Electronic Supplementary Material (ESI) for RSC Advances.


# Supporting Information of

**$Mg^{2+}$ ion as a tuner for colorimetric sensing of glyphosate with improved sensitivity *via* the aggregation of 2-mercapto-5-nitrobenzimidazole capped silver nanoparticles**

**Karuna A. Rawat[a], Rutuben P. Majithiya[a], Jigneshkumar V. Rohit[a], Hirakendu Basu[b], Rakesh Kumar Singhal[b], and Suresh Kumar Kailasa[a*]**

[a]*Department of Applied Chemistry, S. V. National Institute of Technology, Surat-395 007, India*
[b]*Analytical Chemistry Division, Bhabha Atomic Research Center, Trombay, Mumbai 400085, India*
[*]*Corresponding author, Phone: +91-261-2201730; Fax: +91-261-2227334*
*E-mail: sureshkumarchem@gmail.com; skk@ashd.svnit.ac.in*

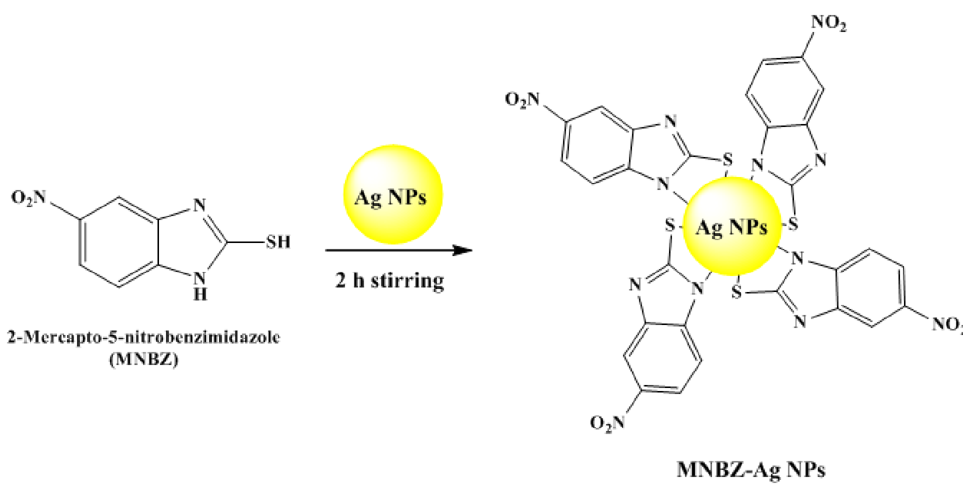


**Figure S1.** Schematic representation for preparation of MNBZ-Ag NPs.

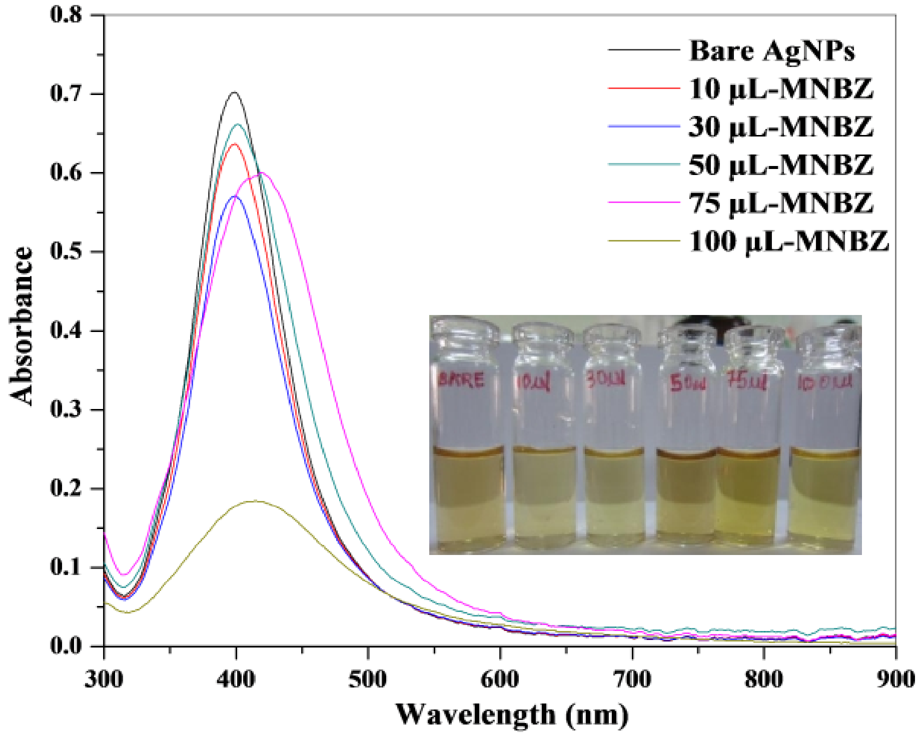


