SIIC093

COMPARATIVE ON SYNTHESIS OF SILVER NANOPARTICLE USING DIFFERENT METHODS

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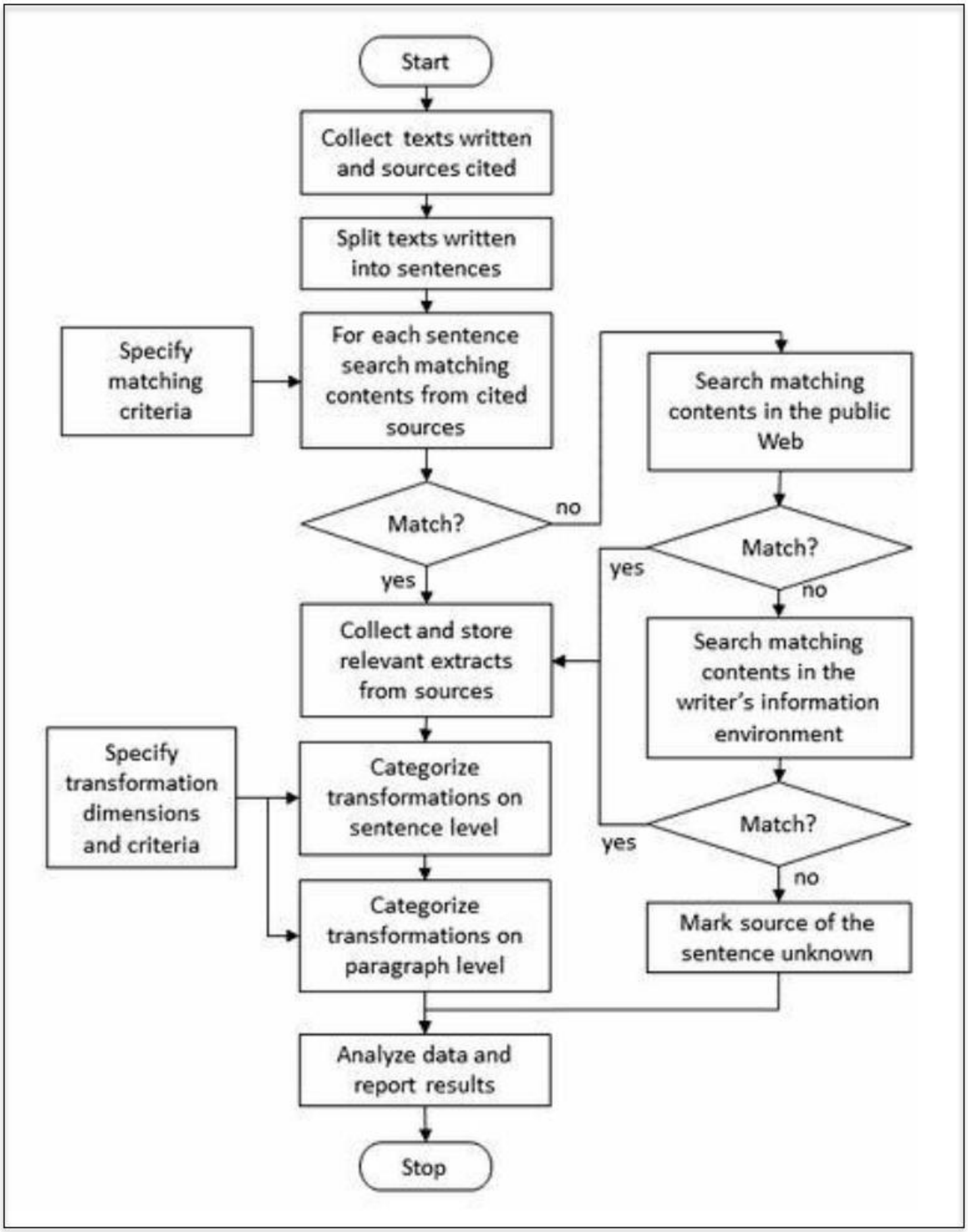
Abstract:
Silver nanoparticle has been a subject of interest for decades for the valuable and unique properties and are used for a wide range of commercial reasons to restrict microbial growth. Each methods used to synthesize silver nanoparticle will fabricate different physiochemical properties of the nanoparticle. Therefore, comparison between physiochemical properties of each methods will be reviewed in this study. This review present an overview of silver nanoparticle by using chemical approach, physical approach and biological approach. Each approach has their own merits and demerits . The drawbacks for chemical approach and physical approach are the process often involve highly toxic and not enviromentally friendly subtance. The biological approach has become a new option in chemistry, consisting of reduction and elimination of dangerous subtance for the design of the product in the enviroment.

