Comparative Studies of Silver Oxide and Unusually High Thermally Stable Silver Chloride Nanoparticles

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Introduction

Nanoparticles have attracted considerable interest in isolated and in consolidated forms as they exhibit unique properties that differ significantly from their coarse-grained counterparts..

Nano silver has found to be of great interest among nanotechnologist owing to its broad area of applications in frontiers of medicine, electrochemistry, polymers, etc. Nano silver oxide has been in spotlight for its applicability as potent antimicrobial agents, cathode material for rechargeable batteries, and in the synthesis of conducting polymers. In vivo studies on tumor cells while using silver oxide as chemotherapeutic agent has shown remarkable effect on the growth of the tumor cells.

Owing to the growing applicability of silver oxide nanoparticles, we here in report a novel facile and straight forward method of synthesis of silver oxide nanoparticles. For a comparative study we have also synthesized silver chloride nanoparticles.

Experimental

Silver Oxide Nanoparticles

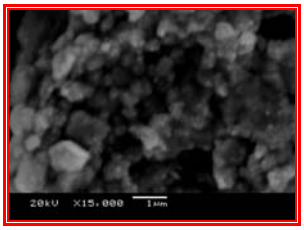
Silver chloride derivative was heated in a 1,2, 4, trichlorobenzene at 65^{o}C for about ½ hr and the resulting mixture was subjected to centrifugation to isolate the nanoparticles and were stored dispersed in hexane.

Silver Chloride Nanoparticles

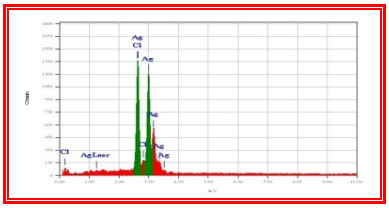
Silver nitrate solution was added to dilute HCl solution, drop-wise and the precipitate was filtered and the heated in a furnace at 700^{o}C for 24 hours, the white solid was collected after cooling and stored in desiccator.

Results and Discussion

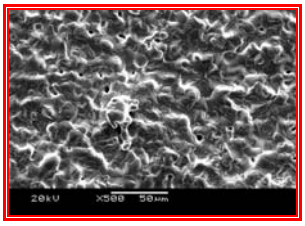
The product obtained was characterized by scanning electron microscopy (SEM), transmission electron microscopy (TEM), and surface analysis (Energy Dispersive X-Ray Analysis: EDX),



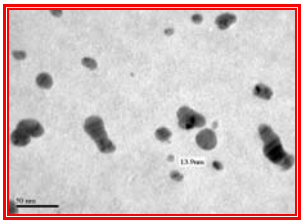
Scanning Electron Micrograph of AgCl



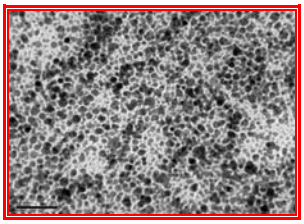
EDAX Results of AgCl



Scanning Electron Micrograph of Ag_2O



Transmission Electron Micrograph of AgCl



Transmission Electron Micrograph of Ag_2O

XRD, XRF, TGA, FT-IR. It was found that thermal treatment of silver chloride precipitate lead to the formation of nanoparticles, which were found to be thermally stable even up to 700°C. The XRD and electron microscopy results clearly indicate that nanoparticles of silver chloride are in the range of 25 - 50nM and that of silver oxide are between 10 and 30nM in size. SEM studies further show the morphology of silver chloride as hexagonal particles clubbed together, whereas the silver oxide nanoparticles appear spherical.

References

1. 1. Archakov, A. I.; Ivanov, Yu. D. *Mol. BioSyst.* **2007**, *3*, 336 – 342.

2. Alexander, B. S.; Kenneth, J. K.; Marchin, G. R.; Sorensen, C. M. *Langmuir*, **2008**, *24*, 7457–7464.

3. Qi, S.; Wu, Z.; Wu, D.; Wang, W.; Jin, R. *Chem. Mater.*, **2007**, *19*, 393–401.

4. Lok, C.-N.; Ho, C.-M.; Chen, R.; He, Q.-Y.; Yu, W.-Y.; Sun, H.; Tam, P. K.-H.; Chiu, J.-F.; Che, C.-M. *J. Proteome Res.*, **2006**, *5*, 916–924

5. Furno, F.; Morley, K.S.; Wong, B.; Sharp, B.L.; Arnold, P.L.; Howdle, S.M.; Bayston, R.; Brown, P.D.; Winship P.D.; Reid, H.J. *J. Antimicrob. Chemother.* **2004** *54*, 1019-1024.