4ai Nanoparticles for Pharmaceutical and Electronic Applications

Ranjit Thakur

Nanoparticles have applications in many aspect of life from medicine to electronic device, due to their unique properties. Going to the nano scale not only enhances the surface to volume ratio of the particles, but also changes their chemical, biological, optical, magnetic and other physical properties.

Organic compounds are soft in nature, so they tend to agglomerate. This agglomeration causes challenges in forming nanoparticles. Supercritical fluid (SCF) based processes like SAS and RESS have been employed to obtain small particles with some modifications. SAS is used for those compounds which are not soluble in CO2 whereas RESS is used for CO2 soluble compounds. RESS is a simpler process to use but has limitation of low solubility in CO2. Also, modeling suggests that particles agglomerate in the expansion zone of RESS process. Considering this agglomeration a new technique has been proposed where a solid cosolvent is used which not only enhances the solubility of the polar compounds, but also forms nanoparticles. Griseofulvin, 2-aminobenzoic acid and phenytoin drugs have been used to prove this concept using menthol as a solid cosolvent. Drug solubility is enhanced as much as 400 fold and particles agglomeration is hindered by using solid cosolvent, forming nanoparticles.

Cooling is one of the most important technical challenges facing the electronic industry. The conventional heat dissipation methods require undesirably large heat removal components for high thermal loads. Nanofluids, which are fluid suspension of nanoparticles, can be used to overcome this challenge. These nanofluids can be a good replacement for conventional liquid coolants due to their high thermal conductance. Considering these advantages, gold nanoparticles with thiol legend was suspended in wax and other conventional heat transfer solvents to use as high thermal conductance nanofluids.