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In Vitro Antioxidant, Antitumor and Photocatalytic Activities of Silver Nanoparticles Synthesized Using *Equisetum* Species: A Green Approach

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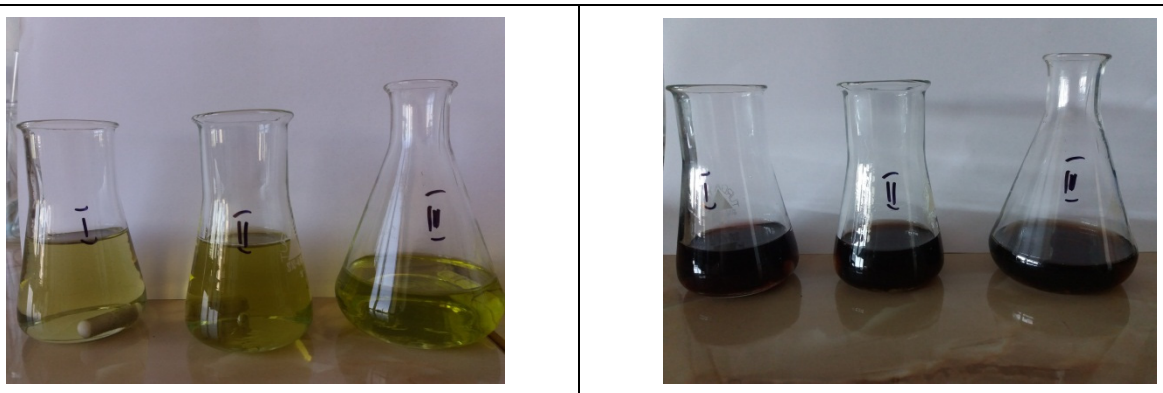
Abstract: The ethanolic extracts of three *Equisetum* species (*E. pratense* Ehrh., *E. sylvaticum* L. and *E. telmateia* Ehrh.) were used to reduce silver ions to silver nanoparticles (AgNPs). The synthesized AgNPs were characterized using UV-Vis spectrophotometry, Fourier Transform Infrared Spectroscopy (FTIR), Energy Dispersive X-ray (EDX), Transmission Electron Microscopy (TEM) and Dynamic Light Scattering (DLS) measurements. FTIR data revealed the functional groups of biomolecules involved in AgNPs synthesis, such as O-H, C-H, C=O, C-O, and C-C. EDX spectroscopy was used to highlight the presence of silver, while DLS spectroscopy provided information on the mean diameter of AgNPs, that ranged from 74.4 to 314 nm. The negative Zeta potential values (−23.76 for Ep–AgNPs, −29.54 for Es–AgNPs and −20.72 for Et–AgNPs) indicate the stability of the obtained colloidal solution. The study also focused on establishing the photocatalytic activity of AgNPs, which is an important aspect in terms of removing organic dyes from the environment. The best photocatalytic activity was observed for AgNPs obtained from *E. telmateia*, which degraded malachite green in a proportion of 97.9%. The antioxidant action of the three AgNPs samples was highlighted comparatively through four tests, with the best overall antioxidant capacity being observed for AgNPs obtained using *E. sylvaticum*. Moreover, the biosynthesized AgNPs showed promising cytotoxic efficacy against cancerous cell line MG63, the AgNPs obtained from *E. sylvaticum* L. providing the best result, with a LD_{50} value around 1.5 mg/mL.

Keywords: *Equisetum pratense; Equisetum telmateia; Equisetum sylvaticum;* silver nanoparticles; green synthesis; photocatalytic activity; antioxidant capacity; cytotoxicity



color before reaction	color after reaction

Figure S1. Color monitoring of mixtures before and after reaction (I – Ep-AgNPs, II – Es-AgNPs, III – Et-AgNPs).

