Final Year Project Showcase Batch-2020
Year 2024

	Department: Chemistry Programme: BS (Industrial Chemistry)
1	**Project Title** Synthesis & Characterization Of Levofloxacin Ag@Au Nanoparticles
2	**Project Idea** Antibiotics are frequently used, and the leftover antibiotics in industrial discharge may increase bacterial resistance while also harming the environment's ecology. Levofloxacin is a 3rd generation fluoroquinolone drug. It is used for the treatment of chronic bronchitis, actual sinusitis, pneumonia, prostatitis, and infections of urinary tracts and skin. Levofloxacin is also used in veterinary medicine to treat management of antibiotic-resistant infections. It is crucial to accurately quantify the concentration of levofloxacin antibiotics in environmental as well as biological samples. Bimetallic nanoparticles of gold and silver have been known to exhibit strong spectrophotometric properties. Therefore, its was assumed that a flavonoid capped silver@gold nanoparticle can be good nanosensor for simple and straightforward quantification of levofloxacin in biological and environmental samples.
3	**Process** Silver nitrate solution (1 mM) for was sonicated for 5 minutes at 80°C. The alkaline quercetin solution (1m M) was added to the $AgNO_3$ solution. The mixture was then sonicated for 40 minutes while maintaining the temperature at 80°C.The color change of the solution during the reaction was observed, with a pale-yellow to brownish color change generally indicating the formation of silver nanoparticles. UV-visible spectra of quercetin capped AgNPs based core appeared at 416 nm. On reacting synthesized silver nanoparticles with gold solution, shell was developed with the appearance of purple color. UV-visible spectra of the reaction mixture exhibited the presence of gold nanoshell at 528 nm. The sensing performance of synthesized Qct-Ag@Au nanoparticles was evaluated using apparent changes in the color of the solution on interaction with different pharmaceutical drugs and by UV-Visible spectrophotometric analysis. A gradual decrease in absorbance intensity of bimetallic nanoparticles with the increase in drug concentration indicated the sensing ability of the bimetallic nanoparticles. Only Levofloxacin was positively sensed by Qct-Ag@Au. A linear relationship was established between concentration of levofloxacin and decrease in the absorbance of Qct-Ag@Au nanosensor,
4	**Outcome** Stable colorimetric/spectrohotmetric nanosensors for the detection of levofloxacin in tap water, distilled water and serum.
5	**Evidence (Theoretical Basis)** The research focused on synthesizing Quercetin-capped silver@gold (QCT-Ag@Au) nanoparticles for it's potential application as advanced nanosensors for drug detection. QCT-capped Ag@Au nanoparticles were synthesized using environment-friendly reducing agents and solvents. Synthesized nanoparticles were characterised using Atomic Force Microscopy (AFM), -visible spectrophotometery, and Scanning Electron Microscopy (SEM-EDx). The QCT-Ag@Au nanoparticles successfully sensed the presence of levofloxacin in tap water and serum samples. A linear relationship was established between the concentration of levofloxacin and

	absorbance (R2= 0.97) The characterization data confirmed that the sizes of the QCT-capped Ag@Au nanoparticles were between 60 and 80 nm, with a mean size of 67.567 nm. When the QCT-capped Ag@Au nanoparticles interacted with Levofloxacin, the particle size increased to an average size of 93.450 nm (80-115 nm). SEM-EDx data was used to validate AFM interpretations. Furthermore, analyses were carried out, which included Stability Test, Drug Sensing, Serum Analysis, Filter paper Sensing and Tap and Distilled water with QCT-capped Ag@Au and Levofloxacin.
6	**Competitive Advantage or Unique Selling Proposition** **Process improvement:** Usually nanoparticles have been synthesized using toxic reagents and chemical reducing agents. In this study, we have used nontoxic and environmentally benign chemicals. Moreover, the detection of levofloxacin involves the use of sophisticated equipment like HPLC, electrochemical methods, chemiluminescence, RP-HPLC . However, these instrumental techniques demand costly equipment, a well-established laboratory infrastructure, laborious sample pre-treatment procedures, extended analysis periods, and skilled operators. However, the synthesized nanosensors provide a much simple and straightforward way to detect presence of levofloxacin spectrophotmetrically.
a	**Attainment of any SDG** (e.g. How it is achieved and why it is necessary for the region) **SDG#3, Good Health and Well being**- Quantitative determination of pharmaceutically active ingredients is an essential step of drug development process. Drug concentration is also determined in biological matrices e.g. urine, blood, serum etc. after its administration to animals and humans during preclinical and clinical trials. Due to their complexity, low concentration of target drug and abundance of interfering compounds, these biological matrices are not suitable for direct analysis using instrumental techniques. Our synthesized nanosensor can be useful for the detection and quantification of levofloxacin in biological samples. **SDG#6, Clean Water and Sanitation-** The presence of the pharmaceutical in water due to it's irresponsible disposal by pharmaceutical and domestic units can pose serious environmental risks particularly, it might result in antimicrobial resistance in water. Therefore, it is very crucial to determine traces of pharmaceutical in water bodies.
b	**Any Environmental Aspect** (e.g. carbon reduction, energy-efficient, etc.) Usually nanoparticles have been synthesized using toxic reagents and chemical reducing agents which burdens the environment. In this study, we have used nontoxic and environmentally benign chemicals.
d	**Process Improvement which Leads to Superior Product or Cost Reduction, Efficiency Improvement of the Whole Process** (e.g. What is the issue is current process and what improvement you suggests) The detection of levofloxacin involves the use of sophisticated equipment like HPLC, electrochemical methods, chemiluminescence, RP-HPLC . However, these instrumental techniques demand costly equipment, a well-established laboratory infrastructure, laborious sample pre-treatment procedures, extended analysis periods, and skilled operators. However, the synthesized nanosensors provide a much simple and straight forward way to detect presence of levofloxacin spectrophotmetrically.
7	**Target Market** (Industries, Groups, Individuals, Families, Students, etc) Please provide some detail about the end-user of the product, process, or service Pharmaceutical companies, Enviromental Agencies etc.