**Figure S2**. UV-visible absorption spectra of Ag NPs at different volumes of MNBZ (10 – 100 µL).

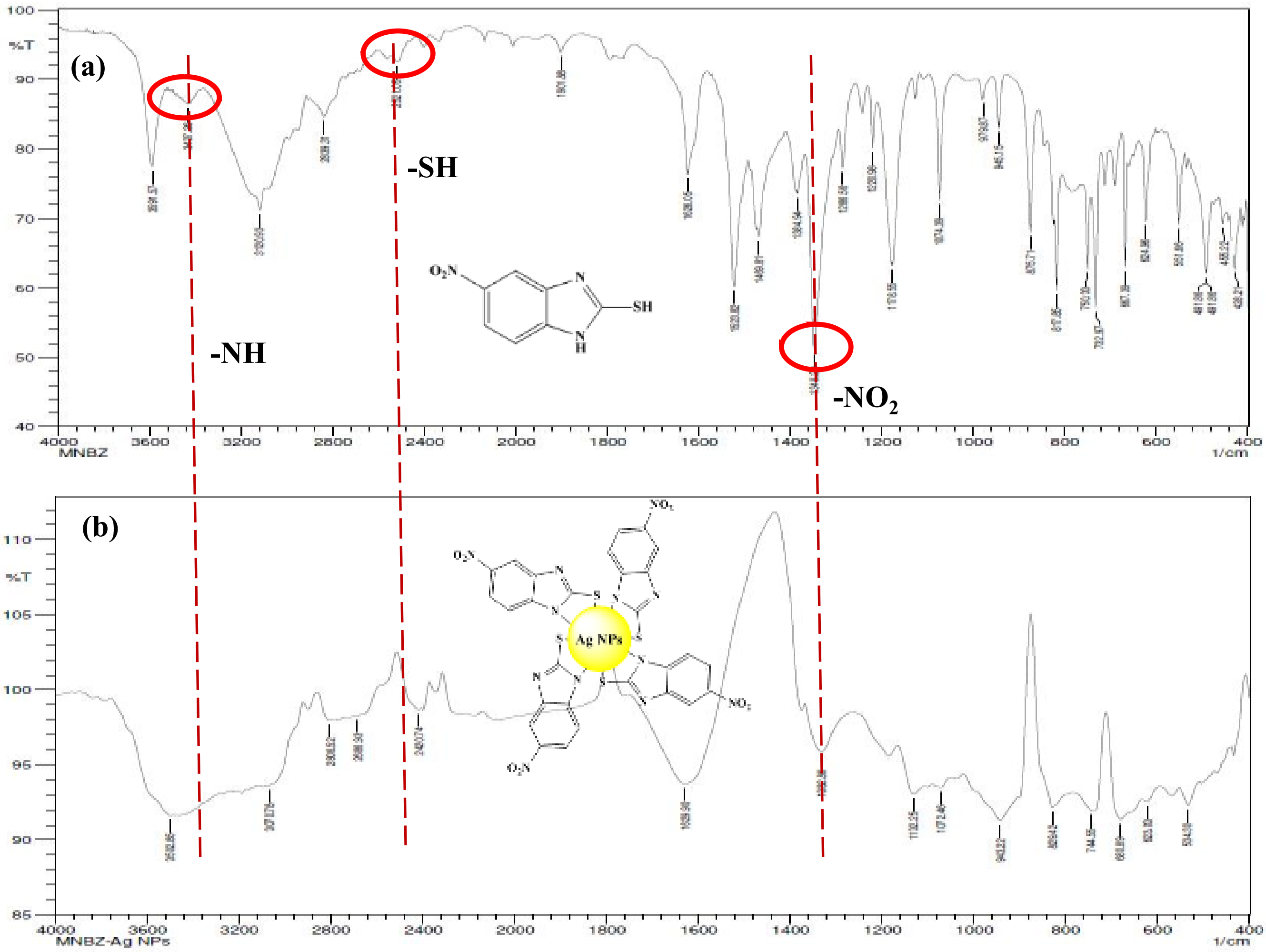


**Figure S3.** FT-IR spectra of (a) pure MNBZ and (b) MNBZ–Ag NPs.

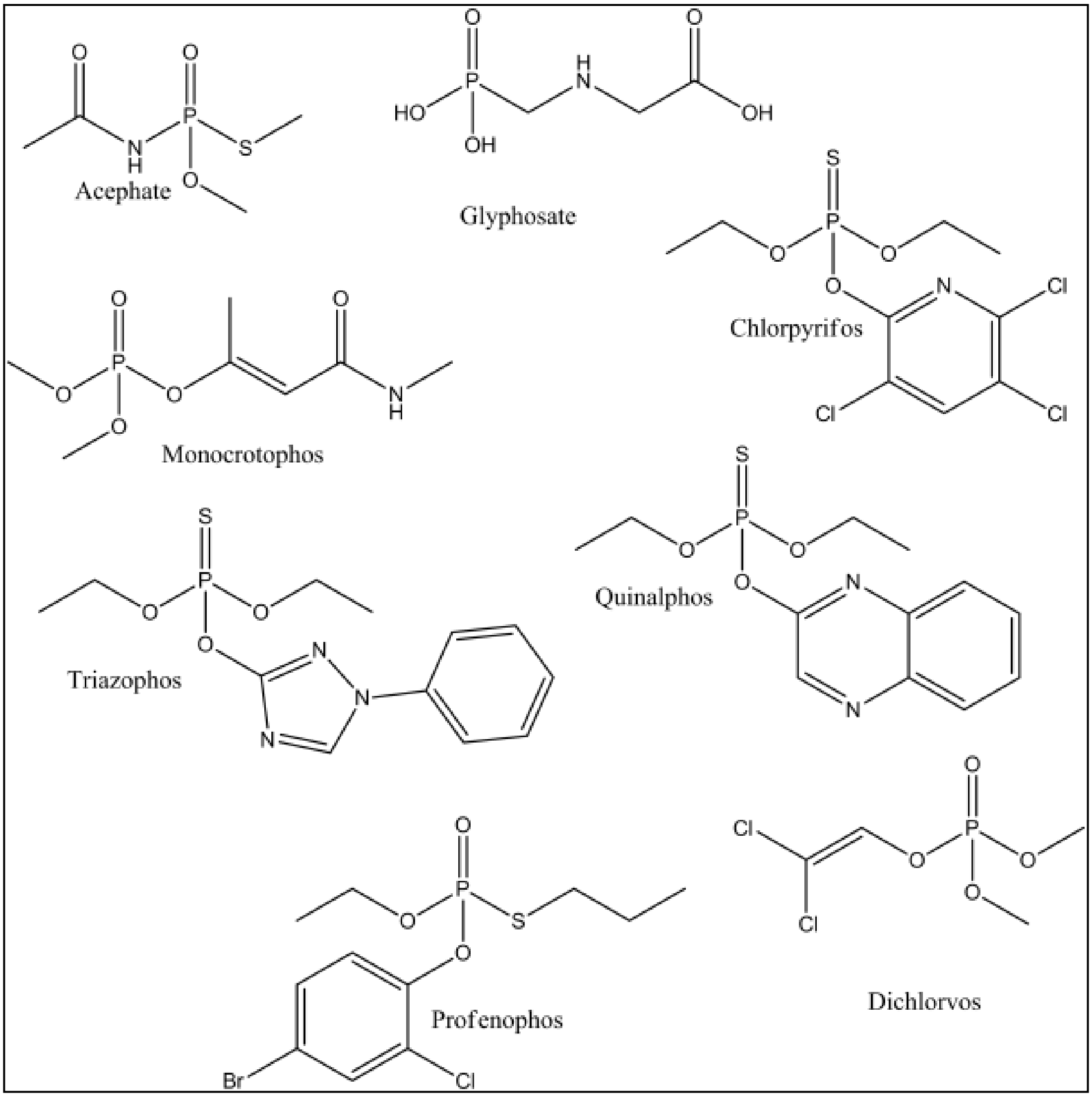


**Figure S4.** Structures of organophosphorus pesticides which are used for selectivity study using MNBZ-Ag NPs as colorimetric probe.

