, 25200, Pahang, Malaysia
[2] School of Pharmacy and Technology Management, Narsee Monjee Institute of Management Studies, 400056, Mumbai, India

*Corresponding author email: farahidah@iium.edu.my

ABSTRACT

Mesoporous silica (MPS), a carrier for active pharmaceutical ingredients, can be synthesised in a variety of particle and pore morphologies. Despite being a simple synthesis system, successful tuning of MPS still needs a better understanding of ingredients during controlled synthesis for achieving desired particle size, shape, pore arrangement and size. The present study aimed to synthesise ordered MPS with large pore size >5 nm and to evaluate the effect of surfactants on the characteristics of MPS during synthesis. Two forms of mesoporous silica particles (MPS) were synthesised separately using different surfactant templates (Cetyltrimethylammonium bromide & Pluronic P123) and Tetraethyl orthosilicate precursor by Stober Sol-Gel approach. The synthesised samples were analysed in comparison for their morphology (SEM), particle size, surface area (BET), functional groups (ATR/FTIR), crystallinity (XRD), and their drug loading efficiency percentage. MPS synthesised with CTAB template (MPS_{CTAB}) were short cubic-shaped particles with size <800 nm and BET surface area 858.94±1.57 m^2g^{-1}, while MPS synthesised with P123 template (MPS_{P123}) were long rod-shaped particles with length >1 μm, and BET surface area 631.32±1.88 m^2g^{-1}. The BJH adsorption-desorption pore size and pore volume of MPS_{P123} were higher than MPS_{CTAB}. The drug loading efficiency of MPS_{P123} was significantly higher than that of MPS_{CTAB}. XRD diffraction patterns and IR spectrums described the amorphous nature of silica for both forms of MPS samples. Advantages of MPS_{CTAB} were having smaller particle size and larger surface area, which can lead to higher drug dissolution and the faster drug release. In contrast, MPS_{P123} had larger pore volume and pore size, which resulted in having better loading efficiency. In conclusion, ordered MPS particles were successfully developed as a promising carrier for loading biologics with emphasis on the details of the synthesis process.

Keywords: Mesoporous silica, Carrier, Biologics, Tunable, Synthesis

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