8	**Team Members** (Names along with email address)	1. Ather Bilal (atherbilal24@gmail.com) 2. Aymen Noor (aymannoor12820@gmail.com) 3. Maha Ahmad (mahaahmed5987@gmail.com) 4. Syed Zeeshan (zeeshan6947@gmail.com)
10	**Supervisor Name** (along with email address)	Supervisor: Dr Amtul Qayoom (amtulq@neduet.edu.pk) Co-Supervisor: Dr Saeeda Nadir Ali (saeeda@neduet.edu.pk)
11	**Video (If any)**	https://drive.google.com/file/d/1D42I4ZpaGO8IyUNUGsqyFGGnD35sBdOo/view?usp=sharing

Pictures (to be pasted below

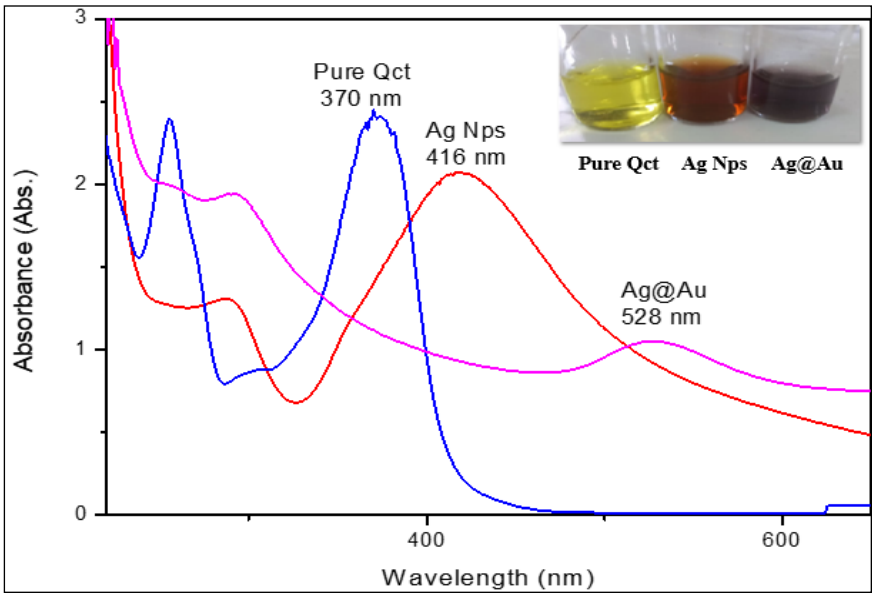

Fig. 1. UV-Visible absorption spectra of pure quercetin Qct-Ag and Qct-Ag@Au nanoparticles

