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SYNTHESIS OF SILVER NANOPARTICLES BY THERMAL REDUCTION  
OF SPRAYED SILVER SALT

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A Thesis Submitted in Partial Fulfillment of the Requirements  
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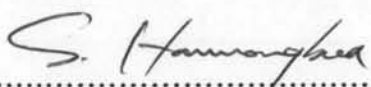
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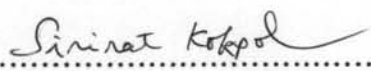
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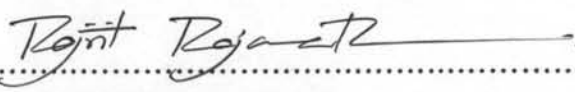
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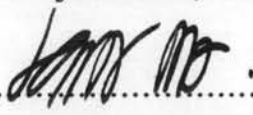
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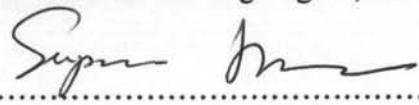
  
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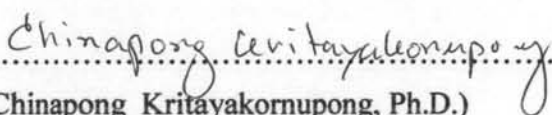
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วีรพัฒน์พีระเดช : การสังเคราะห์อนุภาคเงินนาโนโดยรีดักชันด้วยความร้อนของละอองเกลือเงิน (SYNTHESIS OF SILVER NANOPARTICLES BY THERMAL REDUCTION OF SPRAYED SILVER SALT) อ.ที่ปรึกษา: อ. ดร.โรจน์ฤทธิโรจนธเนศ, อ.ที่ปรึกษาร่วม: รศ. ดร.สนอง เอกสิทธิ์, 85 หน้า.

การสังเคราะห์อนุภาคเงินนาโนโดยการรีดักชันด้วยความร้อนของละอองเกลือเงิน เป็นวิธีการรีดิวส์เกลือของเงินภายในละอองขนาดเล็ก เปรียบเสมือนเป็นอุปกรณ์ในการเกิดปฏิกิริยาขนาดเล็กระดับไมโครเมตร ทำให้สามารถสังเคราะห์อนุภาคเงินนาโนที่มีขนาดที่แน่นอนได้ สารตั้งต้นคือ ซิลเวอร์ไนเตรท กลูโคส และ สารละลายแอมโมเนีย วิธีการนี้สามารถสังเคราะห์อนุภาคเงินนาโนได้ในปริมาณมาก เนื่องจากเป็นกระบวนการที่สามารถสังเคราะห์ได้อย่างต่อเนื่อง การวิเคราะห์ขนาด การกระจายตัวของอนุภาค และรูปร่างของอนุภาคเงินนาโนที่สังเคราะห์ได้โดยใช้ ยูวี-วิสิเบิล สเปกโตรมิเตอร์ และ กล้องจุลทรรศน์อิเล็กตรอนแบบทรานสมิสชัน ได้ทำการศึกษาปัจจัยต่างๆเพื่อสังเคราะห์อนุภาคเงินนาโนที่มีขนาดเล็ก มีการกระจายตัวที่แคบและมีเสถียรภาพโดยไม่ต้องใช้สารคงสภาพ ซึ่งวิธีการนี้สามารถสังเคราะห์อนุภาคเงินนาโนทรงกลมมีขนาดอยู่ในช่วง 10 ถึง 20 นาโนเมตร และมีการกระจายตัวของอนุภาคที่แคบ อนุภาคเงินนาโนที่สังเคราะห์ได้มีเสถียรภาพพอสมควร สามารถเก็บรักษาได้เป็นระยะเวลาประมาณ 1 เดือนโดยขนาดและการกระจายตัวของอนุภาคไม่เปลี่ยนแปลง

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WEE PATANAPERADJ: SYNTHESIS OF SILVER NANOPARTICLES BY  
THERMAL REDUCTION OF SPRAYED SILVER SALT. THESIS ADVISOR:  
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Silver nanoparticles were synthesized by thermal reduction of sprayed silver salt. This method is based on the reduction of silver salt in droplet as a micro-reactor that allows the synthesized particles of definite sizes. The precursor was the mixture of water, silver nitrate, glucose (reducing agent) and ammonia solution. This procedure is a continuous process that can be verified for mass scale production. The size, size distribution and morphology of the synthesized silver nanoparticles were characterized by UV-Visible spectroscopy, and transmission electron microscopy (TEM). The composition was varied in order to produce stabilized silver nanoparticles with a narrow size distribution without any stabilizer or capping agent. The results indicated the synthesized silver nanoparticles have spherical shape, small size with diameter of 10-20 nm with a narrow particle size distribution. The synthesized silver nanoparticles were fairly stable for a month without any stabilizer.

Department of study..... Chemistry..... Student's signature *Wee Patanaperadij*  
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## LIST OF ABBREVIATIONS

AgNO <sub>3</sub>	: silver nitrate
LSPR	: localized surface plasmon resonance
nm	: nanometer
DNA	: Deoxyribonucleic acid
Ag	: Argentum (silver)
Au	: Aurum (gold)
M	: Metal
PVP	: polyvinylpyrrolidone
SDS	: sodium dodecyl sulfate
FWHM	: Full width at half maxima
TEM	: Transmission electron microscopy
NIR	: near infrared
eV	: electron volt

## LIST OF SYMBOL

$A$	: absorbance
$\varepsilon$	: absorption coefficient
$b$	: optical path length
$c$	: concentration
$E$	: redox potential of particles
$E_{\text{redox}}$	: solution potential
$\sigma_{\text{ext}}$	: extinction cross-section
$\sigma_{\text{sca}}$	: scattering cross-section
$I_0$	: intensity of incident beam
$I$	: intensity of transmitted beam
$^{\circ}\text{C}$	: Celsius
$V$	: volume
$\rho$	: density