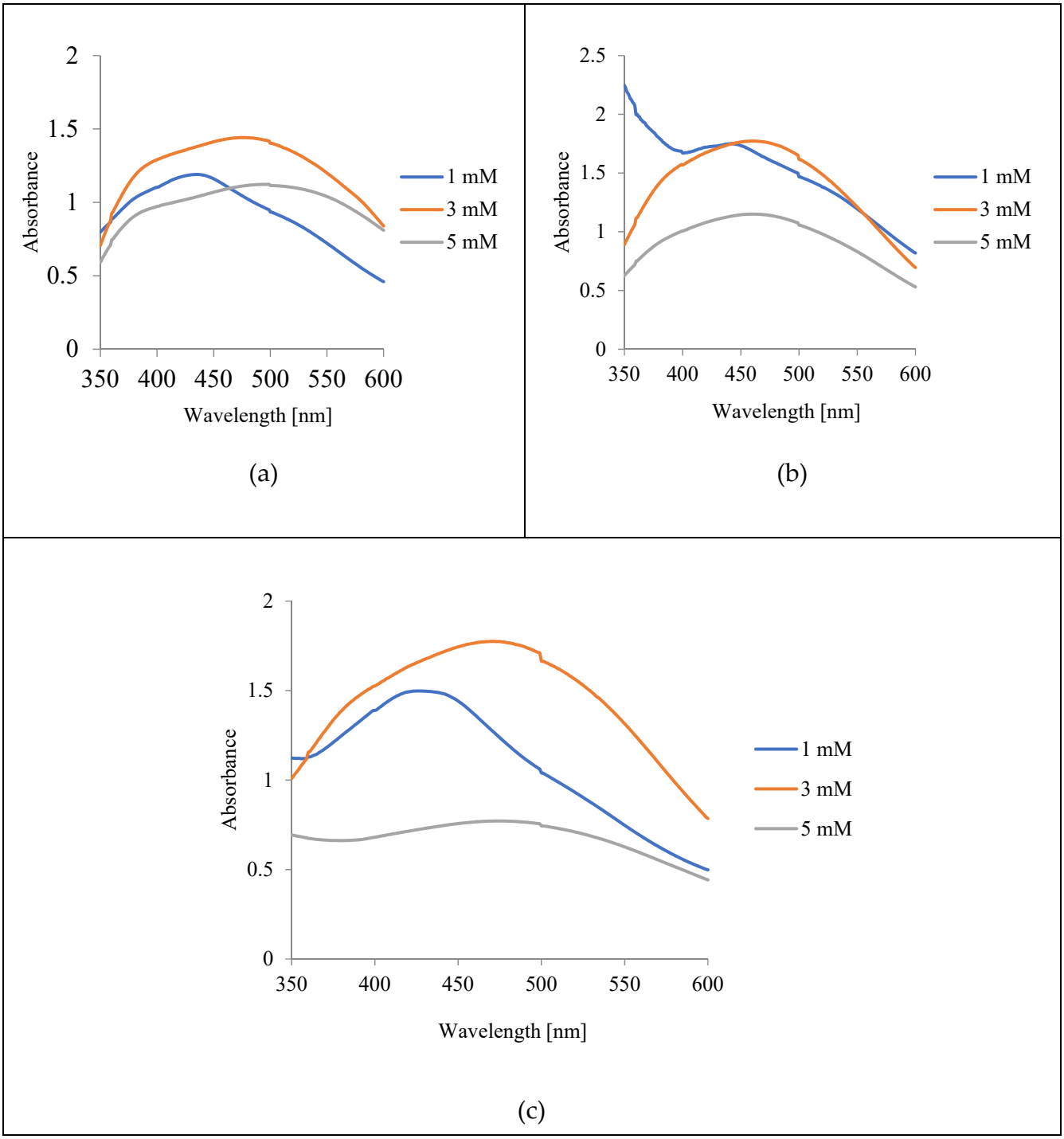


Figure S2. The influence of different $AgNO_3$ concentrations on the formation of AgNPs using *Equisetum* extracts: Ep (a), Es (b) and Et (c).

