

Green synthesis of silver nanoparticles using the cell-free supernatant of *Haematococcus pluvialis* culture

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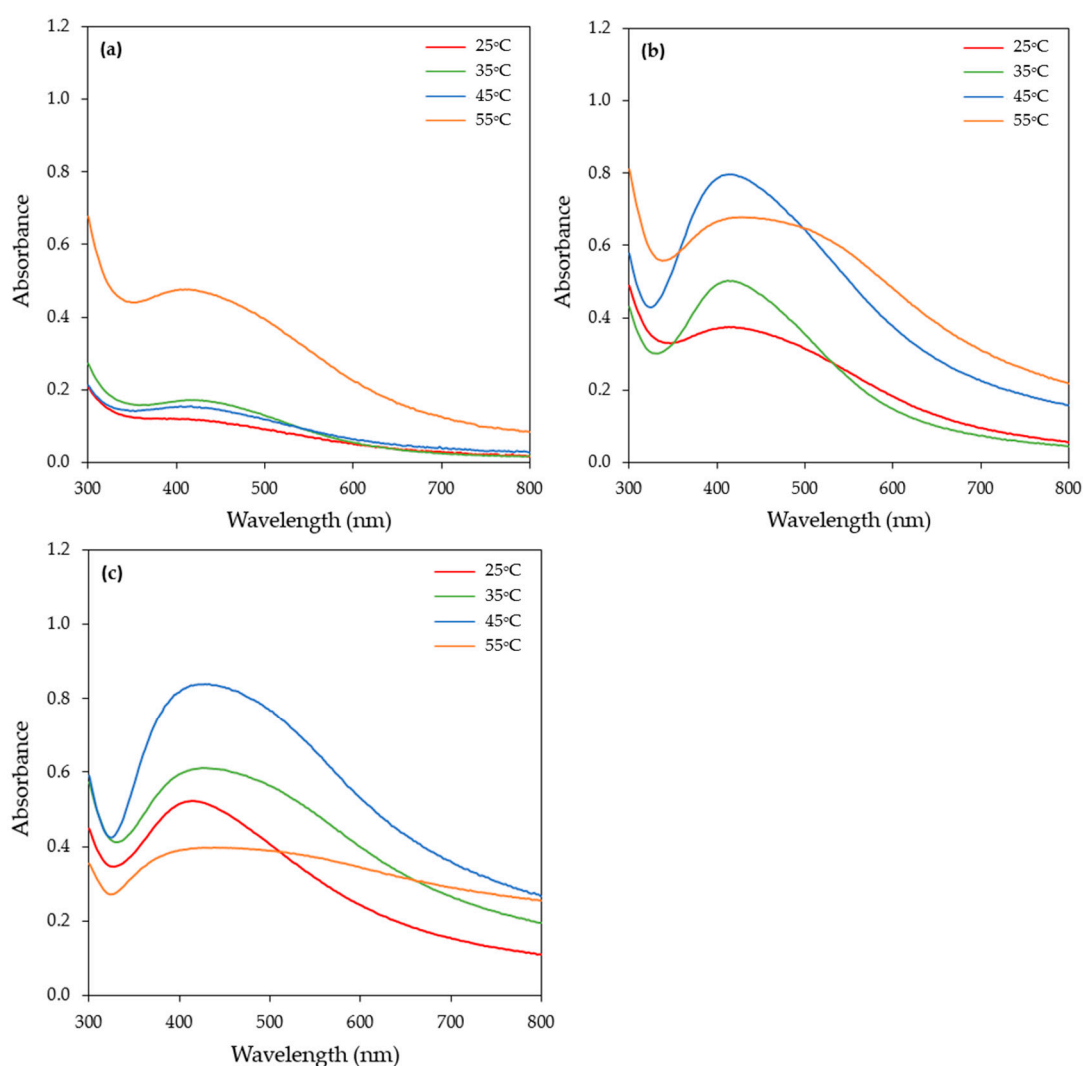
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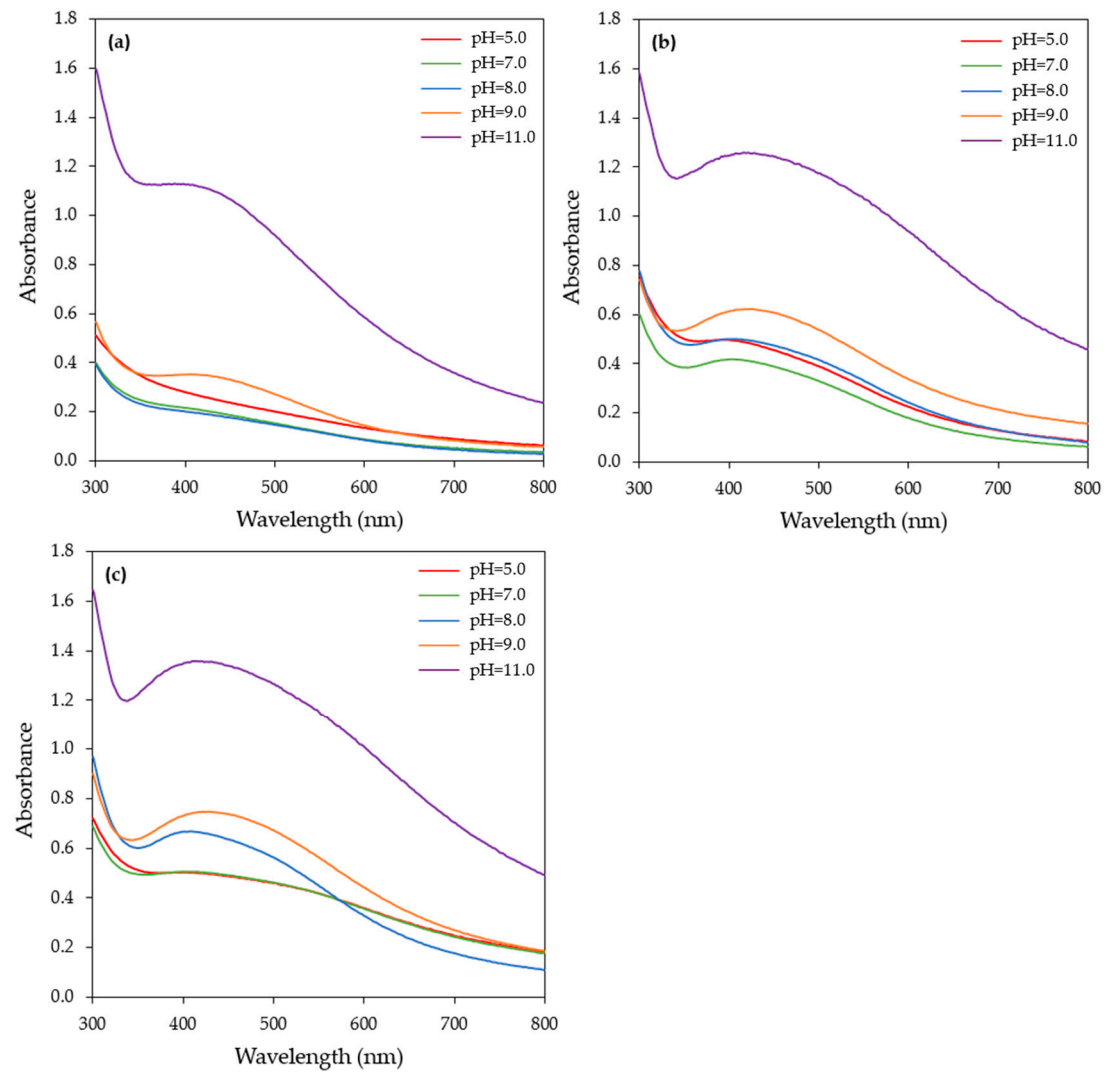
