Green synthesis of larvicidal silver nanoparticles

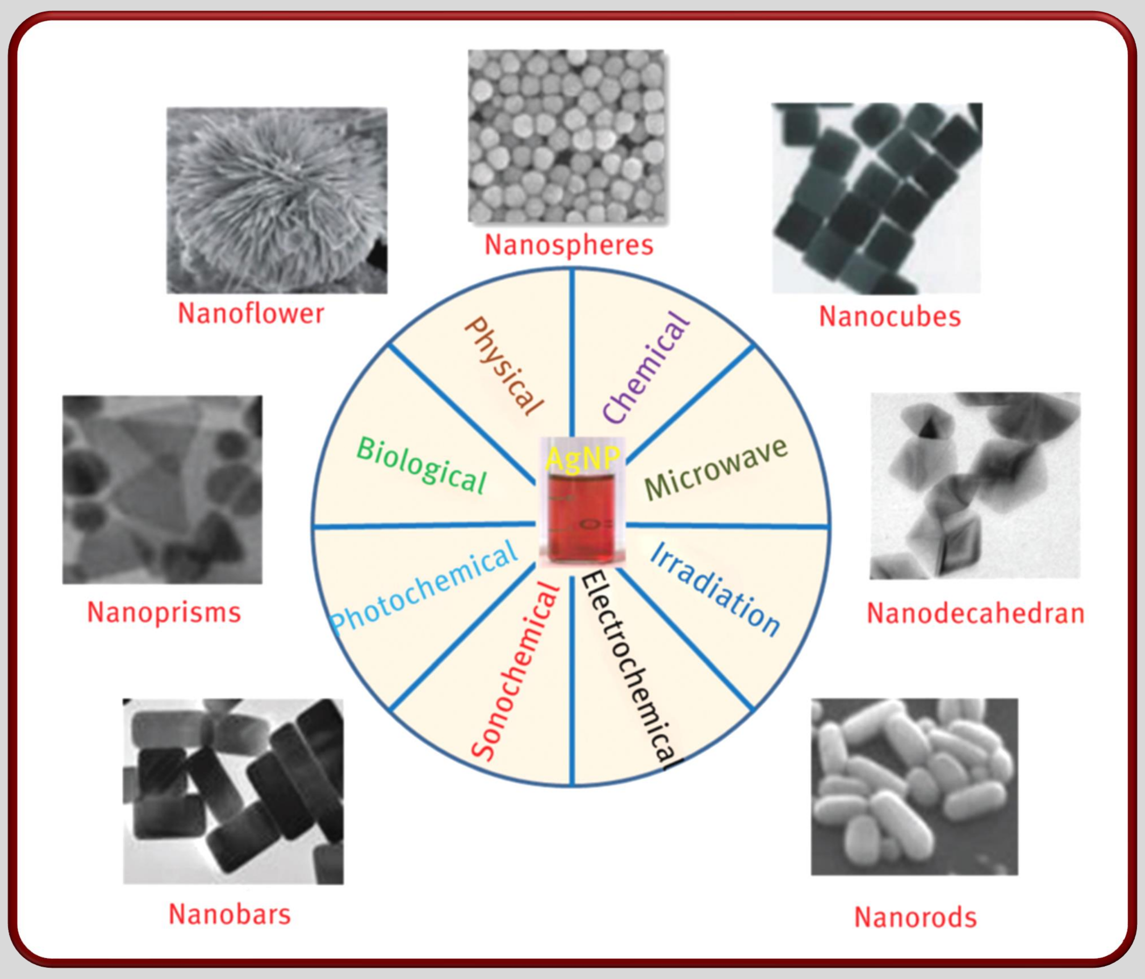
Marcelo Navarro, Martin Bari Garnier, Denilson Vasconcelos Freitas,
Felipe Leon Nascimento de Sousa
Department of Fundamental Chemistry, 50740-560 Brazil

Université de Strasbourg
Universidade Federal de Pernambuco
UPEC Université Paris-Est Créteil Val de Marne

I. Introduction

Blood-feeding mosquitos are vectors of many viruses and diseases, contaminating millions of humans each year. *Aedes Aegypti* is the principal vector of dengue, Zika virus, Chikungunya and the Yellow Fever.

