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Repression of photomediated morphological changes of silver nanoplates

Jinkyu Roh [a,b], Ha Nee Umh [a], Hwa Kyung Sung [a], Byoung-cheun Lee [c], Younghun Kim [a,*]

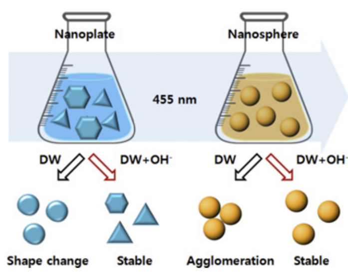
[a] Department of Chemical Engineering, Kwangwoon University, Seoul 139-701, Republic of Korea
[b] Department of Chemical and Biological Engineering, Korea University, Seoul 136-701, Republic of Korea
[c] National Institute of Environmental Research, Incheon 404-708, Republic of Korea

HIGHLIGHTS

- We suggested simple method for repression of photomediated morphological change of AgNPs via addition of hydroxyl ions.
- Additional OH^- successively acted as buffer to repress the release of Ag^+ and oxidation of citrate.
- To store AgNPs in transparent bottle under room light, high pH condition (pH 9) is recommended.

GRAPHICAL ABSTRACT

Additional OH^- successively acted as buffer to repress the photomediated morphological change of AgNPs.



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ABSTRACT

The unique physicochemical properties of silver nanoparticles (AgNPs) give them the potential to be useful in various applications such as sensors, catalysts, and sterilizers. Among the nano-consumer products registered in Woodrow Wilson Center (i.e., inventory of nanotechnology-based consumer products), AgNPs are the most applicable material in the commercial market. To apply AgNPs in nano-consumer products, the stability of colloidal AgNPs must be first assured. Among the destabilizing factors such as temperature, pH, salt concentration, and light, the effect of room light irradiation on morphological changes of AgNPs was investigated. Herein, we attempted to review the mechanism of photo-oxidation of AgNPs and citrate under light irradiation and suggest a repression method for the photomediated morphological changes of AgNPs via addition of hydroxyl ions. Silver nanoplate (AgP) and silver nanosphere (AgS) were used and their surfaces were stabilized with citrate. Based on the TEM images, UV–vis spectra, and zeta potential, we found that additional OH^- successively acted as a buffer to repress the photomediated morphological change of AgNPs.

1. Introduction

Silver nanoparticles (AgNPs) have attracted considerable attention due to their great applicability as catalysts, sterilizers, and sensing materials [1–4]. Among the unique properties of AgNPs, colorimetric sensing based localized surface plasmon resonance (LSPR) is of particular importance in the area of molecular detection. When the incident light resonates with the conduction band electron on their surface, AgNPs of a symmetric shape (i.e., sphere) display specific extinction bands in the UV–vis spectra; AgNPs of an asymmetric shape (e.g., plate, prism, disk, or rod) show two or more extinction bands [5].

In general, two methods are used to prepare AgNPs, namely the chemical reduction [6] and photochemical growth methods [7–9]. While the former is used for easy mass production, the latter is suitable to precisely control the shape and size of AgNPs. Because SPR of AgNPs depends strongly on the size and shape, it is important to maintain the initial size and shape of AgNPs during storing, regardless of the preparation method used for AgNPs. To ensure the dispersion stability in solution, capping agents such

* Corresponding author. Tel.: +82 2 940 5768; fax: +82 2 941 5769.
E-mail address: korea1@kw.ac.kr (Y. Kim).

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