

Green Synthesized Silver Nanoparticles as Sensor for Monitoring Deterioration in Crops

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Introduction

According to United Nations (UN), about 1.3 billion tons of food are lost annually [1]. The quota from developing countries will be higher due to poor post-harvest management of crops [1,2]. Post-harvest lost of above 50% of annual production has been reported in many developing countries for spices, fruits and vegetable. Common technology include refrigeration and indigenous zero energy cooling chamber. Limitations are unstable energy supply and lack of detector to monitor food deterioration during spoilage. In view of these, silver nanoparticles were synthesized using microbe and plant mediated routes and investigated as colorimetric sensor for monitoring of gaseous metabolites released during deterioration.

Materials and Methods

Bacillus subtilis NCIB 3610 and aqueous extract of leaf of *Elaeagnus guinensis* were used for bio-reduction of 1 mM final concentration of AgNO_3 solution. Surface plasmon resonance was monitored with UV/Visible spec. The monitoring of deterioration in crops were studied for a spice and fruit, namely; *Allium cepa* and *Musa acuminata*. The AgNP solution was used to monitor deterioration for ten days and analyzed with UV-Vis and FTIR spectroscopies, while metabolite was analyzed with GCMS.

Result and Discussion

For *Musa sp.* showed no distinct colour variation from of Day 0 (control) to Day 3, onset slight change in colour was observed from Day 4. There was onset of transparent coloration from Day 7 (Fig. 1) while solution eventually turned colourless on Day 10. Colourless solution was obtained on the 9th day for *Allium cepa* (Fig. 2). The consecutive changes in the colour of AgNPs solution might be due to binding and strong interactions between the AgNPs and volatile ester compound released during the deterioration process [1,2].

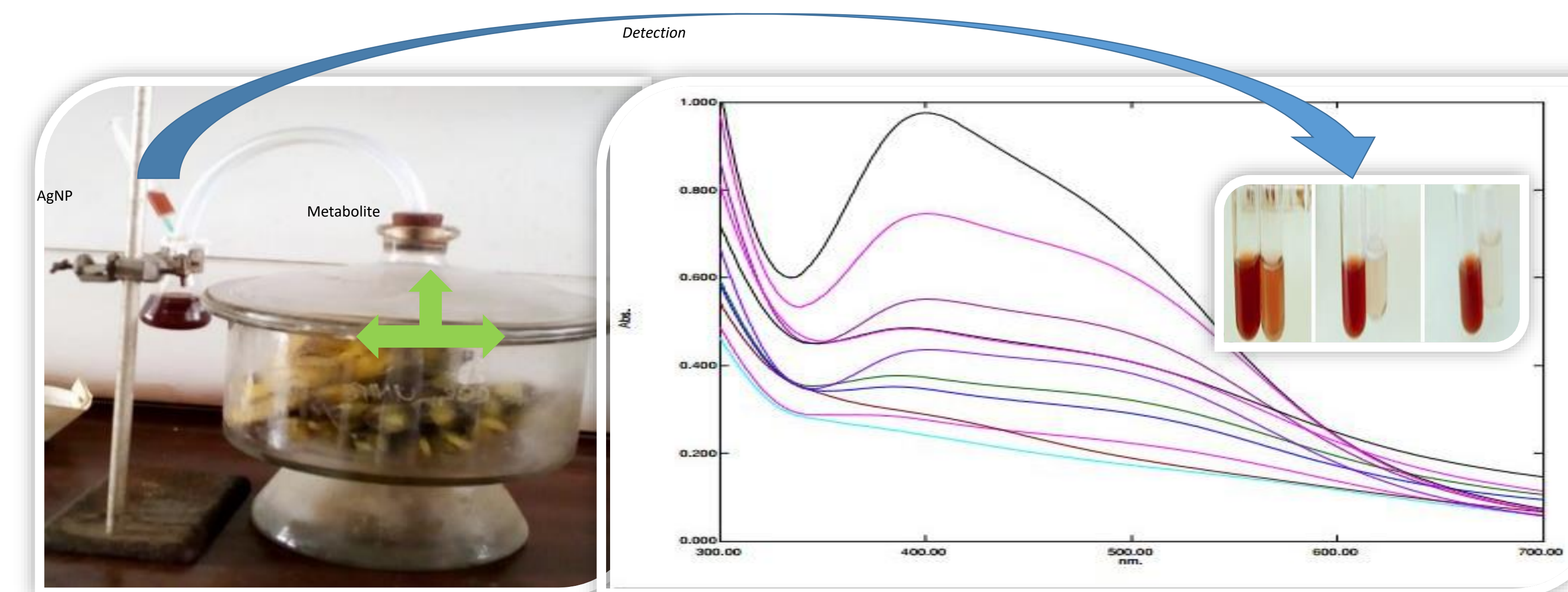


Fig. 1: UV-Vis spectral changes of AgNP solution with compound evolved from the spoiled *Musa acuminata* for 10 days, experimental set-up and virtual colour change.

