

Seed-Mediated Growth of Au Nanoparticles

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Abstracts: We prepared Au nanoparticles by seed-mediated method and investigated the effects of process variables on the seed-mediated growth of Au nanoparticles. The monodispersed Au seed nanoparticles in the size range from 14.3 nm to 20.3 nm were prepared by the reduction reaction between H_{AuCl}₄ and citrate. We added the H_{AuCl}₄ precursors with citrates into the Au seed solution and prepared the Au nanoparticles in the size range from 16.8 and 37.8 nm with monodisperse distribution and could control the size of Au nanoparticles by changing the amount of H_{AuCl}₄ precursor.

1. Introduction

Preparation of monodispersed Au nanoparticles in the desirable size is importance for the medical application of Au nanoparticles, because Au nanoparticles have the negligible cyto-toxicity *in vivo* and *in vitro*, large surface area, high sensitivity and easy conjugation with biomaterials[1,2]. There are several methods to prepare gold nanoparticles with monodisperse distribution: photochemistry, reverse micelles, arc discharge, reduction-oxidation method, etc [3,4]. In this study, we used the seed-mediated method to prepare the Au nanoparticles and investigated the effects of process variables on the seed-mediated growth of Au nanoparticles.

2. Experiment

To prepared the Au seed nanoparticles in the different size, we prepared the H_{AuCl}₄ solutions of 0.18 mM, 0.36 mM and 0.72 mM concentrations and the trisodium citrate solutions of 0.5%, 1% and 2 % concentrations. We added trisodium citrate into the Au precursor solution at 65°C and kept the temperature of the mixed solution until the colour of the solution changed to red and then boiled the solution for 20 minutes. As the seeds for the seed-mediated growth, we used the Au colloidal solution prepared from 0.36 mM H_{AuCl}₄ solution with the molar ratio of 1:8. We added 1% citrate and 3 mM H_{AuCl}₄ solution into the seed solution at 65°C and boiled for 20 minutes. The optical properties of Au nanoparticles were measured by UV-visible spectrophotometer (UV-1600PC, Shimadzu). The size and morphology of Au nanoparticles were examined by Electrophoretic light scattering (ELS) (ELS 8000/Otsuka) and Transmission electron microscope (TEM) (LEO 912AB Omega), respectively.

3. Results and Discussion

Fig. 1 shows the HR-TEM images of Au nanoparticles for various amounts of H_{AuCl}₄ solution added into the seed solution. The size of Au seed nanoparticles were 16.8 nm and they had the monodisperse distribution. For the amounts of H_{AuCl}₄ solution into the seed solution of 15 and 30 ml, the size of Au nanoparticles were 29.0 and 37.8 nm, respectively, and those results were in good agreements with the numerical prediction[5], assuming that all gold precursor ions were consumed to the growth of Au nanoparticles by the seed-mediated method.

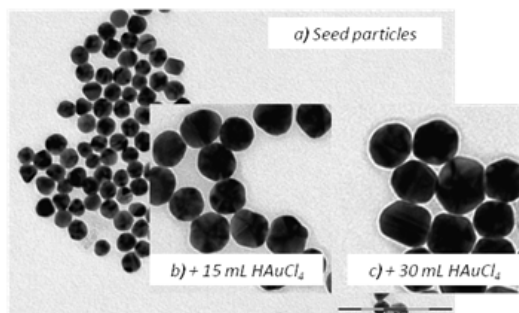


Fig. 1. HR-TEM images of Au nanoparticles for various amounts of H_{AuCl}₄ solution added into the seed solution.

References

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