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" A NOVEL CATALYST FOR PHOTOSYNTHESIS OF GOLD NANOPARTICLES"

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A NOVEL CATALYST FOR PHOTOSYNTHESIS OF GOLD NANOPARTICLES

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ABSTRACT

Preyssler acid, $H_{14}[NaP_5W_{30}O_{110}]$, as a green reducing agent and stabilizer, was used for the synthesis of gold nanoparticles by photolysis of Au(III)/Preyssler acid/propan-2-ol solution. Preyssler acid plays both the role of transferring electrons from propan-2-ol to Au(III) and also stabilizing the nanoparticles. Gold nanoparticles (Au NPs) were characterized by ultraviolet–visible (UV-Vis) spectroscopy, transmission electron microscopy (TEM) and particle size distribution (PSD). Synthesized Au NPs had uniform hexagonal morphology and their size was about 17 nm.

KEYWORDS : *Gold, Nanoparticle, Polyoxometalate, Preyssler, Photodegeradation*

INTRODUCTION

Polyoxometalates (POMs) are a class of molecularly define organic metal-oxide clusters, posses intriguing structure and diverse properties [1]. Their properties encourage researchers to use them in the synthesis of metal nanoparticles using simple, efficient and ambient temperature methods [2]. A wide range of applications have been reported for metal nanoparticles. Among them, gold nanoparticle have variety applications in catalysis, electronics, sensors, medicine, etc [3].

Although, the Keggin and mixed-valance types of POMs have been used in the synthesis of Au nanoparticles [4], the role of Preyssler structure has been largely overlooked. Preyssler acid is unique, because of many advantages, including strong Bronsted acidity, high hydrolytic stability (pH = 0–12), high thermal stability, corrosiveness, safety, and greenness [5]. In the recent years, a series of catalytic reactions using Preyssler have been studied in our group [6].

In the present work, we have used Preyssler acid to synthesis gold nanoparticles via a simple photoreduction technique. To best of our knowledge, the synthesis of nanoparticles has not been investigated using this catalyst.

EXPERIMENTAL

MATERIALS AND PROCEDURE

$HAuCl_4.3H_2O$ and propan-2-ol (analytical grade) were obtained from Merck Company and used as received. $H_{14}[NaP_5W_{30}O_{110}]$ was prepared according to our earlier works [7].

In a typical experiment, an aqueous solution of Preyssler acid, $H_{14}[NaP_5W_{30}O_{110}]$, $HAuCl_4$ (10^{-3} M) and propan-2-ol were placed into a spectrophotometer cell and deaerated with N_2 gas. Then, the mixture was irradiated by UV light for 45 minutes under continuous stirring. The color of the solution changed from colorless to pink, indicating the formation of Au nanoparticles [4]. The nanoparticles were separated by a high speed centrifuge, and washed twice with water.

RESULTS AND DISCUSSION

The applied method was a one pot synthesis technique for Au NPs preparation, which is simple and efficient in ambient temperature and takes place within a short time. Using Preyssler acid, $H_{14}[NaP_5W_{30}O_{110}]$, as a reducing agent and stabilizer, the synthesis of gold NPs by photolysis of solution of Au(III)/Preyssler acid/propan-2-ol was carried out. Preyssler acid plays the role of transferring electrons from propan-2-ol to Au(III) and also stabilizing the nanoparticles. To help and speed the reaction of preyssler acid with Au(III), Propan-2-ol was used as sacrificial reagent.

Figure 1 shows UV-Vis absorption spectra of solution before and after photoreaction synthesis of gold NPs. Before irradiation, there is not any distinct absorption band in the wavelength range of 400-800 nm in the spectrum. But, as shown in Figure 1(b), after UV light irradiation for 30 min, the UV-Vis spectrum shows an SPR band of gold NPs at 530 nm. Also, changing the color of solution from colorless to pink is an indication of gold NPs formation

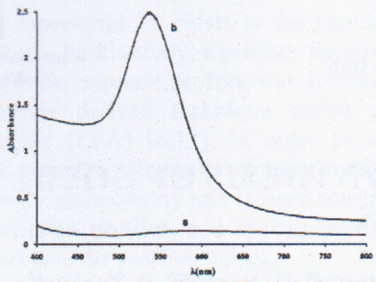

Figure.1 UV-Vis spectra of Au NPs solutions (a) before Irradiation (b) after irradiation for 45 min.

The gold nanoparticles obtained were characterized by TEM. The representative TEM images are shown in Figure 2. The shapes of the gold nanoparticles obtained are nearly uniform hexagonal structures. The particle size distribution of the synthesized Au nanoparticles was quantitatively displayed in a histogram shown in Figure 3. As seen, the particle size distribution indicated that size of the synthesized Au nanoparticles varied from about 13 nm to 43 nm, but most of them are about 17 nm.

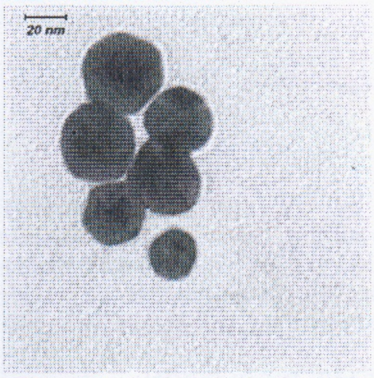

Figure.2 TEM images of synthesized Au NPs after 45 min irradiation.

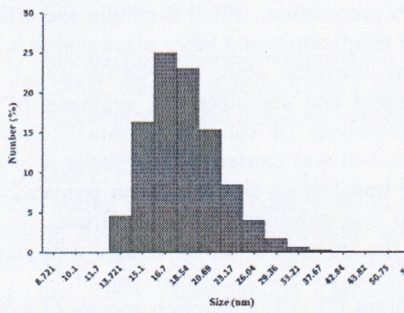

Figure.3 Particle size distribution of Au NPs after 45 min irradiation.

Usually in the synthesis process of nanoparticles, there is a tendency of agglomeration via coulomb or van der Waal forces. Preyssler acid is an excellent stabilizer to prevent agglomeration. Also, Preyssler is easily kept out after the reaction and will not contaminate the nano gold particles.

CONCLUSION

In this investigation, the synthesis of gold NPs was carried out using an inexpensive and easily prepared Preyssler as a green and solid superacid, by photolysis of a deaerated solution of Au (III)/Preyssler acid/propan-2-ol.

REFERENCES

[1] M. M. Heravi, F. F. Bamoharram, Gh. Rajabzadeh, N. Seifi, M. Khatami, *J. Mol. Catal.*, A: Chemical, 259 (2006) 213-217.

[2] F. F. Bamoharram, *Synth. React. Inorg.*, In press (2010).

[3] G. J. Hutchings, *Catal. Today.*, 100 (2005) 55-61.

[4] N. Caihong, W. Ying, W. Zhenping, L. Zheng, L. Rong, *Front. Chem. China.*, 4 (2009) 44-47.

[5] F. F. Bamoharram, M. M. Heravi, M. M. Heravi, M. Meraji, *Inter. J. Green Nanotech.*, 1 (2009) 26 - 31.

[6] F. F. Bamoharram, M. M. Heravi, S. Mehdizadeh, , *Synth. React. Inorg.*, 39 (2009) 746-750.

[7] M. H. Alizadeh, H. Razavi, F. F. Bamoharram, M. K. Hassanzadeh, R. Khoshnavazi, F. M. Zonoz, *Kin. Catal.*, 44 (2003) 524-528.