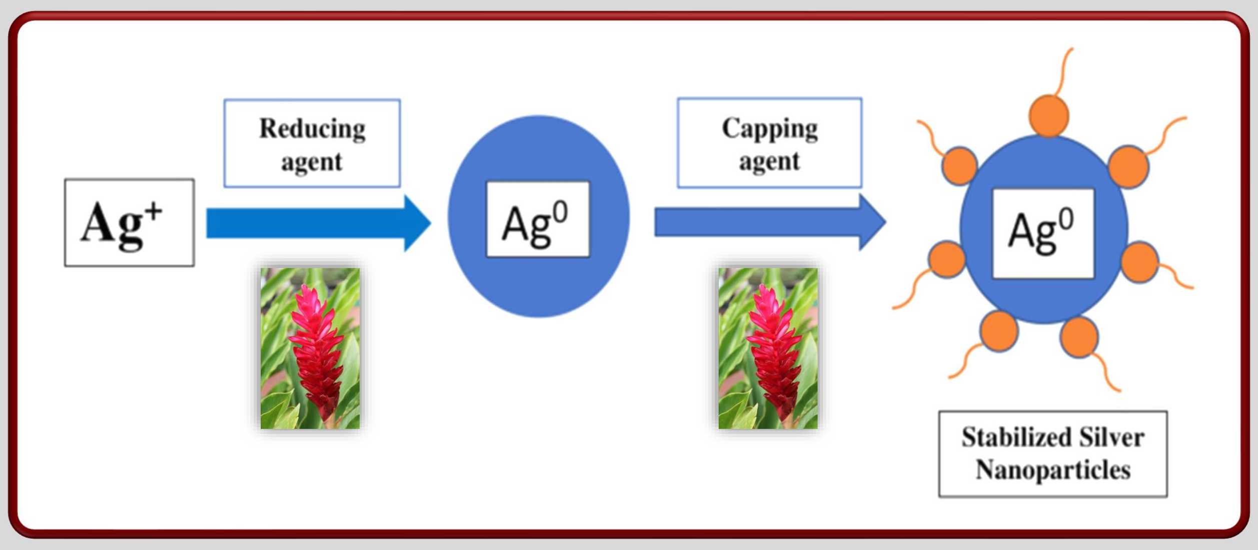
Here we investigated a treatment using green-synthetized silver nanoparticles.



Silver nanoparticles are eco-friendly, show an efficient larvicidal effect, and their synthesis is simple and cheap.

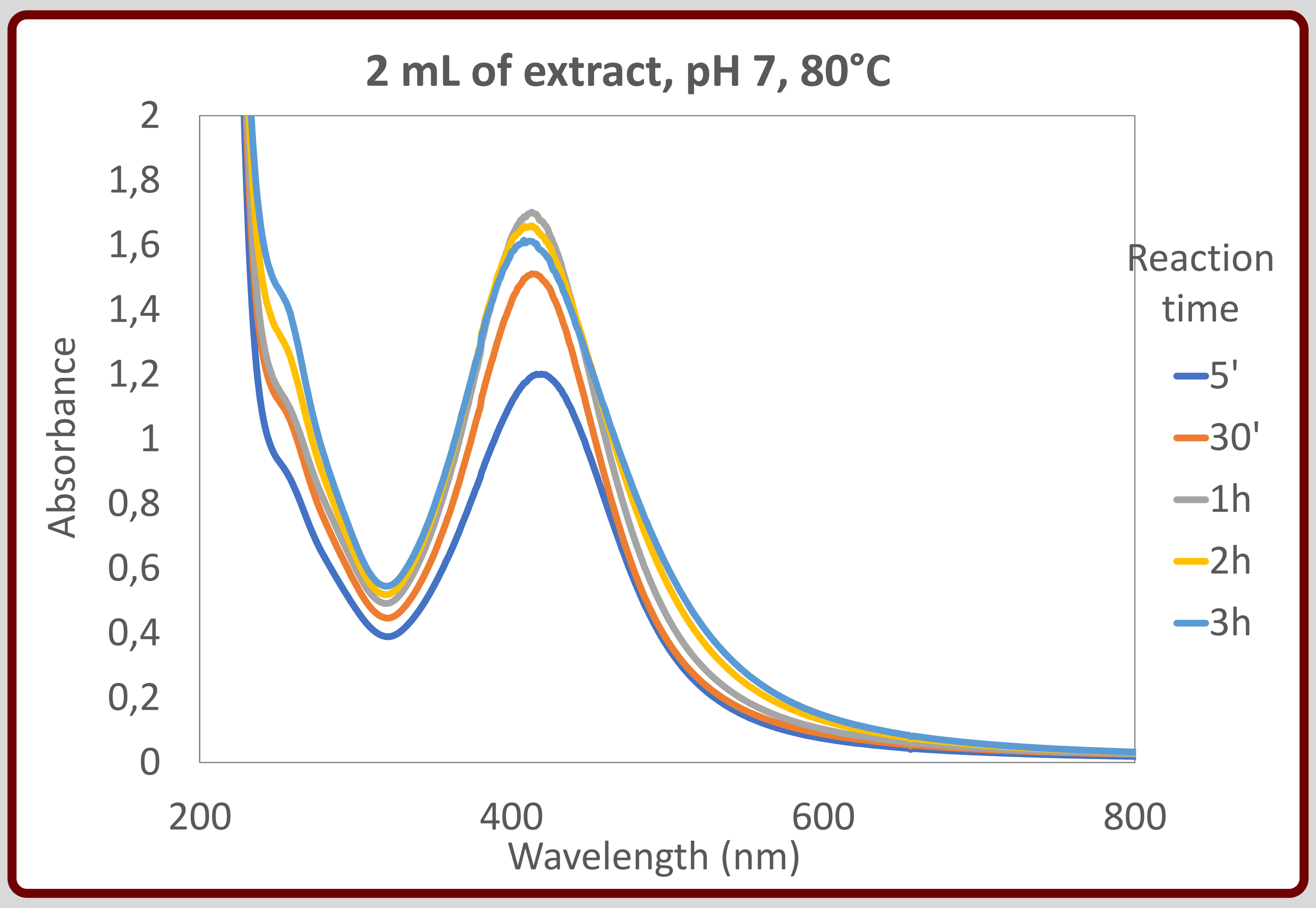
Local plants can act as capping agent. On the spot, we used an *Alpinia Purpurata* extract. Its numerous compounds allow it to reduce and stabilize the silver nanoparticles, avoiding the use of other polluting or toxic chemicals.