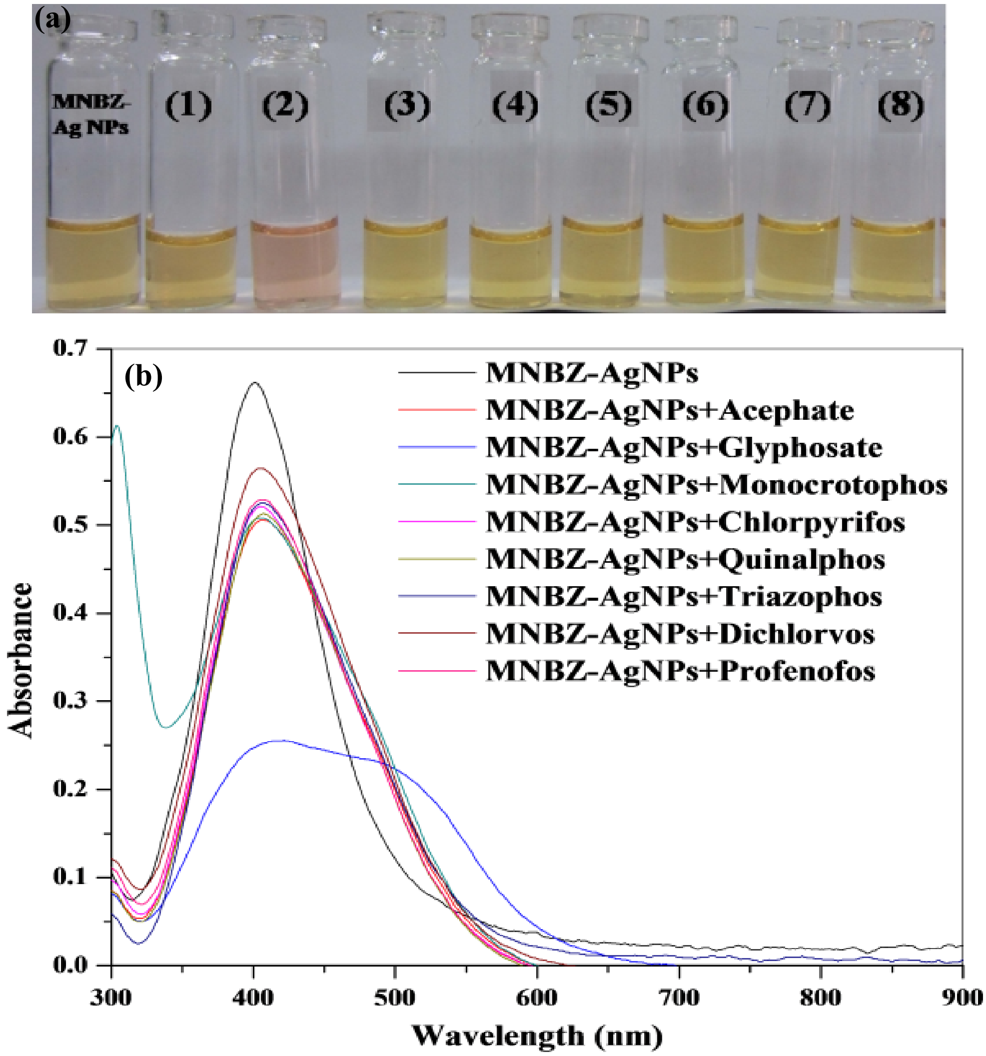


**Figure S5.** (a) Photographic image and (b) UV-visible spectra of MNBZ-Ag NPs in presence of organophosphorus pesticides (1: acephate, 2: glyphosate, 3: monocrotophos, 4: chlorpyriphos, 5: quinalphos, 6: triazophos, 7: dichlorvos, 8: profenophos)

