Electronic Supplementary Material (ESI) for RSC Advances.


**Supplementary materials**

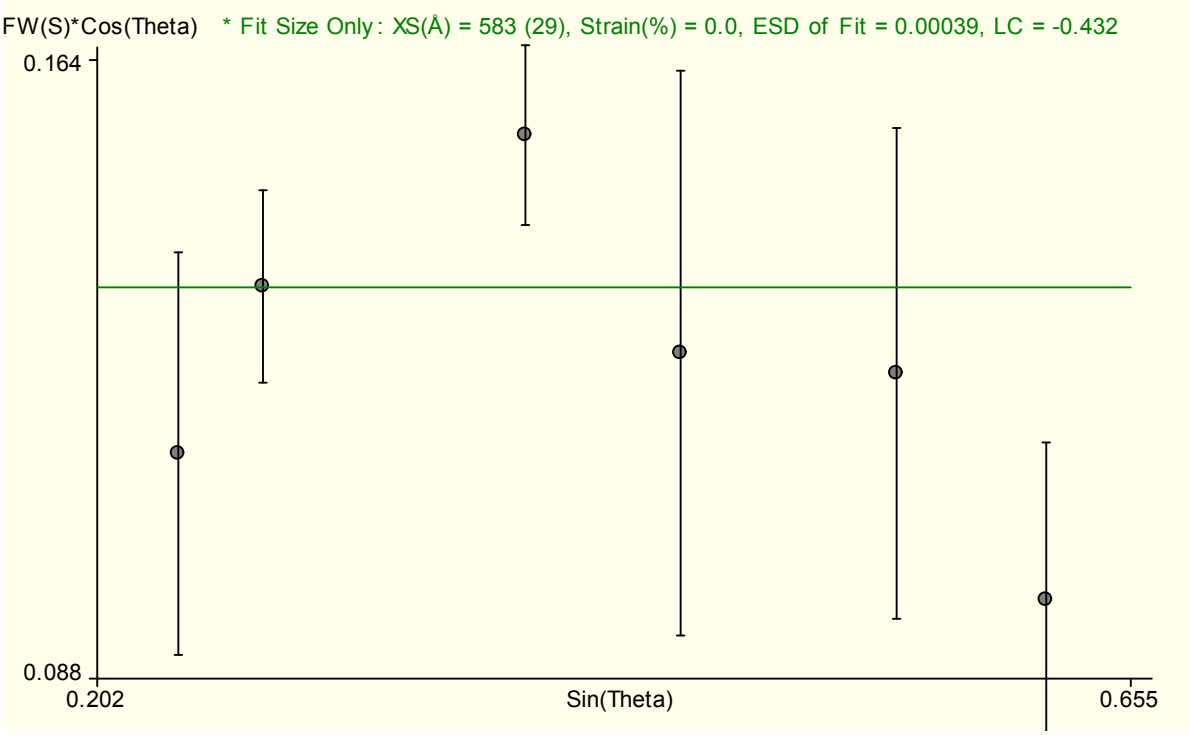


Figure S1: Williamson hull plot to estimate size of Ag·$NiMn_2O_4$ nanocomposite.