II. Optimization of the synthesis



Synthesis using silver nitrate in water, the plant extract solubilized in water and DMSO, and a pH adjustment to 7.

Silver nanoparticles have a very characteristic absorption band. It ranges from 400 to 450nm in average, depending on the shape of the particles.
Our spherical particles have it at **414 nm**.



Absorbance spectra of the solution optimized for the pH, the temperature and the quantity of extract.

III. Characterization of the samples

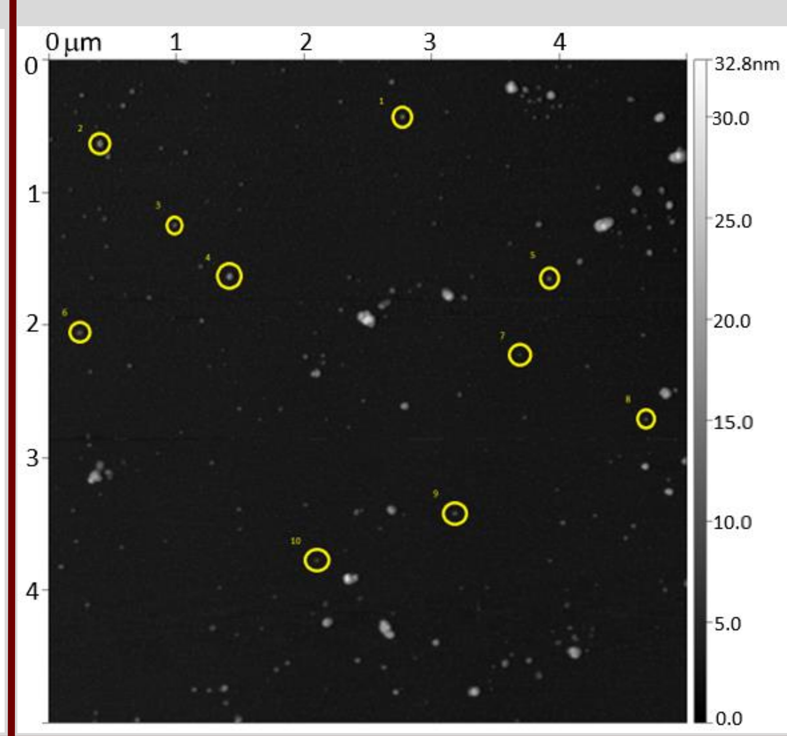
Scanning Electron Microscopy (SEM)

Image of the surface of a sample

- Aggregates
- Unclear shape and size of the NP

To improve:
- Less concentrated sample
- Higher resolution of image

Atomic Force Microscopy (AFM)



