Synthesis of Gold Nanoparticles Using Glucose for Biomedical Applications

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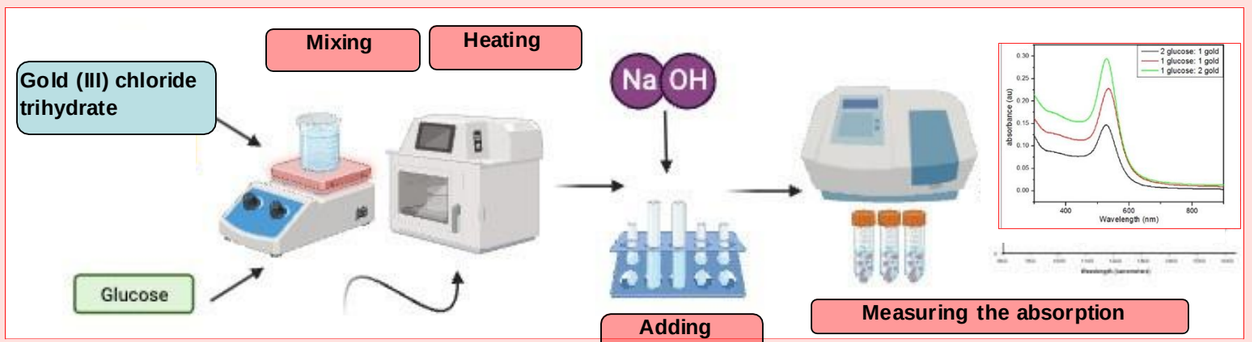
Introduction and Aims

Introduction:

Gold nanoparticles have gained a lot of interest in medical applications due to their plasmonic properties, and many methods have been explored for synthesizing well-defined particles. The detection of blood glucose using gold nanoparticles is emerging as a new method. In this project, we developed gold nanoparticles, using glucose as a mild reducing and stabilizing agent, to detect glucose in the blood through plasmonic reactions. By exploring innovative technologies and emerging techniques, we aim to enhance the accuracy, convenience, and overall user experience of glucose monitoring when using our potential method. The preliminary results will be presented.

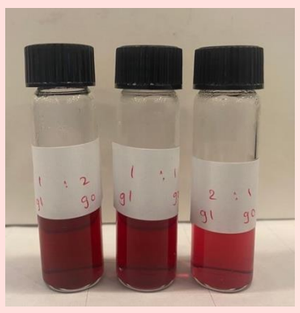
Aims:

1. To synthesize Gold nanoparticles by using Glucose as a reduction and stabilizer agent.
2. Determination of nanoparticles' antibacterial Activity.
3. The nanoparticle approach holds promise for expediting the identification of elevated glucose levels in blood patients.



Methodology

(1)

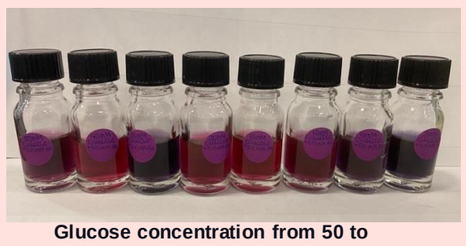


Ratio of glucose:gold

(2)

Ph of NaoH expirements

(3)

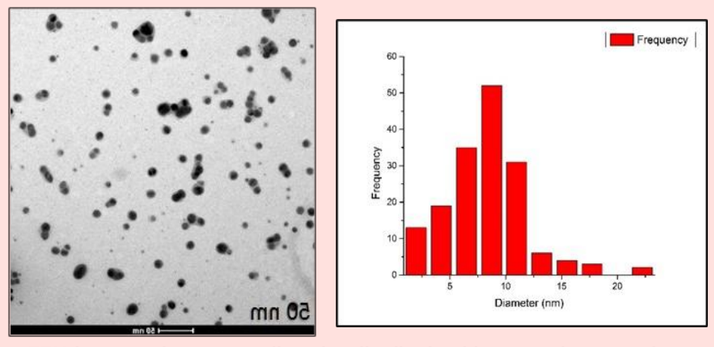


Glucose concentration from 50 to 2mM

(4)

Concentration of NaoH

(5)

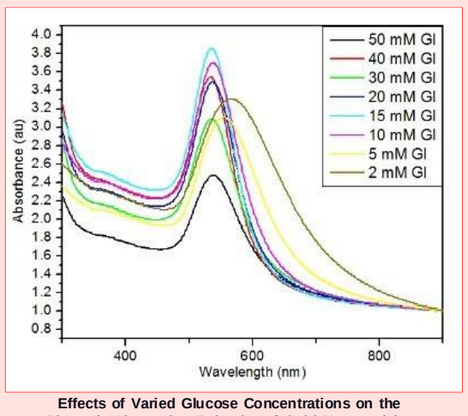


TEM image and corresponding size distribution histogram (average size 9nm).

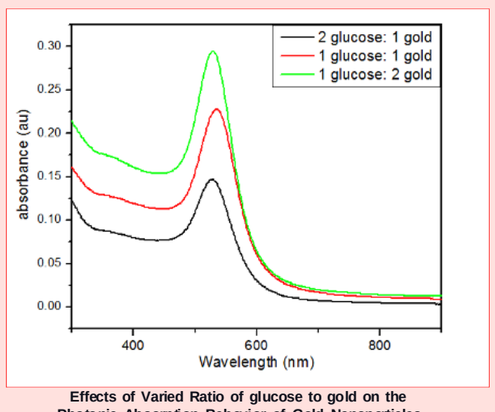
Synthesis:

Various glucose concentrations were meticulously prepared and combined with a consistently proportioned gold solution to synthesize the gold nanoparticles. Sodium hydroxide and heat were employed to accelerate the process. The synthesized nanoparticles were characterized using absorption spectroscopy and electron microscopy.