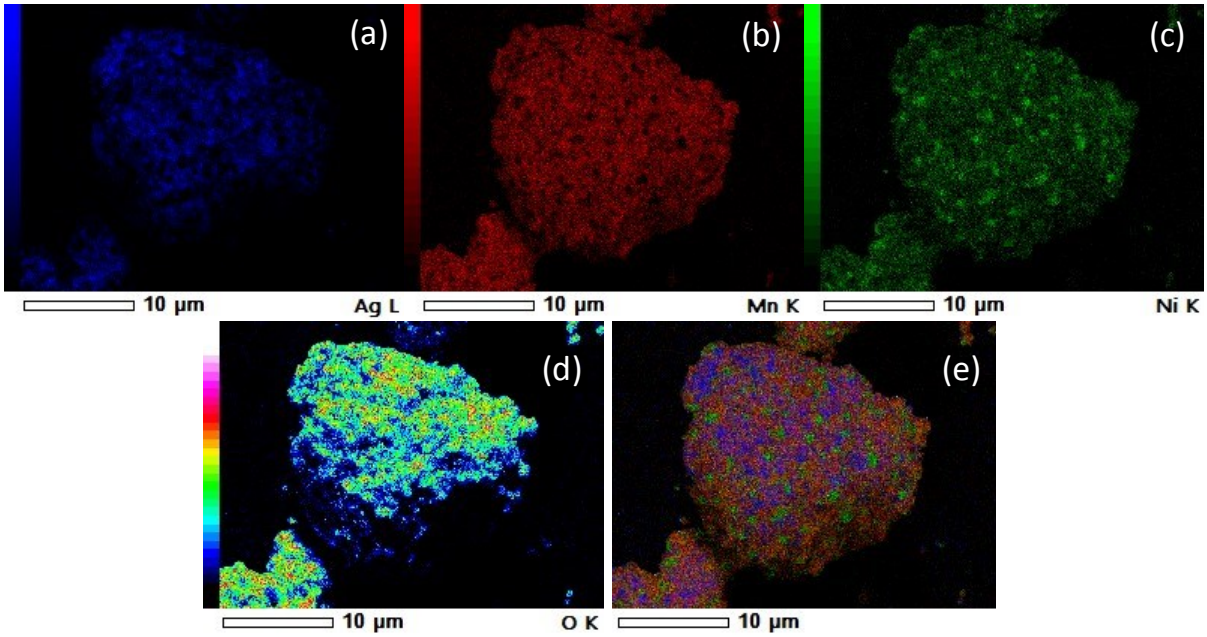


Figure S2: SEM-EDS mapping of (a) Silver, (b) Manganese, (c) Nickel, (d) Oxygen, and (e) is their Overlap