***Keywords*:**
Physiochemical properties, Silver nanoparticle, Chemical approach, Physical approach, Biological approach

Objectives:

- To evaluate the physiochemical properties of silver nanoparticles that synthesized from chemical, physical and biological method.
- To compare the physiochemical properties of silver nanoparticles between chemical, physical and biological method.

Methodology:



Results:

Chemical method

Method	Silver precursor	Reducing agent	Stabilizing agent	Size (nm)
Chemical reduction	$AgNO_3$	DMF	-	<25
Chemical reduction	$AgNO_3$	$NaHB_4$	Surfactin (a lipopeptide biosurfactant)	3-28
Chemical reduction	$AgNO_3$	Trisodium citrate (initial) +SFS (secondary)	Trisodium citrate	<50
Chemical reduction	$AgNO_3$	Trisodium citrate	Trisodium citrate	30-60
Chemical reduction	$AgNO_3$	Ascorbic acid	-	200–650
Chemical reduction	$AgNO_3$	$NaHB_4$	DDA	~7
Chemical reduction	$AgNO_3$	Paraffin	Oleylamine	10-14
Chemical reduction (thermal)	$AgNO_3$	Dextrose	PVP	22 ± 4.7
Chemical reduction (thermal)	$AgNO_3$	Hydrazine	-	2-10
Chemical reduction (oxidation of glucose)	$AgNO_3$	Glucose	Gluconic acid	40–80
Chemical reduction (polyol process)	$AgNO_3$	Ethylene glycol	PVP	5–25
Chemical reduction (polyol process)	$AgNO_3$	Ethylene glycol	PVP	50-115
Electrochemical (polyol process)	$AgNO_3$	Electrolysis cathode: titanium anode: Pt	PVP	~11

Physical method

Method	Shape	size (nm)
Laser ablation	Spherical	31
Laser ablation	Spherical	12–29
Laser ablation	Irregular	27–41
Small ceramic heater	Spherical	6–21.5
Thermal decomposition	Spherical	9.5 ± 0.7
Laser ablation	Spherical	27–120
Laser ablation	Spherical	6.48
Thermal decomposition	Spherical	14.4 ± 3.3
Laser ablation	Spherical	4–18
Laser ablation	Spherical	5–13
Laser ablation	Spherical	20–51
Thermal decomposition	Spherical	4–7
Thermal decomposition	Spherical	4.7
Laser ablation	Irregular	15–20
Laser ablation	Spherical	7.9–16.2
Thermal decomposition	Spherical	8.0 ± 1.3
Thermal decomposition	Spherical	3.1 ± 0.7 to 4.5 ± 0.8
Thermal decomposition	Spherical	40–50
Laser ablation	Spherical	2.5–8.5
Laser ablation	Spherical	10.6 ± 2.6
Laser ablation	Spherical	9–15
Laser ablation	Spherical	50

Biological method

Organism	Size (nm)
Bacillus cereus	4 and 5 [18]
Bacillus licheniformis	50 [19,20]
Bacillus megaterium	46.9 [21]
Bacillus sp.	5–15 [22]
Bacillus subtilis	5–60 [23]
Brevibacterium casei	50 [20]
Corynebacterium sp.	10–15 [16]
Escherichia coli	1–100 [24]
Geobacter sulfurreducens	200 [25]
Klebsiella pneumonia (culture supernatant)	50 [26]
Lactic acid bacteria	11.2 [27]
Lactobacillus Strains	500 [28]
Morganella sp.	20 [29]
Proteus mirabilis	10–20 [29]
Pseudomonas stutzeri AG259	200 [30]
Staphylococcus aureus	1–100 [31]

Conclusion:

Silver nanoparticles acquired by chemical, physical, and biological synthesis methods. Hundreds of research articles reporting diverse synthesis methods for silver nanoparticles are published annually. Throughout this chapter, we have reviewed only some of the most relevant works, dealing mostly with chemical, physical, and biological methods. In scientific journals, all known silver nanomaterials applications may involve the use of nanosilver in place of silver to take advantage of nanosilver's extraordinary properties.

Despite all beneficial uses for nanosilver, its impact on the environment is concerning. These synthesis methods may require the use of different raw materials and yield reaction by using toxic products or wastes. Nevertheless, in recent years, green chemistry is the new solution to an environmental-friendly approach that has become a new variant in chemistry, consisting of reducing and eliminating dangerous substances for the design of products in the environment.

The functional activities of silver nanoparticles owing to their high surface area to volume ratio and vast applications in various fields, such as in biomedical, biomedicine, pharmaceutical, catalysis, superior rigidity thermal conductivity, tensile strength, hardness, and erosion resistance.