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# SYNTHESIS OF NOVEL HYBRID Au-$TiO_2$ NANOPARTICLES FOR WATER REMEDIATION


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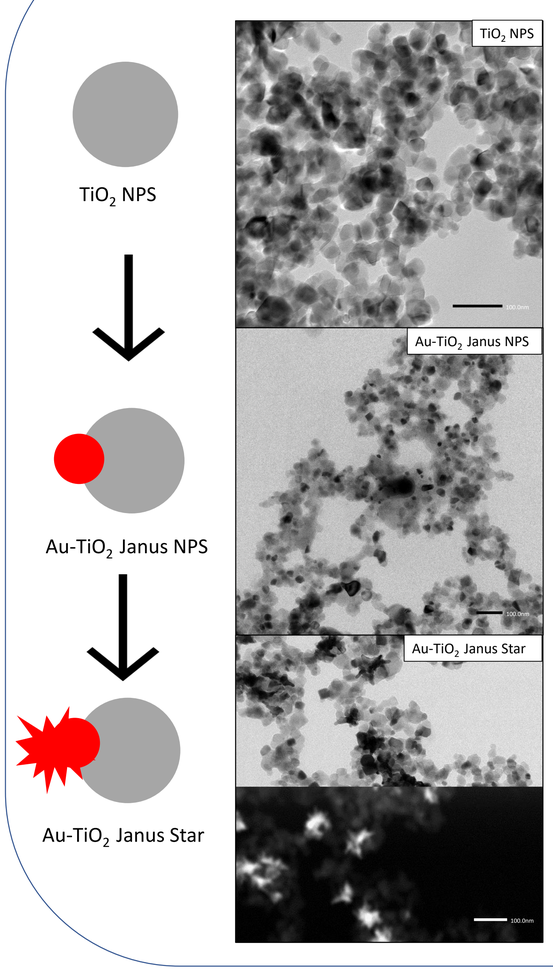
## ABSTRACT

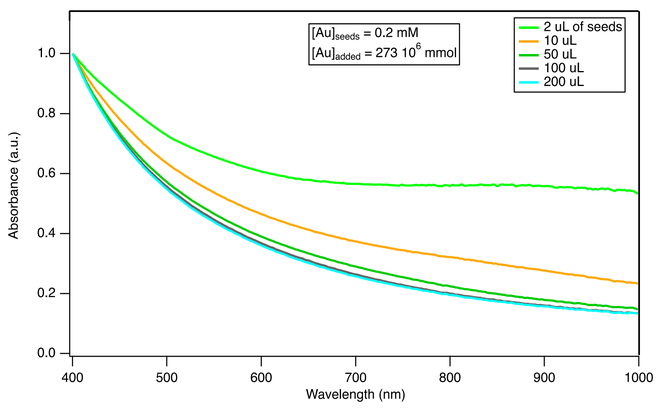

Photocatalysis is an attractive process to remove organic pollutants from aquatic environments, especially because it is inexpensive and can be carried out under ambient conditions. Among several catalysts, titanium dioxide ($TiO_2$) is one of the most used photocatalysts due to its stability, low toxicity, high turnover and catalytic activity, and chemical resistance among other properties. However, $TiO_2$ is limited by its large bandgap (≈ 3 eV), which results in poor efficiency upon visible light irradiation.[1] To overcome this limitation, noble metal nanoparticles, exhibiting plasmonic properties, can be employed together with $TiO_2$. Among those noble metal nanoparticles, gold is one of the most promising candidates as its characteristic localised surface plasmon resonance band takes place in the visible region. Most of the works using Au:$TiO_2$ in plasmonic photocatalysis have been performed with the use of spherical gold nanoparticles,[2] limiting the spectral irradiation region in the 500-550 nm, and wasting a large portion of visible radiation.

In this work, two methods have been explored to synthesise hybrid Au:$TiO_2$ nanoparticles with metal shape anisotropy that expand the plasmonic absorption covering both visible and near IR regions. The synthesis methods were based on seed-mediated growth processes, in sequential synthesis allowing a good control on the nanoparticle morphology and the Au to $TiO_2$ molar ratios.