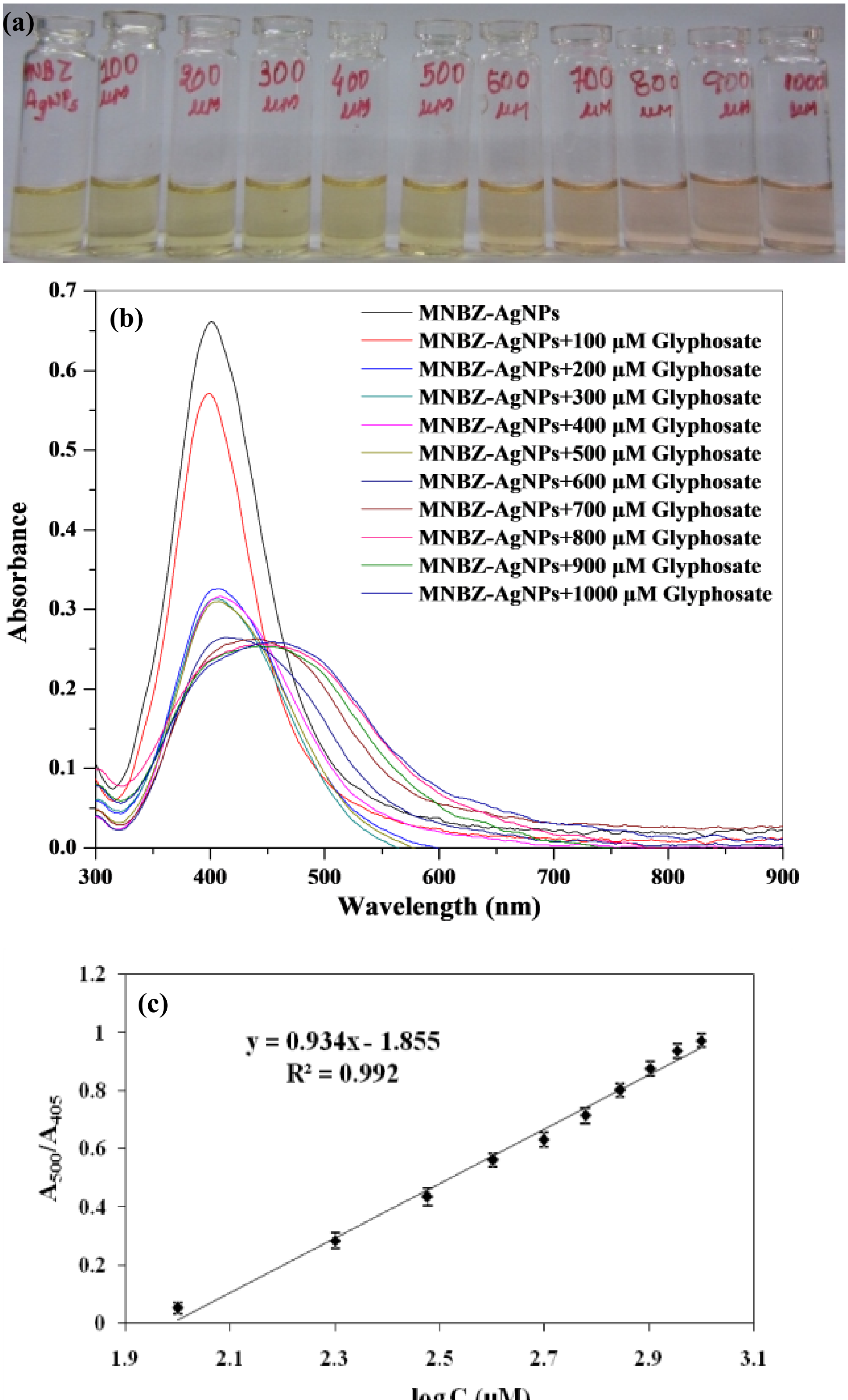


**Figure S6.** (a) Photographic image of MNBZ-Ag NPs solution upon the addition of glyphosate in the range of 100 – 1000 µM without $Mg^{2+}$ ion. (b) UV-visible absorption spectra of MNBZ-Ag NPs solution upon the addition of glyphosate in the range of 100 – 1000 µM without $Mg^{2+}$ ion. (c) A calibration plot of the SPR band shift relative to MNBZ-Ag NPs-$Mg^{2+}$ ion ($A_{500}/A_{405}$) *versus* the logarithm of concentration of glyphosate in the range of 100 – 1000 µM at PBS pH 4.