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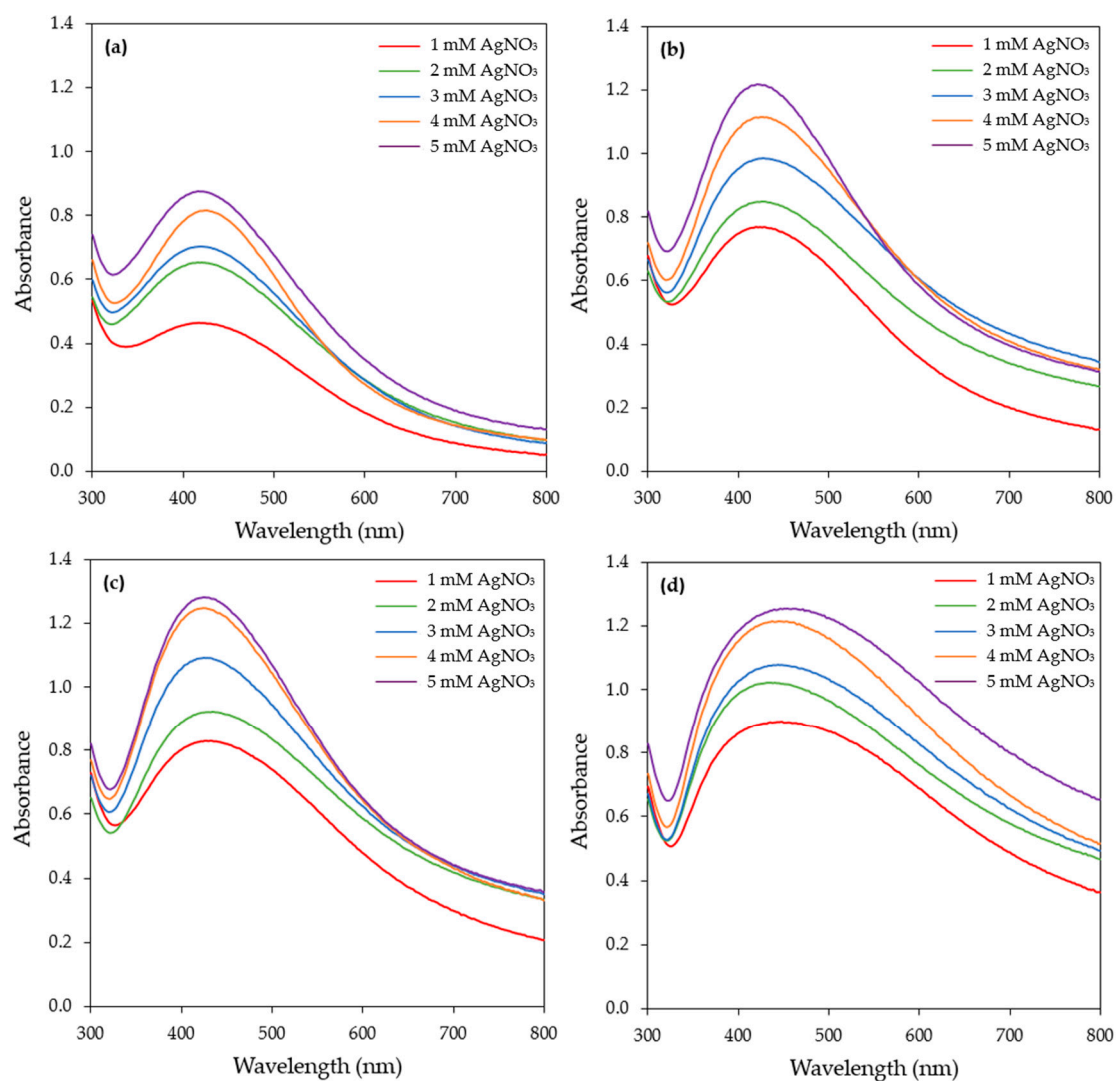
† These authors contributed equally to this paper