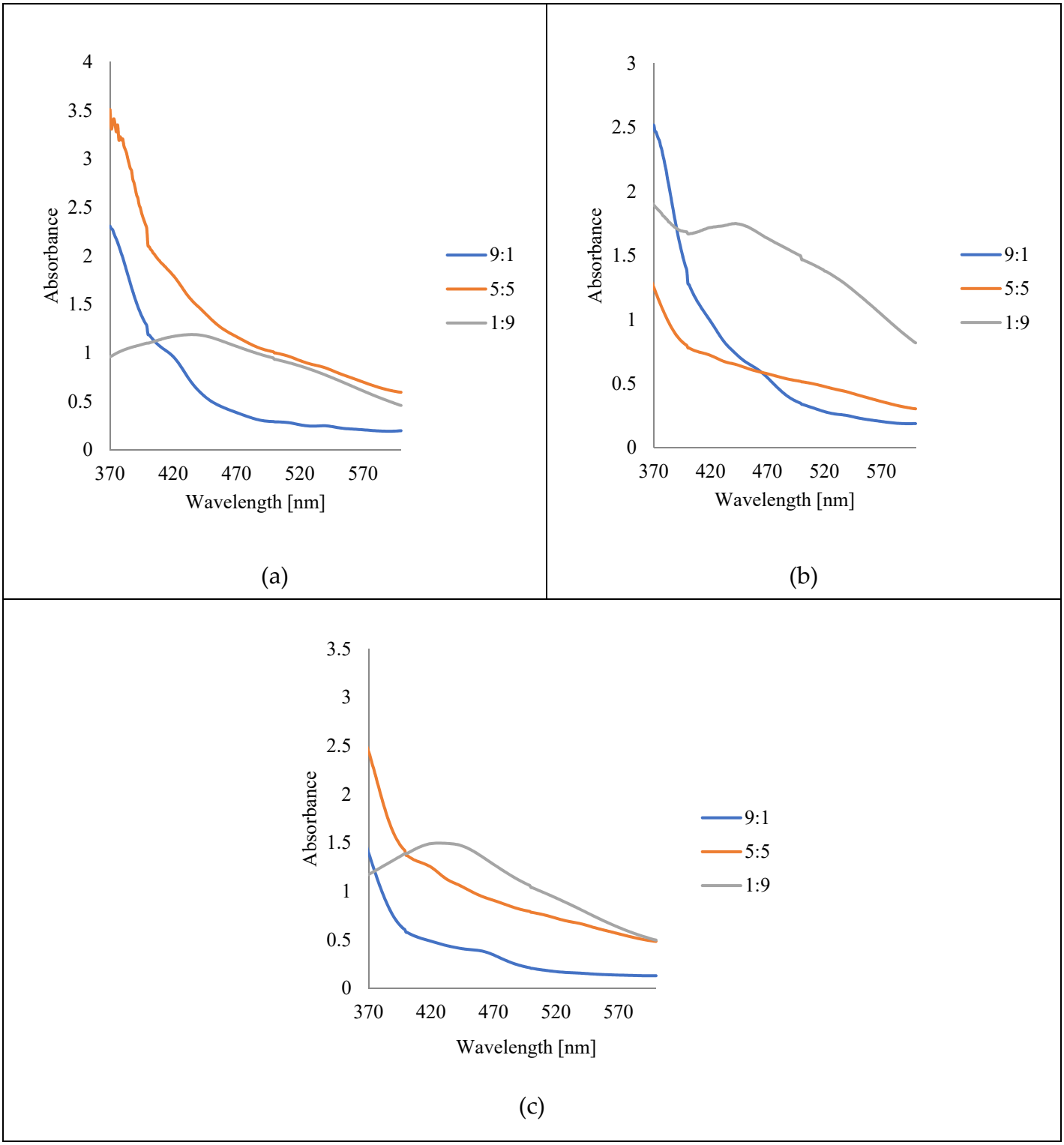


Figure S3. The influence of the extract:$AgNO_3$ molar ratio on the formation of AgNPs using *Equisetum* extracts: Ep (a), Es (b) and Et (c)

