Study of silver nanoparticles prepared via phytosynthesis on microfluidic platform as fillers for graphene nanocomposites

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Abstract

Tilia cordata and many other plants as well as diatoms were used for a period in our laboratory for gold and silver nanoparticles preparation [1]. These nanoparticles are then mostly used in disinfection in the case of silver [2] or as catalyst for gold [3]. For nanosilver particles there is further emerging application as agents to enhance conductivity and antimicrobial property of graphene. Because of some issues of batch synthesis, typically kinetics of reaction, heterogeneity of nanoparticles, etc., we are focusing now on preparation of nanoparticles on microfluidic 3D printed chips, however still with phytochemicals contained in plants and serving as reducing agents and stabilizers in once. Low reproducibility of bionanotechnology is well known and microfluidics may tackle this challenge in future. Our preliminary tests revealed that different flow rates (15, 30, 45, 60 ml/h) on the same chip have no grate effect on silver nanoparticles morphology and size. However, when chip with more complicated channels geometry (Zig-Zag or 3D Zig-Zag) and micromixing system is used, phytosynthesized nanoparticles seem to be smaller and better stabilized by phytomolecules. Because of silver reactivity in the final colloid and agglomeration tendency, further experiments of oil microfluidic synthesis were performed and showed that enclosure of reaction mixture in a drop leads to the formation of even smaller particles then in previous cases. In general, applying microfluidics completely different results regarding shape, size and stability of nanoparticles may be achieved compared to the batch synthesis. Further, more in depth studies with some preferred experimental conditions set on the base of these experiments will be conducted with the main goal to prepare functional graphene nanocomposites.

References

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