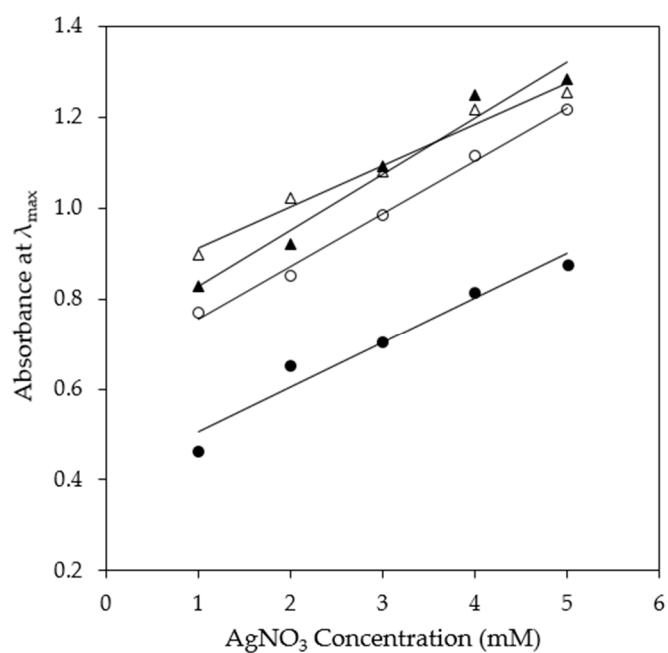
Supplementary Figure S1. UV–visible absorption spectra of AgNPs biosynthesized by the CFS of *H. pluvialis* culture at different temperatures and for reaction time of (a) 0.25 h, (b) 3 h, (c) 6h. (Conditions: illumination, pH=8.0, AgNO₃ concentration: 1mM, AgNO₃ aqueous solution to CFS ratio: 90:10 (v/v), stirring: 180 rpm for 15 min followed by stirring at 80 rpm)