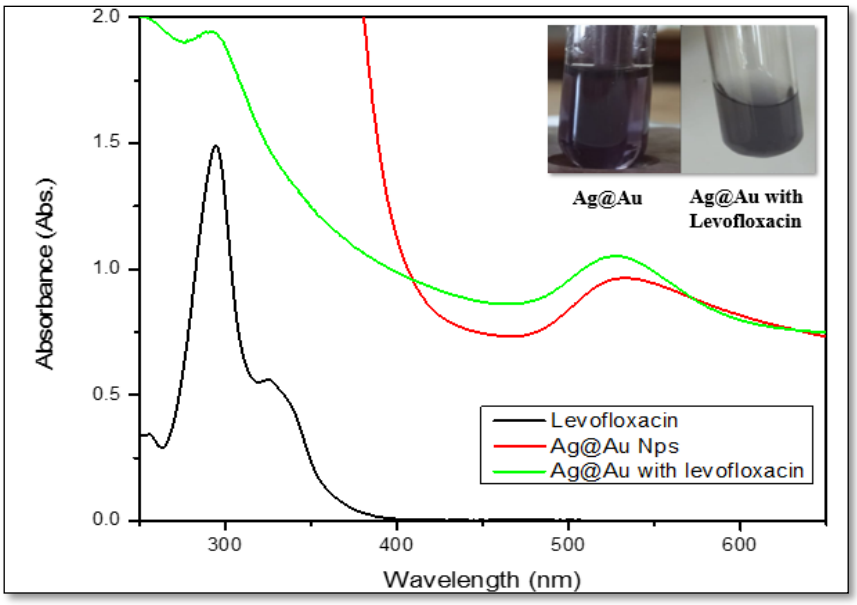

Figure 2. Absorbance of Qct-Ag@Au before and after interaction with levofloxacin

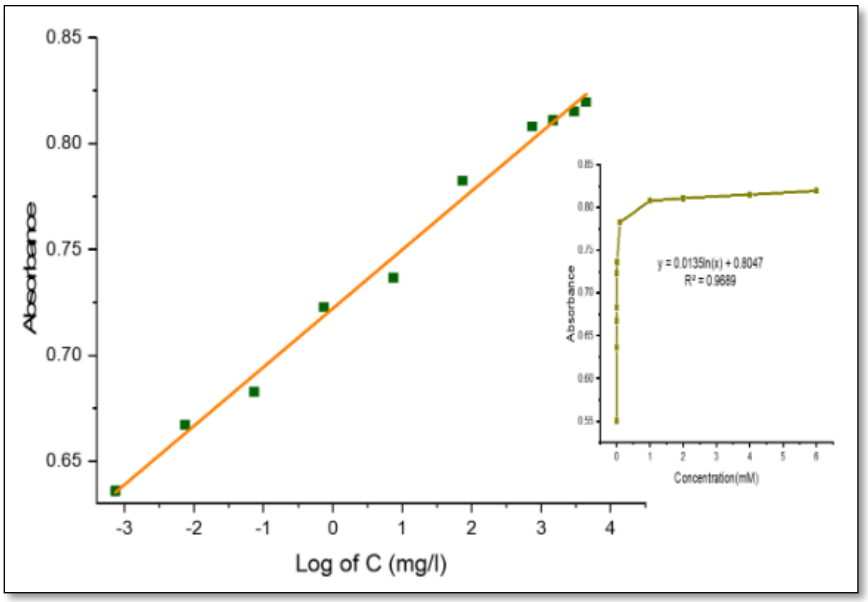

Figure 3. Absorbance of Qct-Ag@Au versus concentration and graph after taking log of levofloxacin concentration against Absorbance

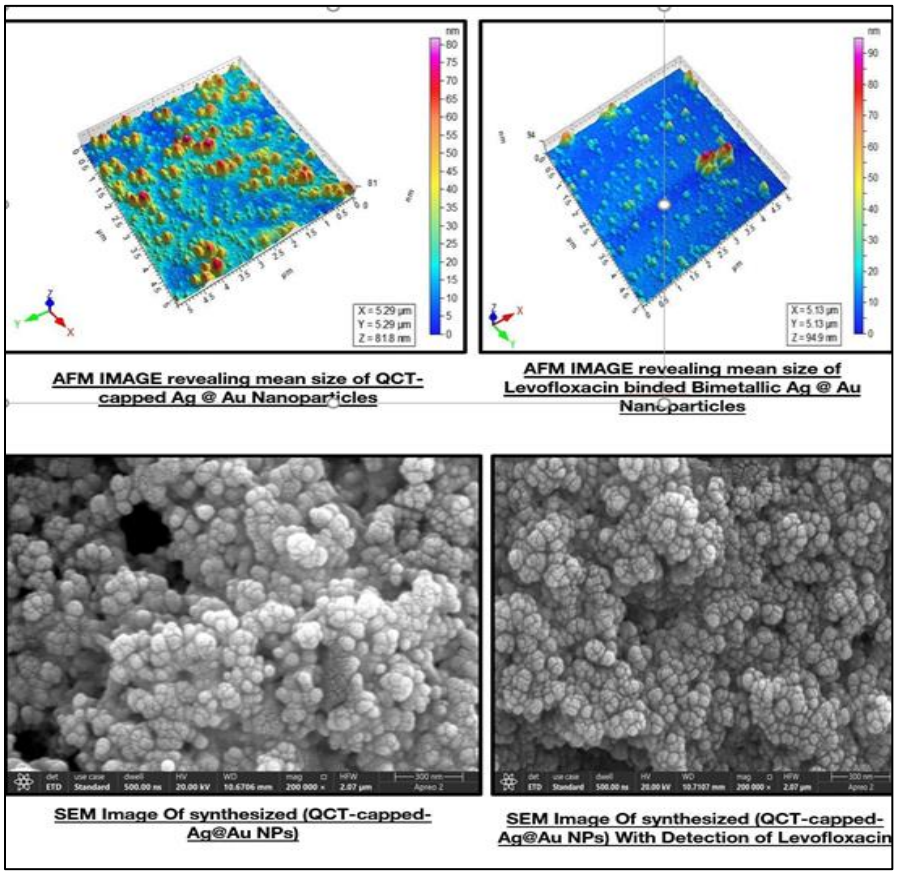

Figure 4: Characterization of Qct-Capped Ag@Au and its complex with levofloxacin