

Photophysical characterization of nanocomposites formed by silver nanoparticles and methylene blue

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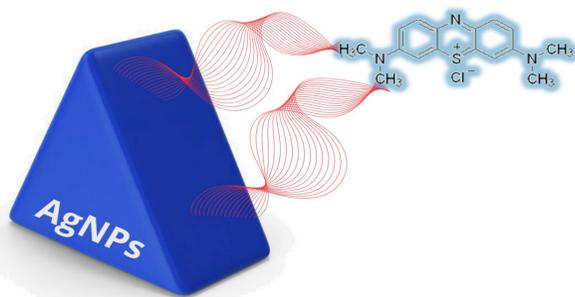
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INTRODUCTION & AIM

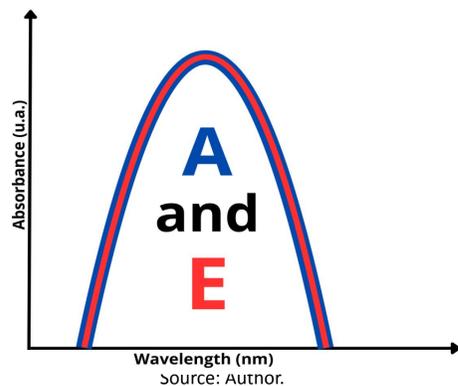
Silver nanoparticles (AgNPs) are capable of producing a plasmonic effect, which can amplify the local electric field of certain fluorophores, such as methylene blue (MB) (as shown in Figure 1), resulting in fluorescence spectra with increased intensity. However, for this effect to occur, two conditions must be met: (i) spectral overlap between the extinction spectrum of the AgNPs and the absorption spectrum of MB (Figure 2); and (ii) an intermediate distance (10–20 nm) between the AgNPs and the material whose electromagnetic signal is to be amplified.

Figure 1 - Plasmonic effect of AgNPs on MB.



Source: Author.

Figure 2 - Overlap between the absorption band (A) of the material and the extinction of AgNPs (E).



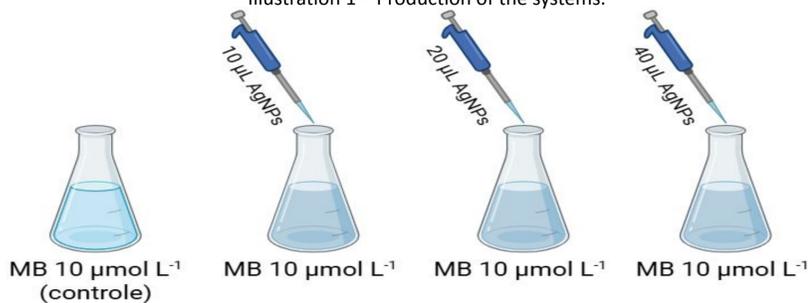
Source: Author.

METHOD

Synthesis of AgNPs: Silver nanoparticles were synthesized in a solution containing 10 mmol sodium citrate, 500 mg L⁻¹ poly(sodium 4-styrenesulfonate), ascorbic acid, and 10 mmol sodium borohydride, followed by titration with 0.5 mmol AgNO₃ under stirring.

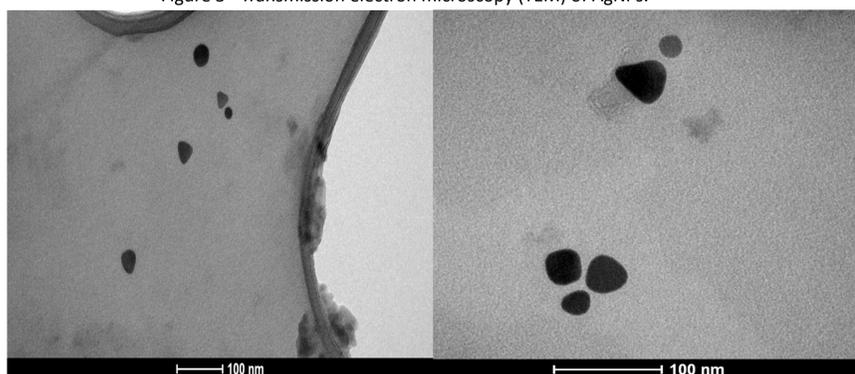
Production of the systems:

Illustration 1 – Production of the systems.