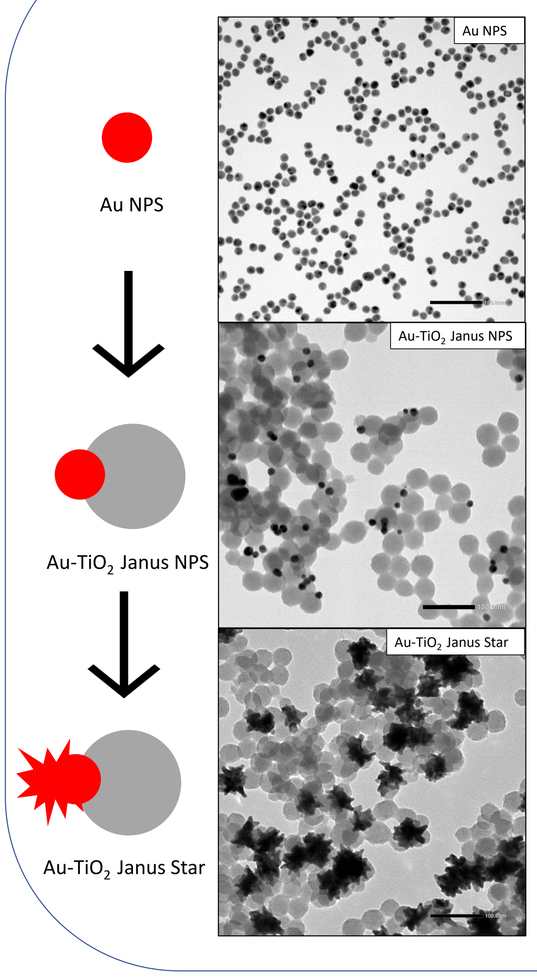

## SYNTHESIS METHOD & CHARACTERIZATION

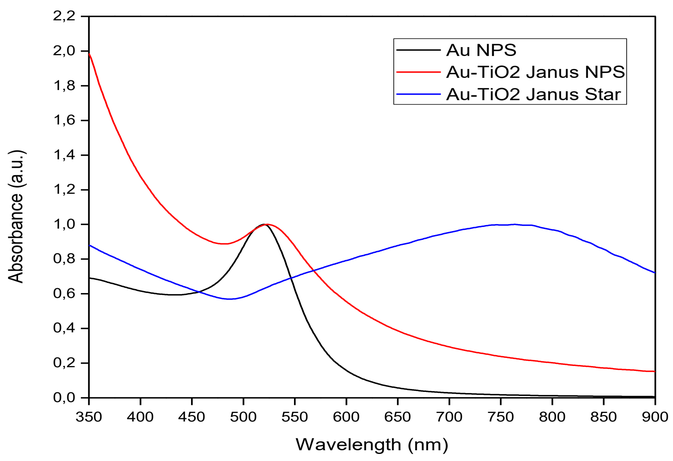
### METHOD I



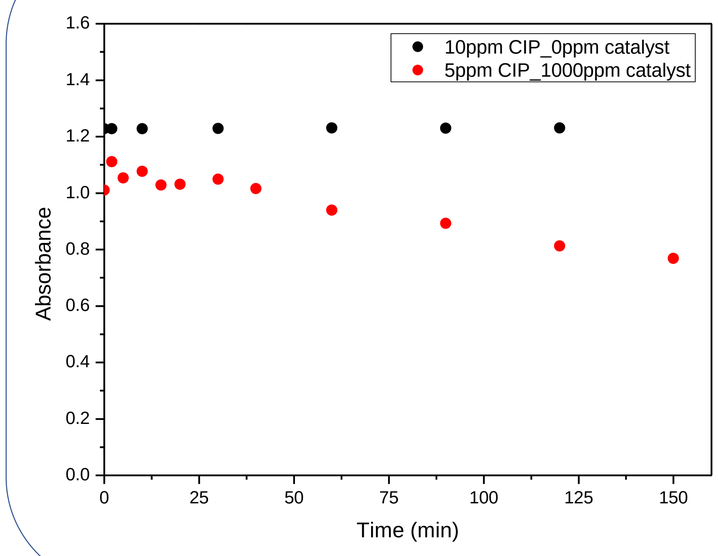

### METHOD II



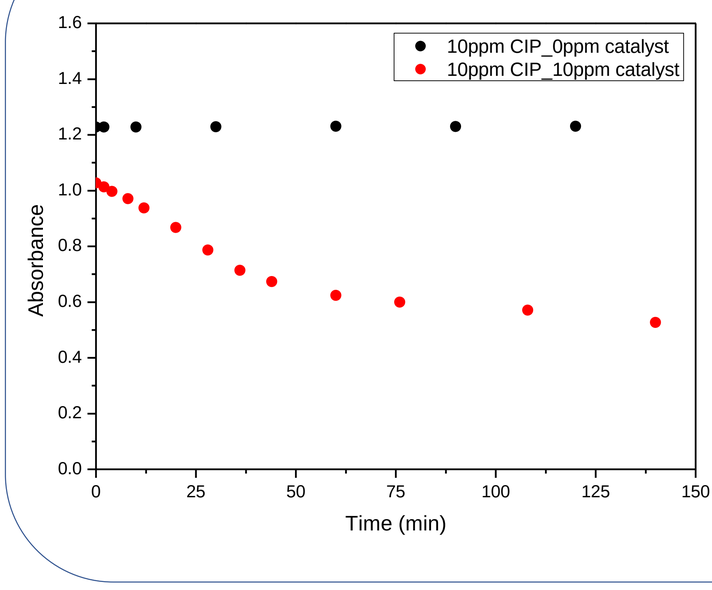

## PHOTOCATALYTIC EXPERIMENT

### METHOD I




- **Condition**: Under visible light (xenon lamp)
- **Pollutant**: Ciprofloxacin (CIP)
- Adsorption-desorption equilibrium after 30 min
- **Photocatalytic degradation of ≈ 24%**

### METHOD II




- **Condition**: Under white light (≈ 500-700nm)
- **Pollutant**: Ciprofloxacin (CIP)
- Adsorption-desorption equilibrium after 30 min
- **Photocatalytic degradation of ≈ 49%**

## PHOTOCATALYTIC EXPERIMENT

- The hybrid Au-$TiO_2$ nanoparticles with **different morphology** have been produced by both methods.
- All produced nanoparticles show a **broad spectral absorption in the visible-near IR.**
- The hybrid Au-$TiO_2$ nanoparticles are excellent photocatalysts **under visible light** to **degrade the ciprofloxacin.**
- In the future work, **a wide range of pollutants degradation** will be studied.


## CONTACT PERSON

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## REFERENCES


[1] Singh S, Mahalingam H, Singh PK (2013) Applied Catalysis A: General Ed 462-463: 178-195

[2] Kochuveedu ST, Jang YH, Kim DH (2013) Chem Soc Rev Ed 42: 8467-8493


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