Supplementary Figure S2. UV–visible absorption spectra of AgNPs biosynthesized by the CFS of *H. pluvialis* culture at various pHs and for reaction time of (a) 0.25 h, (b) 3 h, and (c) 6 h. (Conditions: illumination, $T=45^{\circ}\text{C}$, AgNO_3 concentration: 1mM, AgNO_3 aqueous solution to CFS ratio: 90:10 (v/v), stirring: 180 rpm for 15 min followed by stirring at 80 rpm)

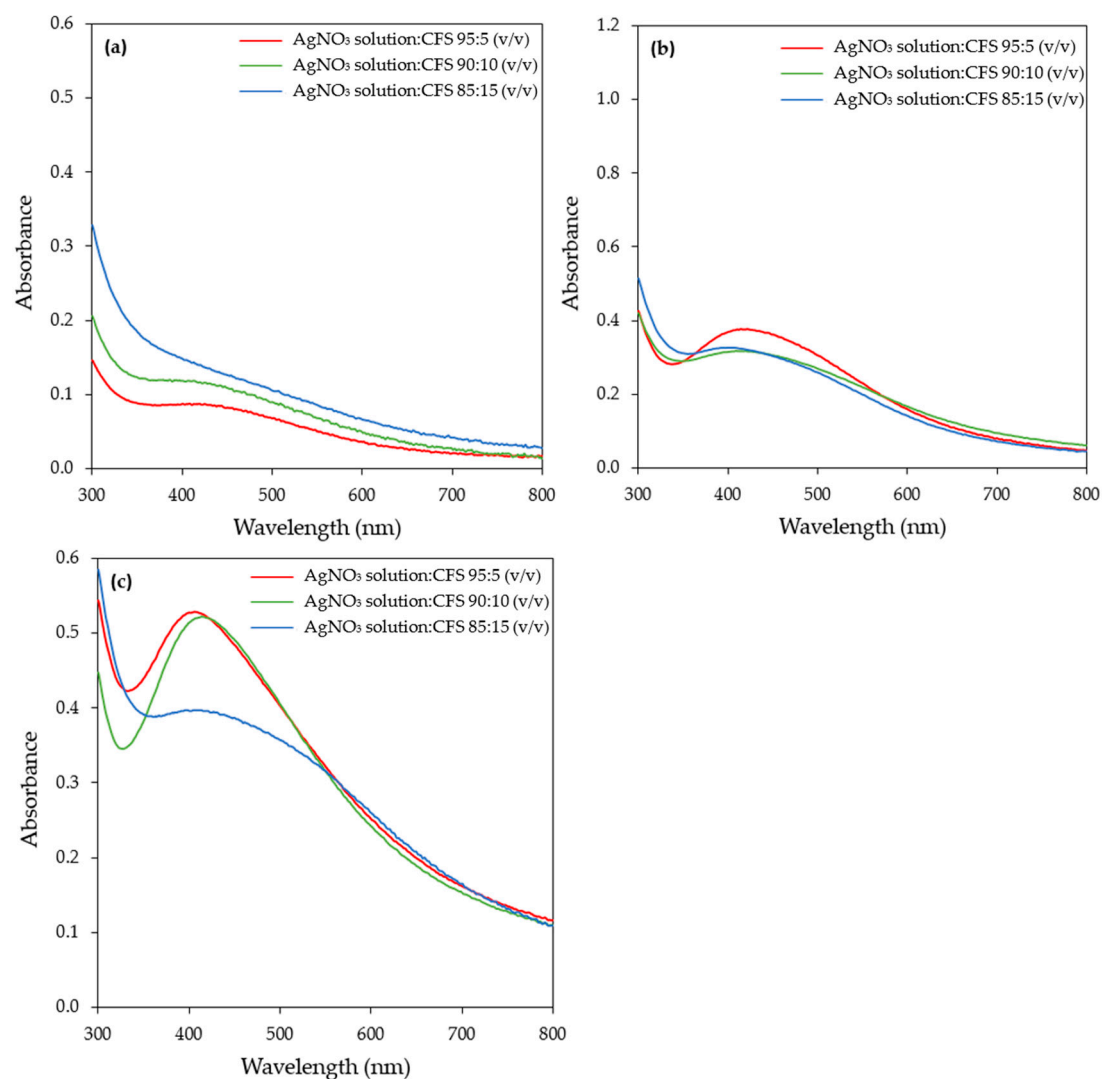


Supplementary Figure S3. UV–visible absorption spectra of AgNPs biosynthesized by the CFS of *H. pluvialis* culture at various AgNO_3 concentrations (1-5 mM) and for reaction time of (a) 1 h, (b) 3 h, (c) 6 h, and (d) 24 h. (Conditions: illumination, $T=45^\circ\text{C}$, $\text{pH}=11.0$, AgNO_3 aqueous solution to CFS ratio: 90:10 (v/v), stirring: 180 rpm for 15 min followed by stirring at 80 rpm)