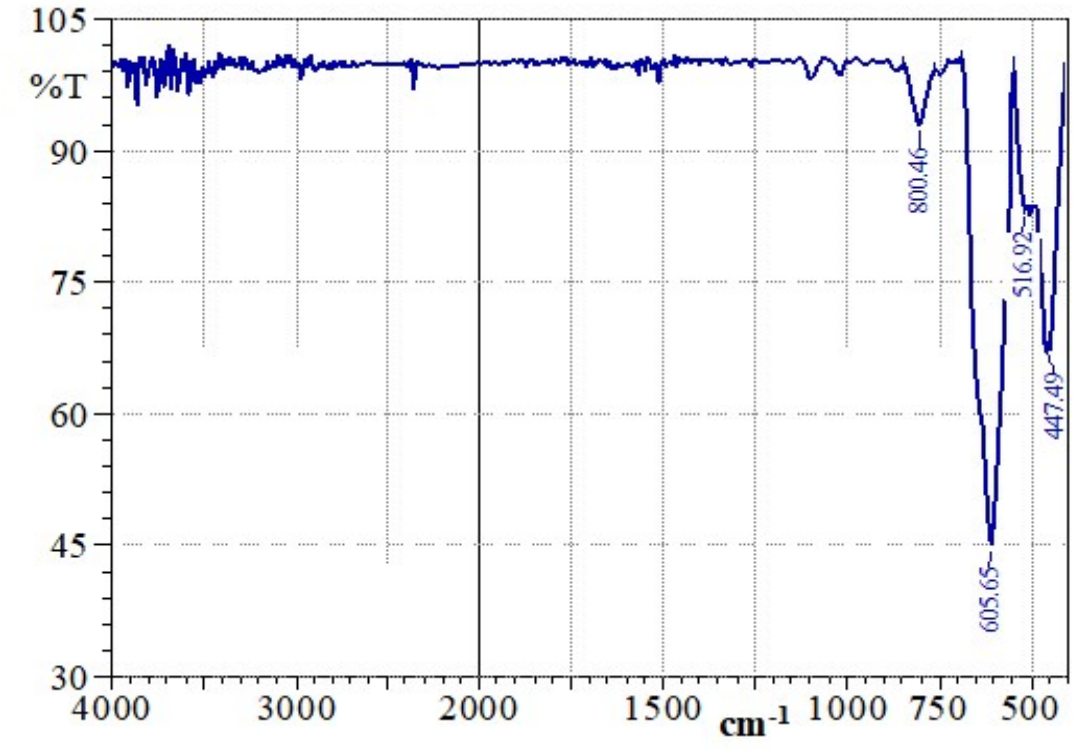


**Figure S3**: FTIR spectra of $Ag{\cdot}NiMn_2O_4$ nanocomposite calcined at 950 °C

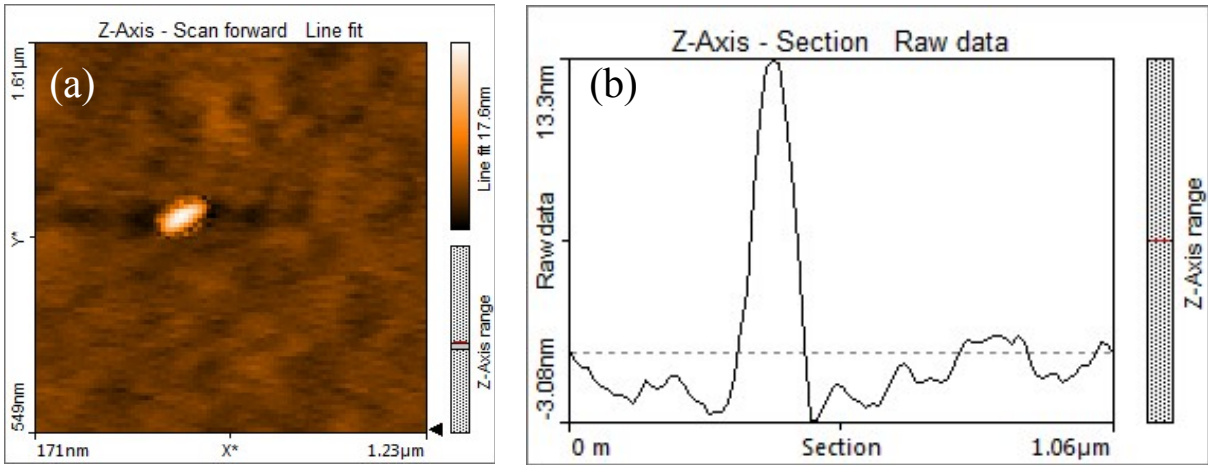


Figure S4: Atomic Force Microscopy: (a) image of $Ag{\cdot}NiMn_2O_4$ nanocomposite and (b) linear surface roughness analysis

