**THESIS INFORMATION**

Thesis title: **A study of** **fabrication of anisotropic silver nanoparticles for surface-enhanced Raman scattering sensor application**

Specialty: Theoretical and Physical chemistry

Code: 62440119

Name of PhD Student: Mai Ngoc Tuan Anh

Academic year: 2015

Supervisor:

Assoc. Prof.Nguyen Thi Phuong Phong

Assoc. Prof. Nguyen Dai Hai

At: UNIVERSITY OF SCIENCE – VNU. HCMC

**1. SUMMARY OF THESIS CONTENTS:**

Anisotropic silver nanoparticles (ASNs) have drawn intensive attention around the world because of their special optical properties and applications in surface-enhanced Raman scattering (SERS). These properties of ASNs are depended on their size and shape, so that size- and shape-controlled synthesis of them are necessary. The thesis mentions the shape- and size-controlled synthesis of ASNs using one-pot chemical reduction method, seed-mediated method, and photochemical method (under LED irradiation). ASNs were further characterized by measuring their physicochemical properties with Ultraviolet Visible spectroscopy (UV-Vis), X-Ray diffraction (XRD) technique, field emission scanning electron microscope (FE-SEM), transmission electron microscopy (TEM), raman microscopy…

In one-pot chemical reduction method, trisodium citrate (TSC) and polyvinylpyrrolidone (PVP) are capping agents to form silver nanoplates (AgNPTs). The thesis was studied of fabrication of AgNPTs molar ratio R=[TSC]:[AgNO3] from 3,8 to 37,5. The effects of H2O2, PVP were carried out. The results showed that R=15 was suitable to form uniform 30 nm-AgNPTs. AgNPTs were also formed in case of R=3,8 but their sizes were not uniform. PVP played as a secondary capping agent to prevent the formation of larger AgNPs and facilitated the production of small-sized AgNPTs with equal uniformity. This role of PVP was particularly significant at the low level of TSC. The effects of molar ratio R, properties of seeds were also studied in seed-mediated method with acid L-ascorbic, a second reducing agent.

In the photochemical method, irradiation with blue LEDs would result in the formation of silver nanodecahedrons (AgNDs), while AgNPTs can be generated under green LEDs. The higher power of LEDs, ASNs were formed faster but their final size and shape were not influenced. R=5 was suitable to form AgNPTs while R=25 was suitable to form AgNDs.

AgNPTs and AgNDs exhibited good SERS enhancement in the presence of 4- mercapto benzoic acid (4-MBA), the enhanced factor (EF) was 105 – 106. 40 nm-AgNPTs were used to detect 4-MBA with a limit of detection (LOD) of 10-9 M.

SERS substracts were fabricated from silica wafer, 3-mercaptopropyl trimethoxysilane (3-MPTS), and AgNPTs, its EF could reach ~104. The results of FE-SEM images showed that AgNPTs were non-uniform on wafer subtracts. AgNPTs were conjugated with 4-MBA (raman reporter) and anti-clenbuterol antibodies, played as probes for extrinsic SERS.

**2. NEW RESULTS OF THE THESIS:**

This thesis is a systematic study of the fabrication of ASNs with controllable size and shape via various methods. The role and effects of each reagent, LEDs on forming ASNs were investigated. The mechanism in each method was also suggested.

Estimating the SERS activity of ASNs and successfully orienting them intrinsic and extrinsic SERS.

**3. APPLICATIONS/POSSIBILITIES OF APPLICATION IN PRACTICE OR QUESTION ISSUES TO CONTINUE THE RESEARCH**

ASNs can be used to detect residues of antibiotics and pesticides by intrinsic and extrinsic SERS methods. The authors are going to research combining ASNs and other potential nanomaterials (carbon nanotube, nano TiO2, nano ZnO, other metal nanoparticles…) for SERS applications.

|  |  |
| --- | --- |
| **SUPERVISOR**Assoc. Prof.Nguyen Thi Phuong Phong Assoc. Prof.Nguyen Dai Hai | **PhD. STUDENT**Mai Ngoc Tuan Anh |

**CONFIRMATION OF THE UNIVERSITY OF SCIENCE**

**(VICE PRESIDENT)**