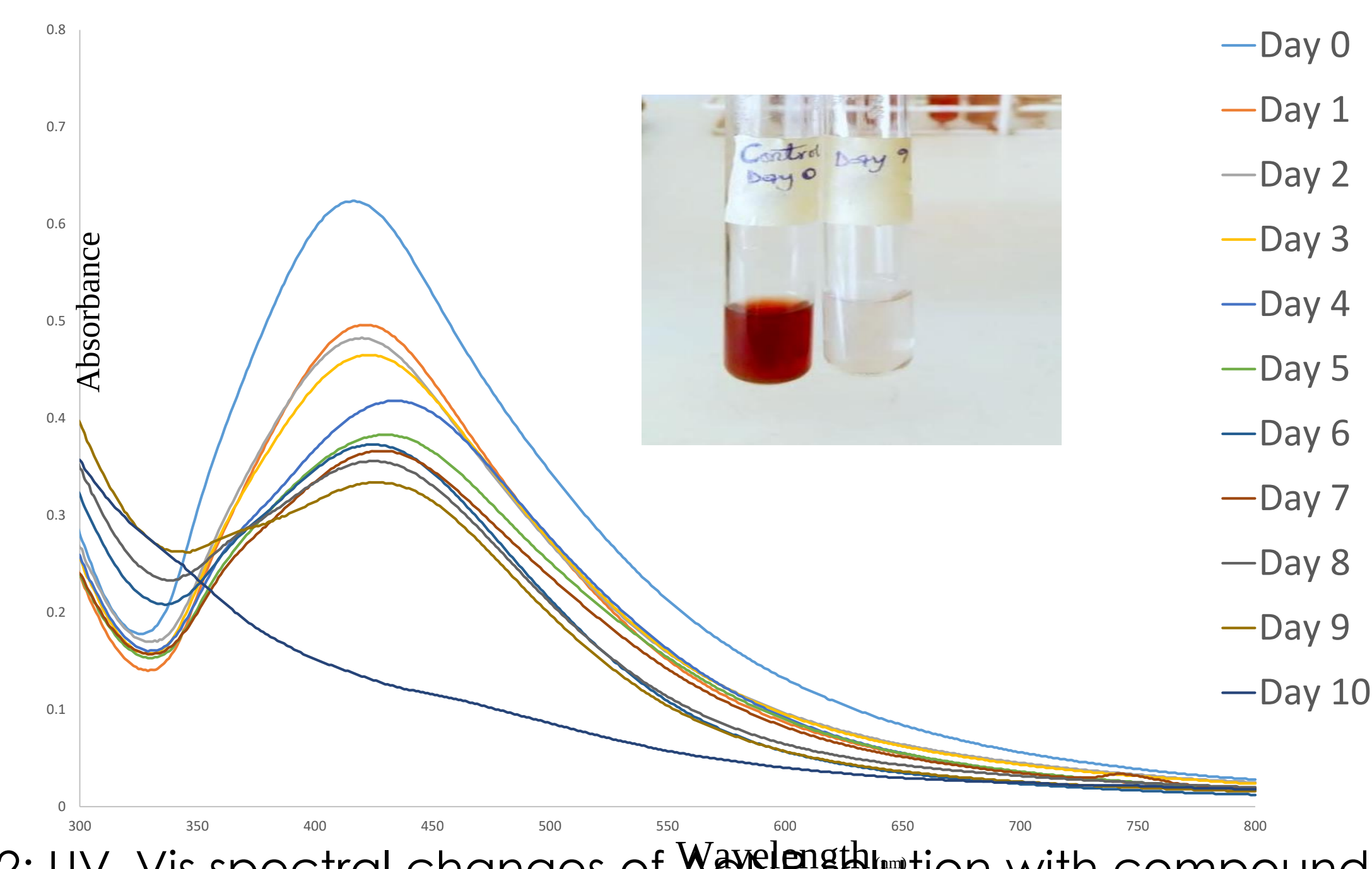
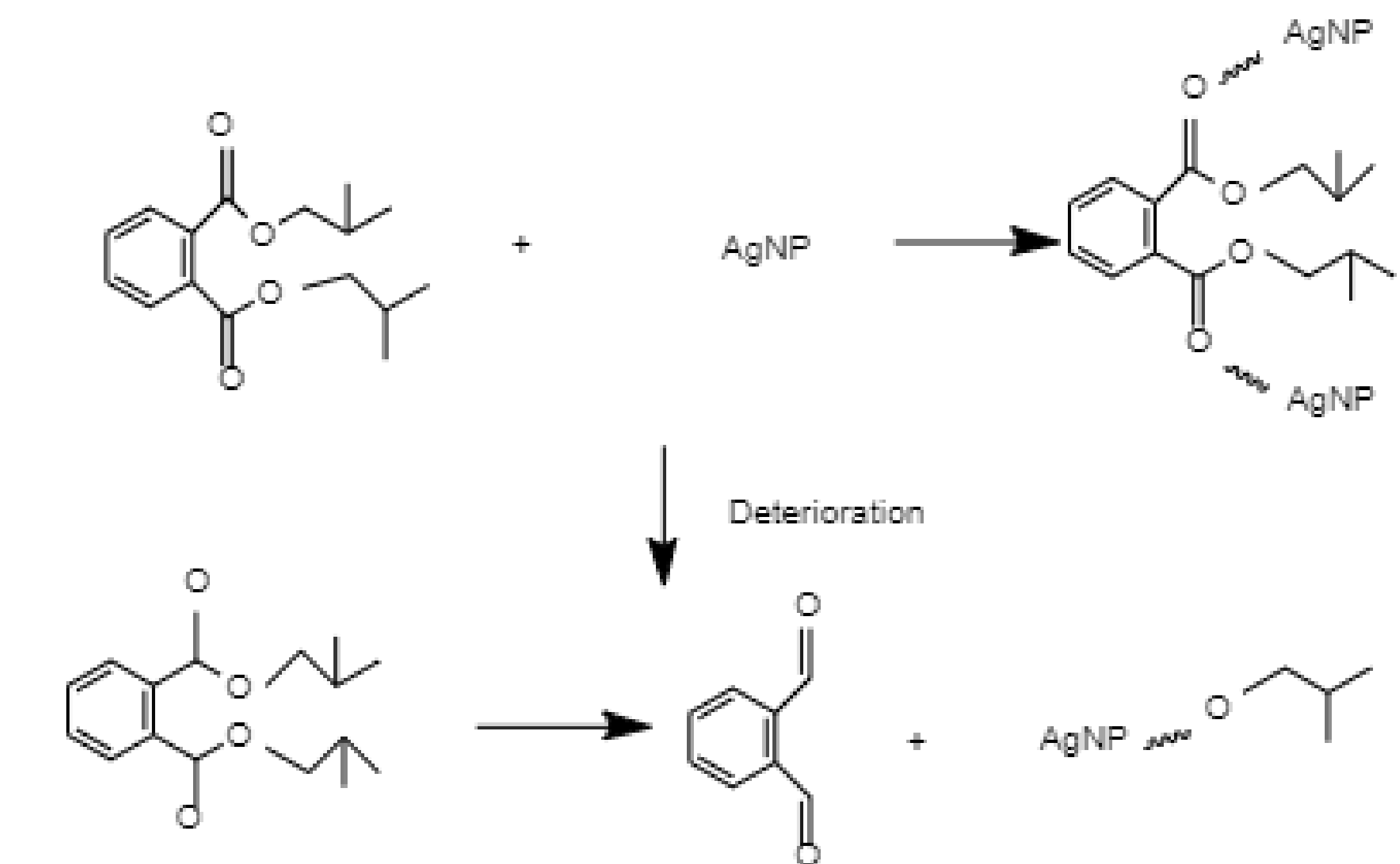


Fig. 2: UV-Vis spectral changes of AgNP solution with compound evolved from the spoiled *Allium cepa* for 10 days and visible colouration.



Conclusion

The major metabolite released in *Musa sp.* was 1,2-Benzene dicarboxylic acid bis (2-methyl propyl) ester while 1-isothiocyanato- 2-methylbenzene and 2,6-dimethyl-4-heptanone were released in *Allium cepa*. Sustainable pathway to monitor crop deterioration is presented.

Reference

1. Omole R.K. et. al. (2018) DOI:/10.1016/j.scp.2018.08.005
2. Alayande S.O., et.al. (2021) doi.org/10.1016/bs.coac.2021.01.010