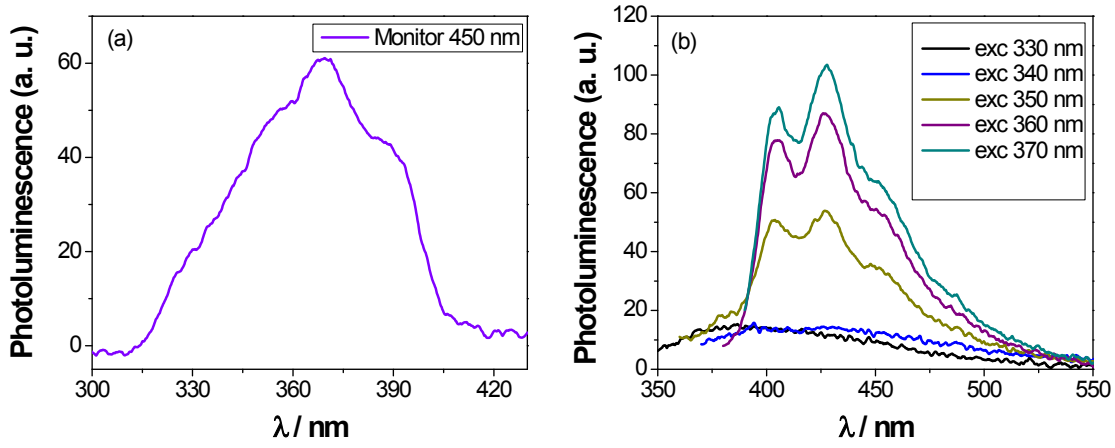


**Figure S5:** PLE (a) and PL(b) spectra of single metal oxide ($Ag_2O$) nanocomposites heated at 950 ˚C

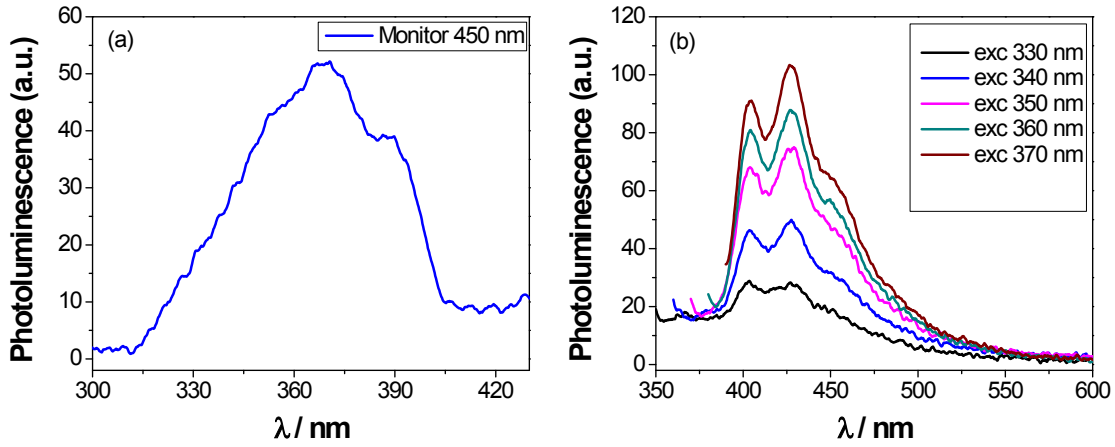


**Figure S6:** PLE (a) and PL (b) spectra of single metal oxide (NiO) nanocomposites heated at 950 ˚C

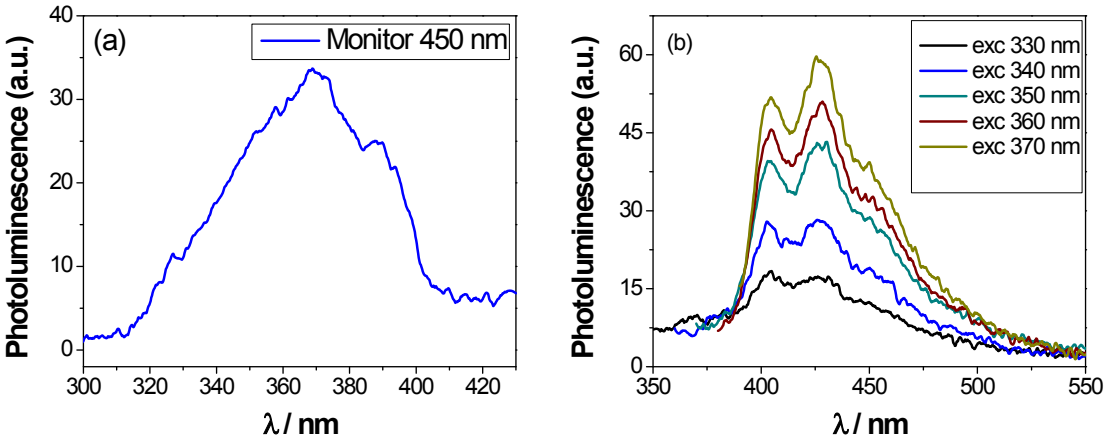