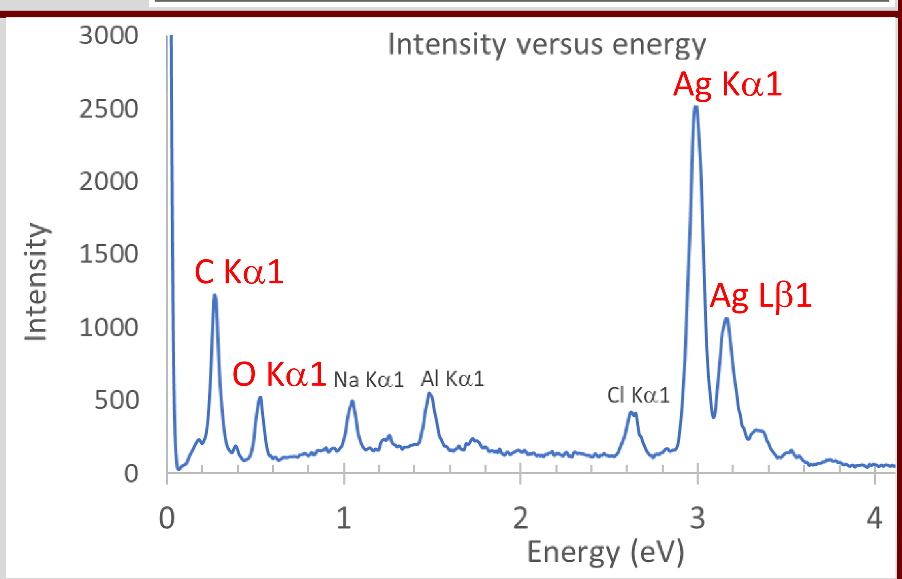
Topography of a sample

- NP of 58 nm in average
- Close sizes of NP
- A few aggregates

- Successful synthesis

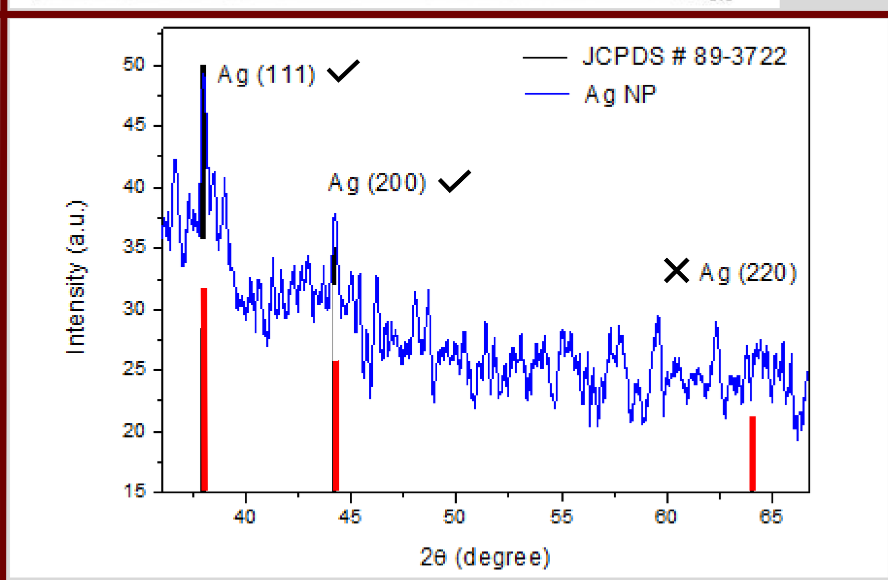
- Major compound is Ag
- C and O (*Alpinia* extract)

- Successful synthesis



Atomic composition of a sample

Energy-Dispersive X-Ray spectroscopy



- Matching reference for silver
- Presence of silver

Crystalline identity of a sample

X-Ray Diffraction (XRD)

IV. Larvicidal tests

- Populations of 20 larvae with different concentrations of silver nanoparticles.
- Get the LC_{50} : concentration corresponding to the death of 50% of the population.

=> AgNP showed a larvicidal effect, and promising results for future researches.

V. Conclusion

- The synthesis is easy, but it needs to be optimized if your local plant has not been used before.
- Good results, but a complete characterization is needed to control the good formation of the nanoparticles and the effectiveness of the plant is the synthesis.
- Promising larvicidal tests that need to be further conducted.

- **Promising future to regulate mosquitos' population, knowing that global warming will induce their installation in regions that were not favorable before.**