

Title: The past to the current advances in the synthesis and applications of silica nanoparticles

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Abstract: To deal with different important and updated applications like biomedical, pharmaceutical, industrial, agricultural, environmental, food, cosmetics, and even [water purification](#), the synthetic approaches of solid silica [nanoparticles](#) (SSiNPs) and its porous variant [mesoporous silica nanoparticles](#) (MSiNPs) become a matter of attention. The outstanding non-toxic nature and exceptional properties like bio-mobilizability, easy surface modifiability, stability, micro or meso [pore structure](#), volume, and high surface area make them versatile contributors and potential candidates in human civilization. This review article comprises a brief summarization of the synthesis of SiNPs chemically as well as through a green approach along with its noteworthy characteristics in which it is clearly shown how the functional molecules change the particle size and shape for multiple purposes. This article mainly focuses greatly effective all conventional chemical and green approaches of both [silica nanoparticles](#) (SiNPs) and MSiNPs (a total of 21 synthesis techniques). Also, the newly modified methods are cited in this review paper along with challenges and prospects. One of the most important discussions regarding sustainable, reliable, and eco-friendly (green) synthesis techniques and their available sources, advantages, and principles are mentioned in this paper. Finally, several relevant recent applications by many researchers are also noted with possible research in the industrial, chemical, agricultural, and biomedical life-related sectors. This review will help the researchers to gain the necessary information in perfect order which can be applied in the near future to invent and modify new methods on a bigger scale.

Keywords: Silica nanoparticles (SiNPs) Mesoporous silica nanoparticles (MSiNPs) Solid silica nanoparticles (SSiNPs) Green synthesis Chemical synthesis Mesoporous materials

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