**Figure S7:** PLE (a) and PL (b) spectra of single metal oxide (MnO) nanocomposites heated at 950 ˚C

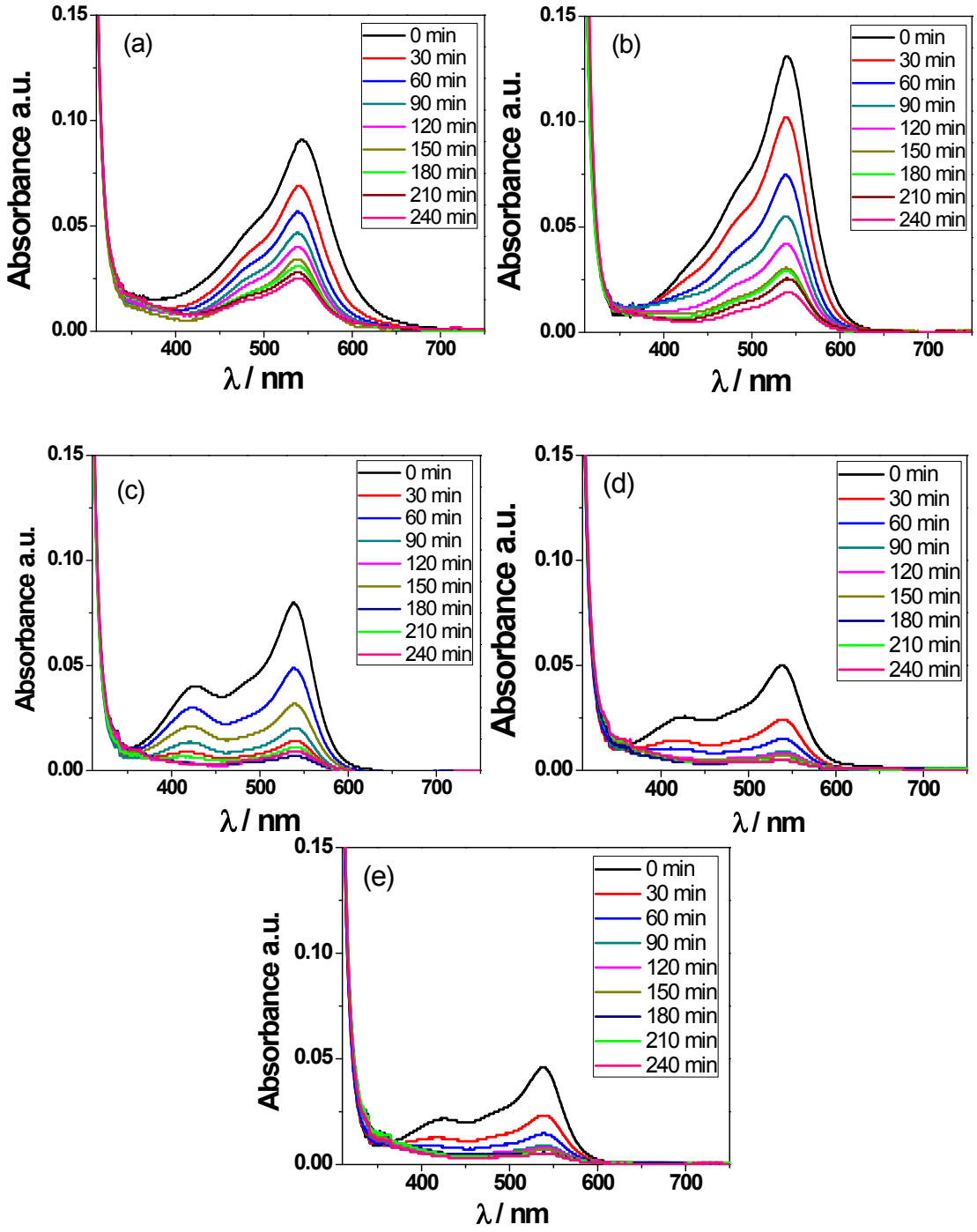


Figure S8: Effect of catalyst amount of Ag·$NiMn_2O_4$ on degradation efficiency of MV under visible light (a) 0.3 $gL^{-1}$, (b) 0.4 $gL^{-1}$, (c) 0.5 $gL^{-1}$, (d) 0.6 $gL^{-1}$, (e) 0.7 $gL^{-1}$, and (f) % of efficiency comparison (MV concentration: 5 $mgL^{-1}$; pH-4; irradiation time 4h)