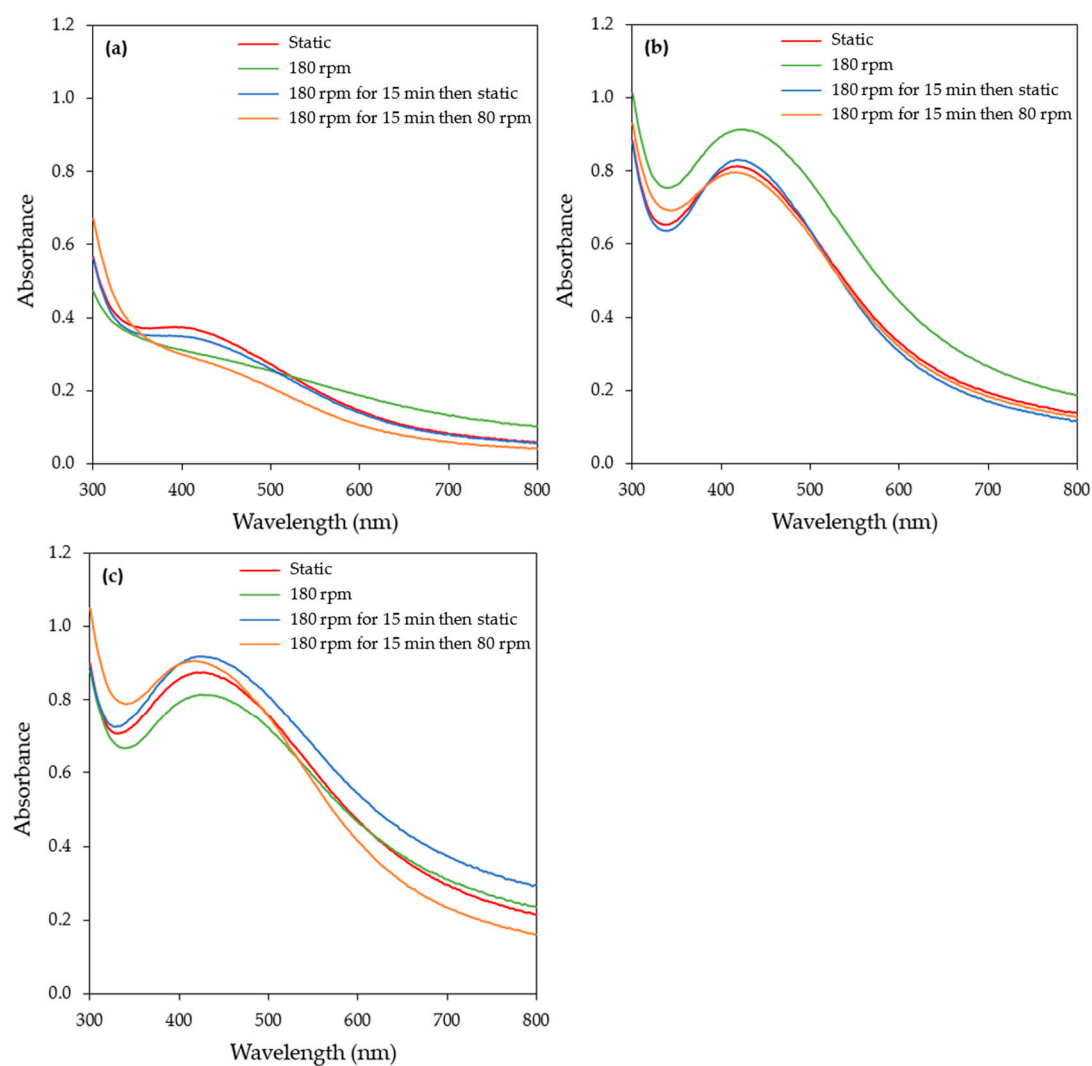


Supplementary Figure S4. Linear relationship between AgNO₃ concentration and absorbance at λ_{max} (420 nm). Symbols:

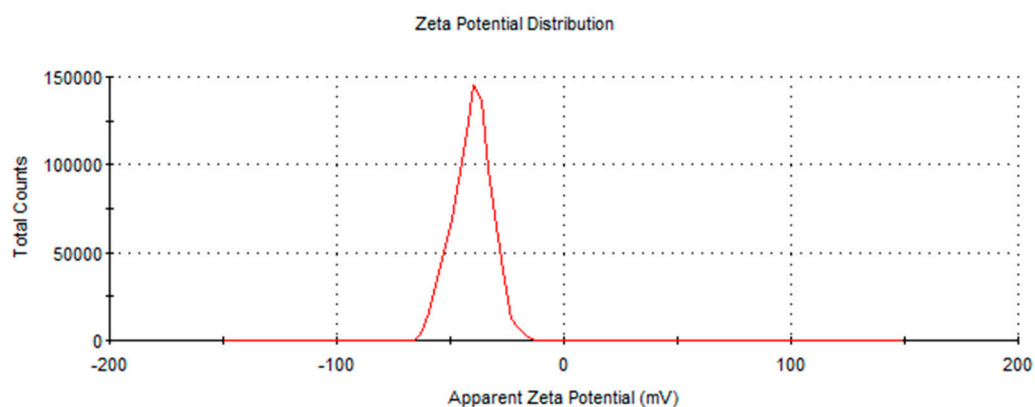
- (●) 1h reaction time $ABS (at \lambda_{max}) = 0,0987 * C_{AgNO_3} + 0,4065$, ($R^2=0.96$, $p=0.0042$);
- (○) 3 h reaction time $ABS (at \lambda_{max}) = 0,1162 * C_{AgNO_3} + 0,6392$, ($R^2=0.99$, $p=0.0002$);
- (▲) 6 h reaction time $ABS (at \lambda_{max}) = 0,1235 * C_{AgNO_3} + 0,7043$, ($R^2=0.97$, $p=0.0026$);
- (△) 24 h reaction time $ABS (at \lambda_{max}) = 0,0904 * C_{AgNO_3} + 0,8228$, ($R^2=0.97$, $p=0.0018$).



Supplementary Figure S5. UV–visible absorption spectra of AgNPs biosynthesized by the CFS of *H. pluvialis* culture at different AgNO_3 aqueous solution to CFS ratios and for reaction time of (a) 0.25 h, (b) 3 h, and (c) 6 h. (Conditions: illumination, $T=45^\circ\text{C}$, $\text{pH}=11.0$, AgNO_3 concentration: 1mM, stirring: 180 rpm for 15 min followed by stirring at 80 rpm).



Supplementary Figure S6. UV–visible absorption spectra of AgNPs biosynthesized by the CFS of *H. pluvialis* culture at various stirring conditions and for reaction time of (a) 0.25 h, (b) 3 h, and (c) 6 h. (Conditions: illumination, T=45°C, pH=11.0, AgNO₃ concentration: 1mM, AgNO₃ aqueous solution to CFS ratio: 90:10 (v/v)).



Supplementary Figure S7. Zeta potential of AgNPs biosynthesized by the CFS of *H. pluvialis* culture under optimal conditions.