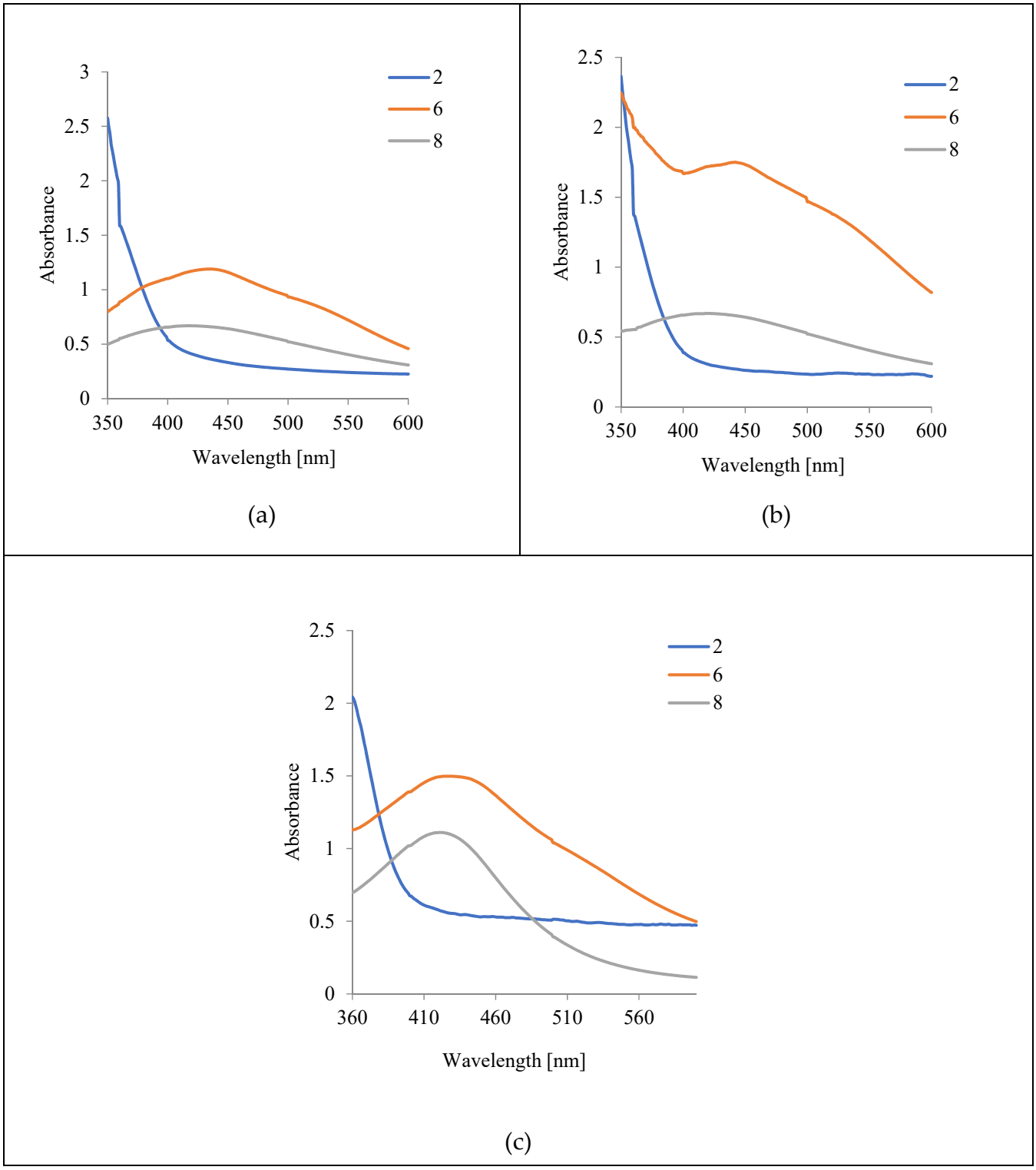


Figure S4. The influence of the pH on the formation of AgNPs using *Equisetum* extracts: Ep (a), Es (b) and Et (c).