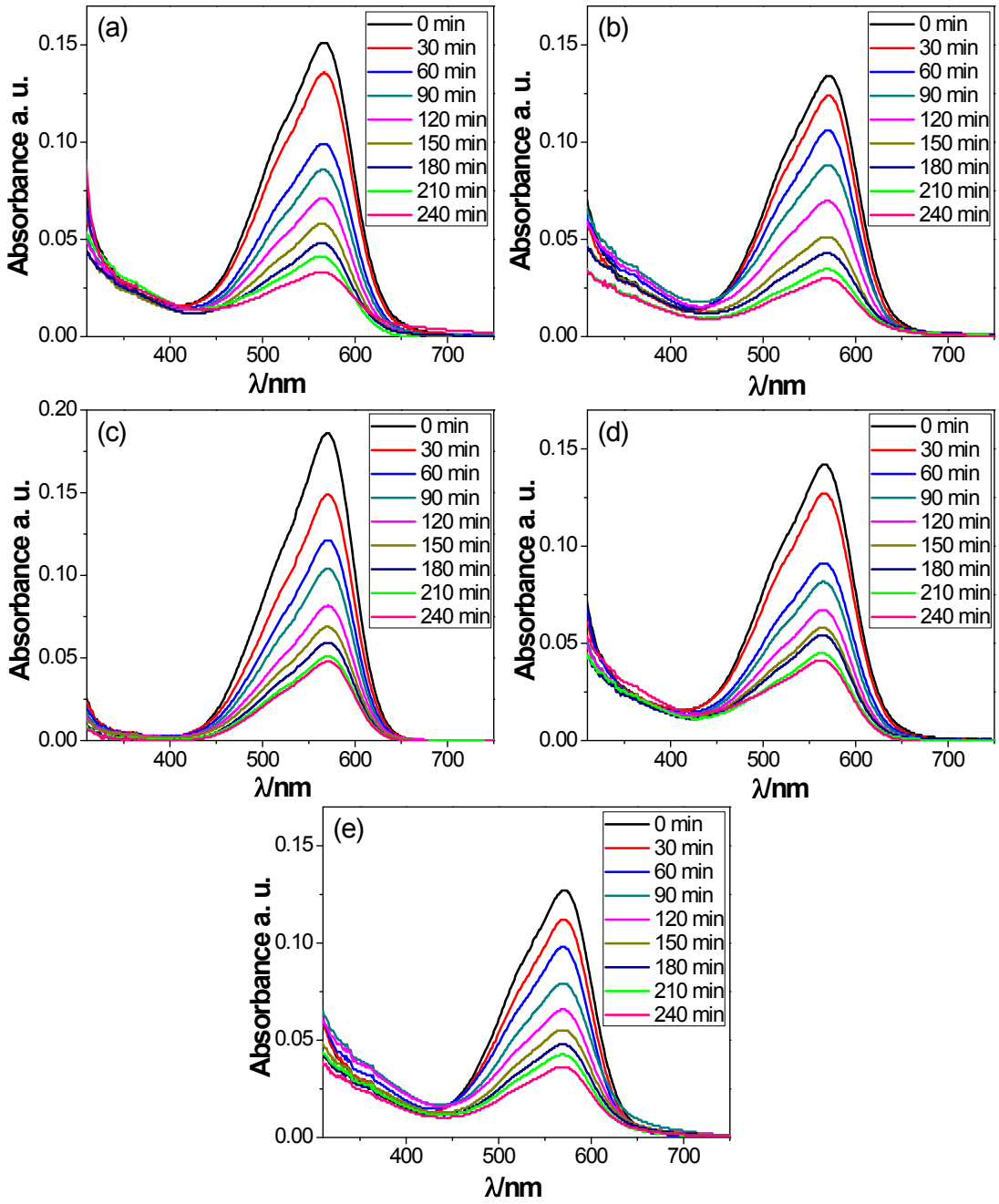


Figure S9: (a-e) Recycle and reuse of photocatalyst for MV degradation (MV concentration: 5mgL$^{-1}$), Photocatalyst dosage: 0.4 gL$^{-1}$, in the presence of catalyst Ag·$NiMn_2O_4$ at pH-9 (irradiation time 4h).