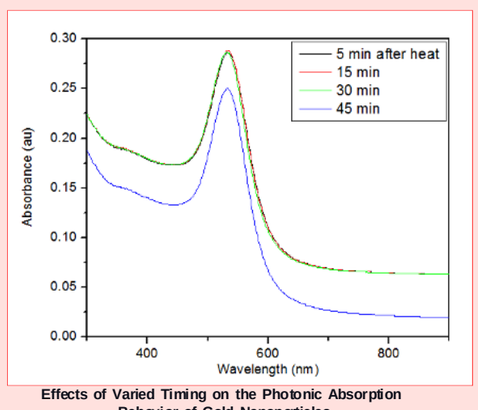
Preliminary Results



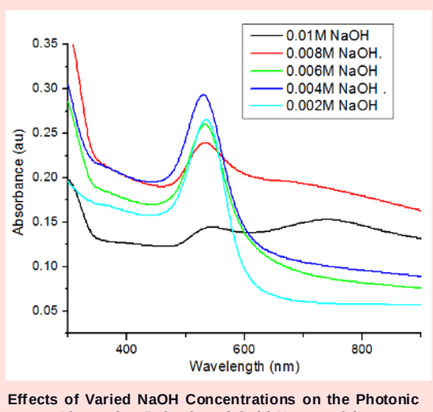
Effects of Varied Glucose Concentrations on the Photonic Absorption Behavior of Gold Nanoparticles



Effects of Varied Ratio of glucose to gold on the Photonic Absorption Behavior of Gold Nanoparticles



Effects of Varied Timing on the Photonic Absorption Behavior of Gold Nanoparticles

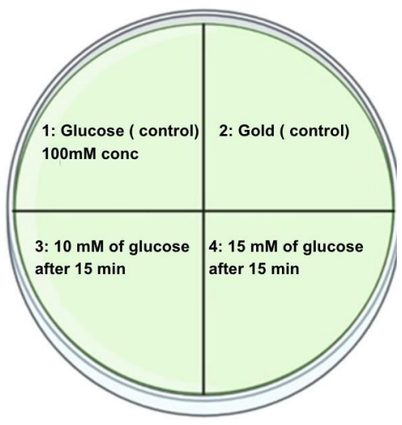


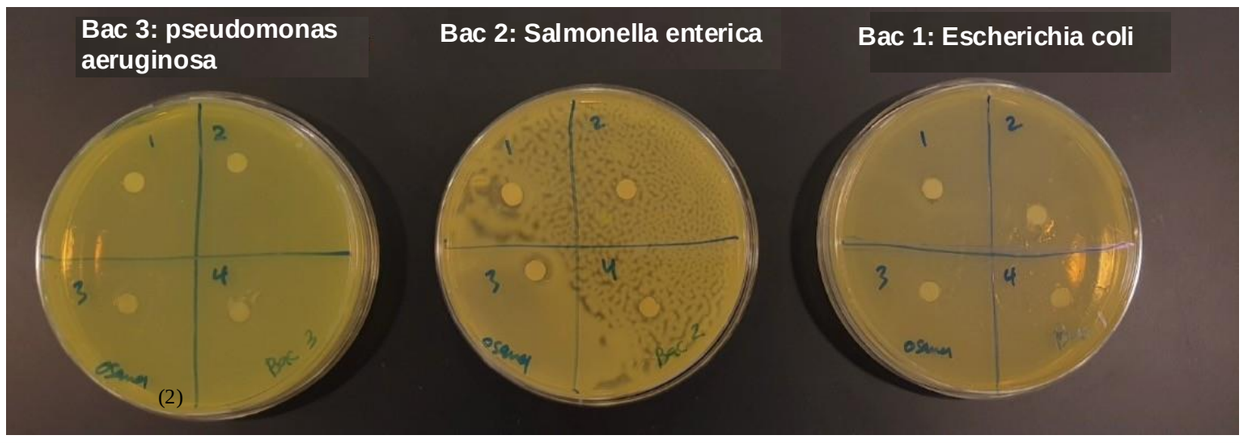
Effects of Varied NaOH Concentrations on the Photonic Absorption Behavior of Gold Nanoparticles

Characterizations

- Colour changes of colloidal solution confirm the formation of nanoparticles.
- UV-visible spectroscopy was used to look for surface
- plasmon resonance (SPR), a unique metal
- nanoparticle phenomenon.
- TEM and to image the size and shape of Au nanoparticles. elevated glucose levels in patients, offering a more time- efficient alternative to existing diagnostic methods. (1)

Antibacterial Characteristics





The nanoparticles had no significant effect on the bacteria studied.

References

1. Unser S, Campbell I, Jana D, Sagle L. Direct glucose sensing in the physiological range through plasmonic nanoparticle formation. Analyst. 2015;140(2):590-9.
2. Tendencia, E. A. (2004). Disk diffusion method. In Laboratory manual of standardized methods for antimicrobial sensitivity tests for bacteria isolated from aquatic animals and environment (pp. 13-29). Tigbauan, Iloilo, Philippines: Aquaculture Department, Southeast Asian Fisheries Development Center.

Conclusions & Work in progress

Glucose is a mild reducing agent, and it reduces the gold salt into gold nanoparticles. The formation of gold nanoparticles was confirmed by measuring the surface plasmon resonance peak around 500 nm. The detection limit was in the range of 2mM to 50 mM with good reducibility, showing the potential application of this method. We are currently working on the interference of other ions/enzymes present in the blood with this procedure and expect to develop a potential method for glucose detection in blood and saliva.

Acknowledgement

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