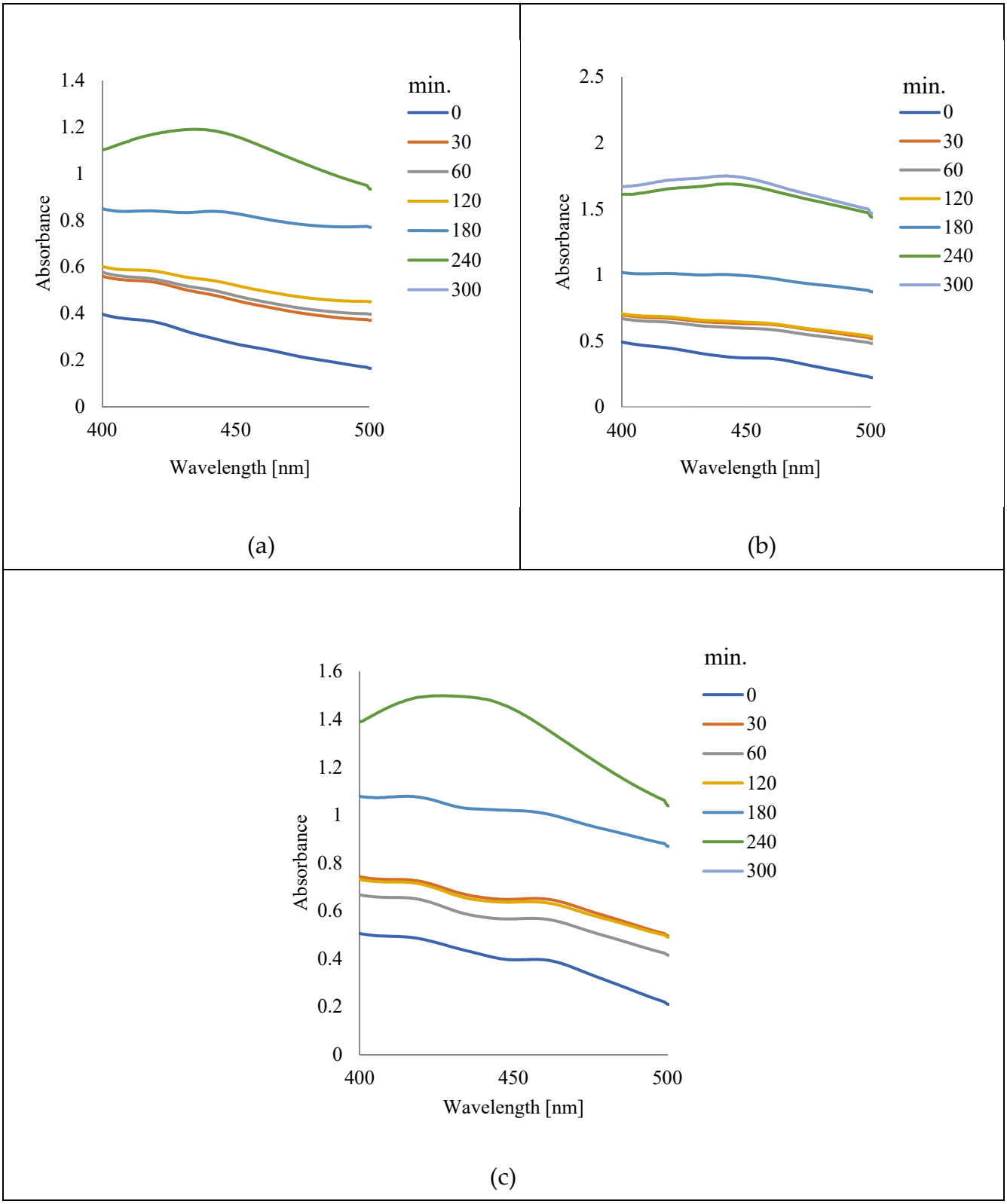


Figure S5. The influence of the stirring time on the formation of AgNPs using *Equisetum* extracts: Ep (a), Es (b) and Et (c).

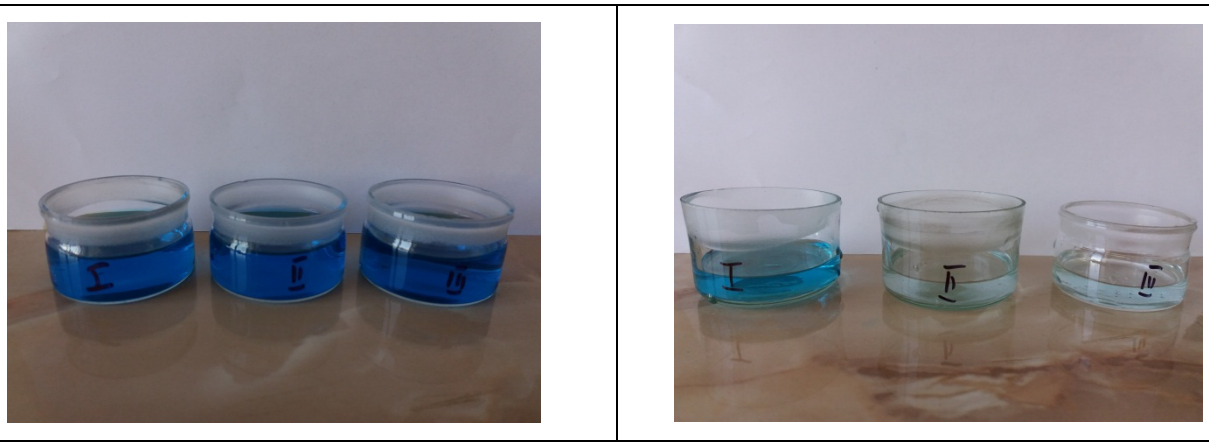


Figure S6. Photocatalytic degradation of the dye solution in 180 minutes after treatment with AgNPs (I – Ep-AgNPs, II – Es-AgNPs, III – Et-AgNPs).