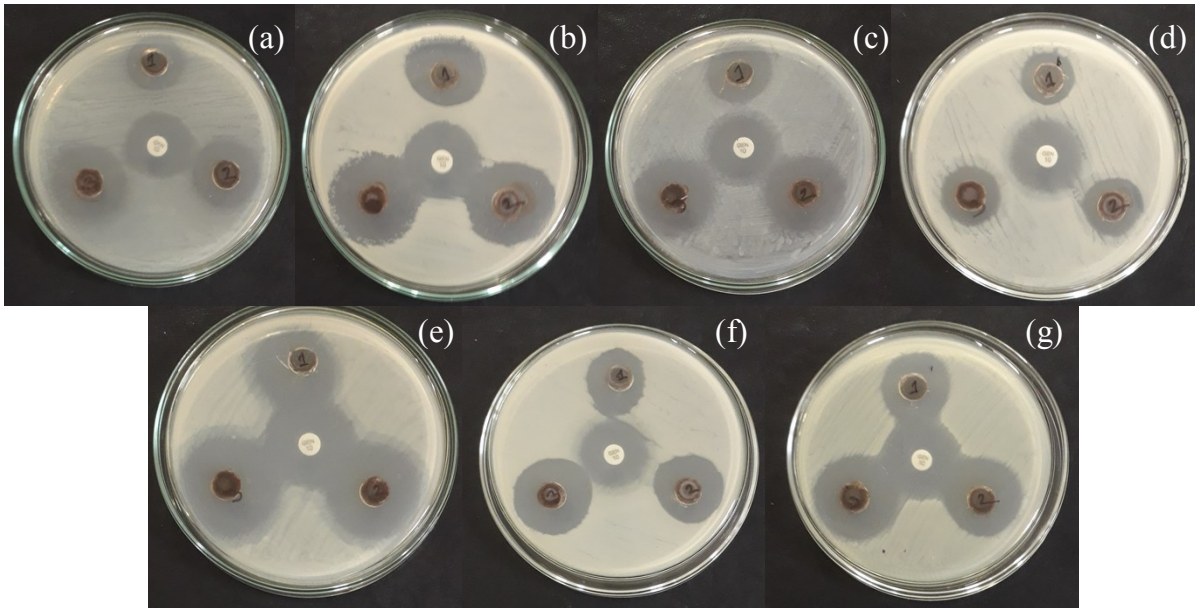


**Figure S10**: Anti-bacterial study of as synthesized nanocomposite against (a) *E. coli*, (b) *K. pneumoniae*, (c) *P. aeruginosa*, (d) *P. mirabilis*, (e) *S. mercescens,* (f*) B. subtilisabsence* and (g) *S. aureus* in absence of light. (center point is GEN 10 standard)

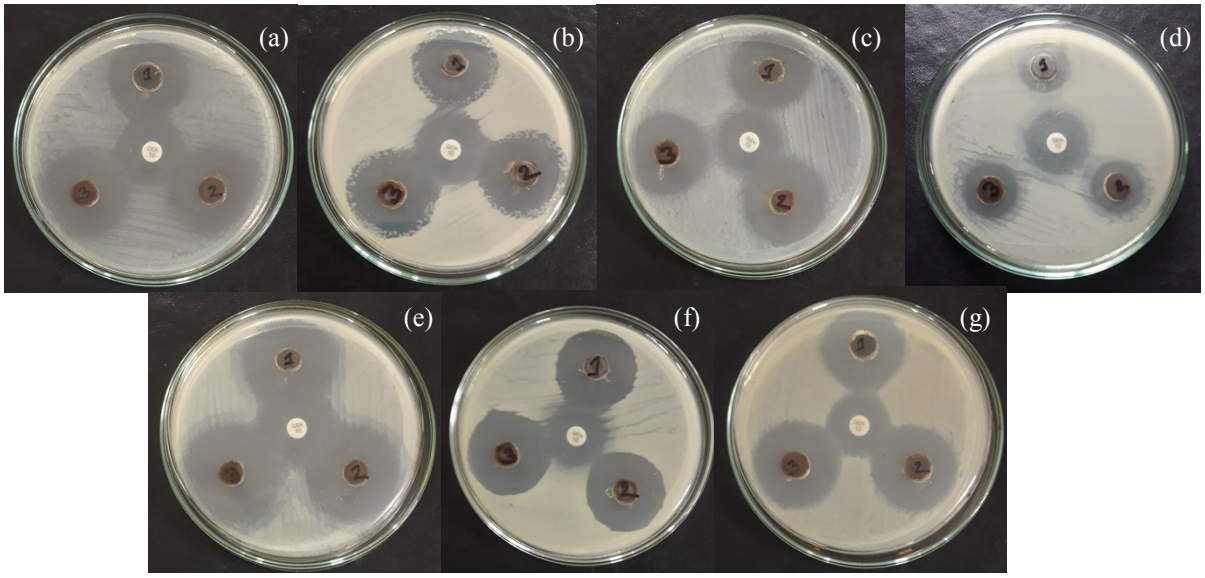


Figure S11: Anti-bacterial study of as synthesized nanocomposite against (a) *E. coli*, (b) *K. pneumoniae*, (c) *P. aeruginosa*, (d) *P. mirabilis*, (e) *S. mercescens,* (f*) B. subtilisabsence* and (g) *S. aureus* in presence of light (center point is GEN 10 standard)