Characterization of the systems: Absorption, emission, and transmission electron spectroscopy.

Figure 3 - Transmission electron microscopy (TEM) of AgNPs.

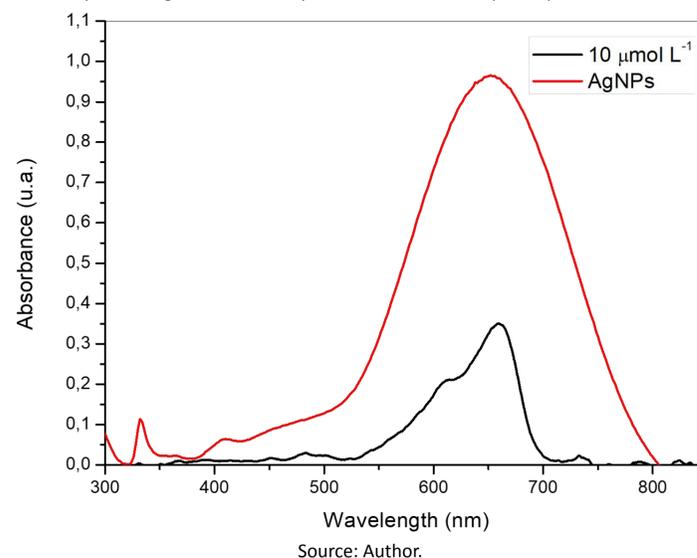


Source: Author.

Most of these AgNPs have widths between 25 and 30 nm, with an average size of 26 ± 7 nm, with the extinction spectrum shown in Figure 5.

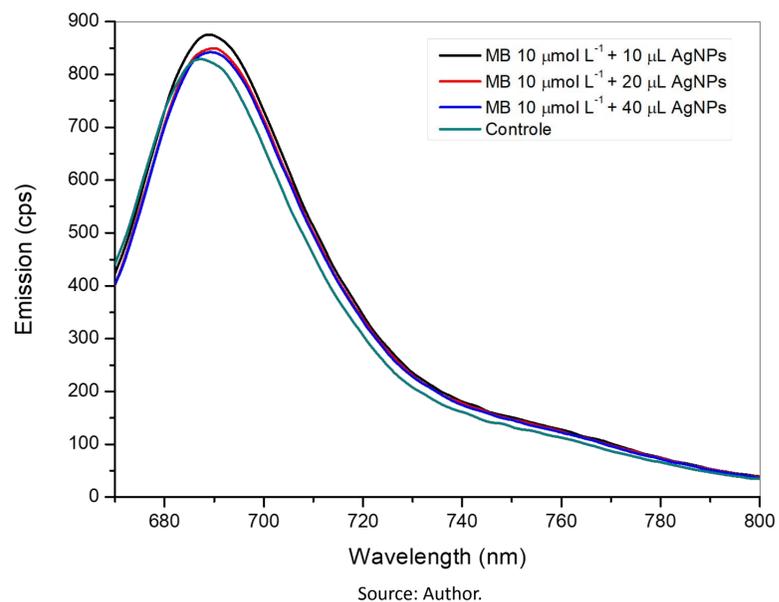
RESULTS & DISCUSSION

Figure 4 - Overlap of the AgNPs extinction spectrum with the absorption spectrum of MB 10 µmol L⁻¹.



Source: Author.

Figure 5 - Emission of the control group and the produced systems.



Source: Author.

Upon the addition of 10, 20, and 40 µL of AgNPs, the fluorescence intensity increased by 5.7%, 2.5%, and 1.7%, respectively. These results demonstrate that higher volumes of AgNPs did not result in a further enhancement of the fluorescence intensity of MB.

CONCLUSION

In conclusion, at the concentration studied, it is possible to achieve amplification of the fluorescence signal of MB using the synthesized AgNPs; however, the ideal added volume was approximately 10 µL.

FUTURE WORK / REFERENCES

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