Short Note on Nanoparticle Synthesis

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Commentary

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DESCRIPTION

Nanoparticles are fundamental segments in multiple aspects of utilizations, including medication, semiconductors, catalysis, and energy. These particles can be characterized with a size range between 1-1000 nm. At more modest size scales, particles can act uniquely in contrast to their mass partners. For instance, as particles become more modest, their surface region increments enormously. This takes into account properties like expanded electrical and warm conductivity, brought down softening focuses, more grounded attraction or special optical properties to emerge. For the improvement of cutting edge materials, the capacity to reliably use materials at this size gives an abundance of chances in fields like clean energy, catalysis, and sensors to give some examples.

Nanoparticle synthesis refers to different methods for producing nanoparticles. Nanoparticles can be derived from bigger molecules and can also be synthesized by 'bottom-up' methods that, for example, nucleate and grow particles from fine molecular distributions in liquid or vapour phase. Functionalization by conjugation to bioactive molecules can also be included in synthesis.

Synthesis of nanoparticles can be done by various methods like physical, chemical, and biological approaches. Generally, the physical and chemical methods are considered as the best methods to get nanoparticles with uniform-size and long-term stability. Anyway, these approaches are economically high and release toxic materials into the environment. The nanoparticles obtained from chemical methods where toxic chemicals are used for nanoparticle synthesis makes them less suitable for medical, cosmetic, or food applications. As several nanoparticles have been widely

utilized in processing medical products, disease diagnosis, and cosmetics, it has become highly important to improve the biocompatibility of nanoparticles. Since last decade, substantial consideration has been given to biosynthesis approaches for the production of metal nanoparticles such as silver, gold, copper, and platinum. Biosynthetic routes of nanoparticle synthesis are considered as eco-friendly because bacteria, fungi, yeasts, and plants themselves or their active components are used as the reduced agents and stabilizing agents.

VARIOUS METHODS FOR THE SYNTHESIS OF METAL NANOPARTICLES

Chemical methods

- ✓ Colloidal chemical method
- ✓ The polyol method
- ✓ Microemulsions
- ✓ Thermal decomposition
- ✓ Electrochemical synthesis

Physical methods

- ✓ RF Plasma
- ✓ Chemical vapour deposition
- ✓ Microwave irradiation
- ✓ Pulsed laser method
- ✓ Sonochemical reduction
- ✓ Gamma radiation

APPLICATIONS OF NANOPARTICLES

1. ZnO has opaque and antifungal properties.
2. Nanowires made up of ZnO can improve the elastic toughness of bulk materials.
3. For paper, paints, plastics, and whitening agents, Titanium Dioxide is used as an inorganic white pigment.
4. TiO2 has a unique photo catalytic property that make it suitable for a number of advanced applications like Self-cleaning glass and antifogging coatings, Photoelectrochemical cells (PECs), Detoxification of waste water, Hydrolysis etc.,
5. Iron nanoparticles (50-100nm) are used for both digital and analog data in magnetic recording devices.
6. Iron Oxide nanoparticles have unique magnetic and optical properties.
7. Iron oxide nanoparticles are translucent to visible light and opaque to UV light.

8. Iron-platinum nanoparticles have increased magnetism and it is predicted that 3nm particle can increase the data storage capacity by 10 times per unit area.
9. Aluminum Oxide is used in Chemical Mechanical Polishing (CMP) slurries and also in ceramic filters.
10. Silver has great conductivity and has been used as an antimicrobial material for thousands of years.