Table S1: Line Roughness of synthesized composites $Ag{\cdot}NiMn_2O_4$ from AFM data

| **Parameters** | **Values (nm)** |
|---|---|
| Average roughness, $R_a$ | 2154.4 pm |
| Root Mean Square (RMS) Roughness, $R_q$ | 3.57 |
| Maximum peak to valley Distance, $R_y$ or Total roughness, $R_t$ | 17.57 |
| Maximum profile peak height, $R_p$ | 13.93 |
| Maximum profile valley Depth, $R_v$ | -3.64 |

**Table S2:** Values of rate constant (k) and $r^2$ for dye degradation kinetic

| **Observation** | **k ($min^{-1}$)** | **$r^2$** |
|---|---|---|
| pH-4 | 0.01043 | 0.97731 |
| pH-7 | 0.0032 | 0.97964 |
| pH-9 | 0.0062 | 0.99563 |

**Table S3:** MDR pathogens used in this study

| **Isolates** | **Gram positive/ Gram negative** |
|---|---|
| *E. coli* | Gram negative |
| *K. pneumoniae* | Gram negative |
| *P. aeruginosa* | Gram negative |
| *P. mirabilis* | Gram negative |
| *S. mercescens* | Gram negative |
| *B. subtilis* | Gram positive |

| | |
|---|---|
| *S. aureus* | Gram positive |

**Table S4:** Antibacterial Activities of Ag·$NiMn_2O_4$ nanocomposite against pathogenic bacteria in dark

| **Bacterial culture** | **Diameter of inhibition zone, Diz (mm)** | | | **Diameter of well, Dw (mm)** | **Ratio, R=Diz/Dw** | | |
|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | | **1** | **2** | **3** |
| *Escherichia coli* | 19 | 22 | 24 | 4 | 4.75 | 5.5 | 6 |
| *Klebsiella pneumoniae* | 24 | 26 | 26 | 4 | 6 | 6.5 | 6.5 |
| *Pseudomonas aeruginosa* | 20 | 24 | 28 | 4 | 5 | 6 | 7 |
| *Proteus mirabilis* | 16 | 17 | 18 | 4 | 4 | 4.25 | 4.5 |
| *Serratia marcescens* | 22 | 26 | 28 | 4 | 5.5 | 6.5 | 7 |
| *Bacillus subtilis* | 18 | 22 | 25 | 4 | 4.5 | 5.5 | 6.25 |
| *Staphylococcus aureus* | 20 | 24 | 28 | 4 | 5 | 6 | 7 |

**Table S5**: Antibacterial Activities of Ag·$NiMn_2O_4$ nanocomposite against pathogenic bacteria in the presence of visible light.

| **Bacterial culture** | **Diameter of inhibition zone, Diz (mm)** | | | | **Diameter of well, Dw (mm)** | **Ratio, R=Diz/Dw** | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **GEN 10** | | **1** | **2** | **3** | **GEN 10** |
| *Escherichia coli* | 27 | 28 | 29 | 20 | 4 | 6.75 | 7 | 7.25 | 5 |
| *Klebsiella pneumonia* | 27 | 28 | 30 | 22 | 4 | 6.75 | 7 | 7.5 | 5.5 |
| *Pseudomonas aeruginose* | 24 | 27 | 28 | 22 | 4 | 6 | 6.75 | 7 | 5.5 |
| *Proteus mirabilis* | 18 | 19 | 19 | 20 | 4 | 4.5 | 4.75 | 4.75 | 5 |
| *Serratia marcescens* | 29 | 30 | 32 | 25 | 4 | 7.25 | 7.5 | 8 | 6.25 |
| *Bacillus subtilis* | 26 | 27 | 28 | 20 | 4 | 6.5 | 6.75 | 7 | 5 |
| *Staphylococcus aureus* | 26 | 27 | 30 | 20 | 4 | 6.5 | 6.75 | 7.5 | 5 |