

Prashant Patil*, Sandesh Bole, Sachin Kothawade,
Jayprakash Suryawanshi, Vishal Pande

Chapter 11

Industrial production and commercialization of MSNs

Abstract: This chapter explains the industrial production and commercialization of mesoporous silica nanoparticles (MSNs), highlighting their synthesis, functionalization, and broad range of applications. Various synthesis methods, including the Stöber process, sol–gel process, and self-assembly induced by evaporation, are explored to produce MSNs with tailored morphologies and pore structures. The chapter discusses the role of surfactants and silica precursors in controlling the size, shape, and porosity of MSNs. Additionally, it examines the practical applications of MSNs in fields such as catalysis, drug delivery, fluorescence sensing, and vaccine delivery, emphasizing their unique structural properties and functional versatility. Key challenges and future directions for the industrial scale-up and commercialization of MSNs are also addressed, underscoring the potential for innovative applications in various industries.

Keywords: Stöber method, sol–gel process, evaporation-induced self-assembly (EISA), templating approaches, drug delivery, cytotoxicity, antibiotic adsorption

11.1 Synthesis of MSN