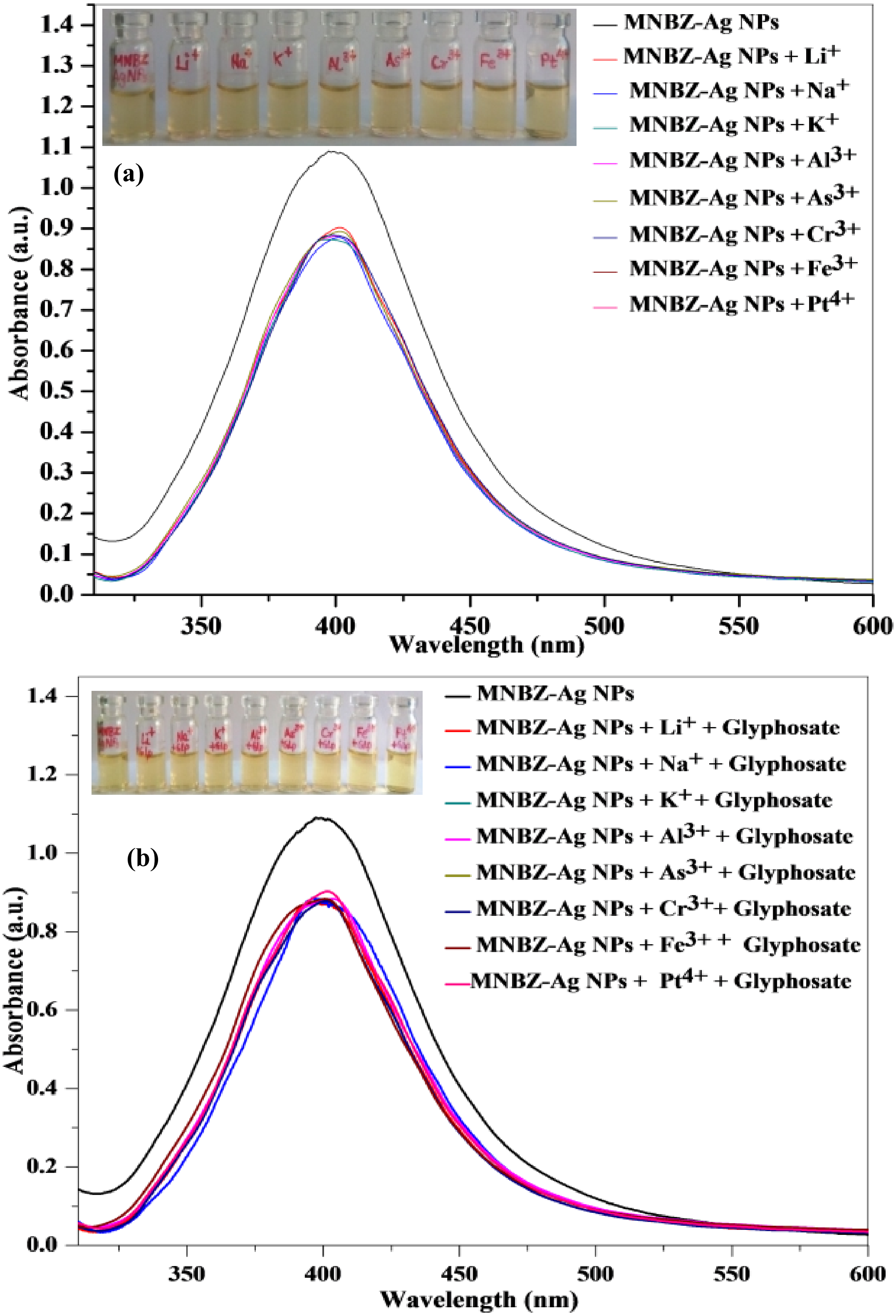


**Figure S7.** (a) UV-visible absorption spectra of MNBZ-Ag NPs in the presence of various metal ions (monovalent metal ions - $Li^{+}$, $Na^{+}$, $K^{+}$, trivalent metal ions - $Al^{3+}$, $As^{3+}$, $Cr^{3+}$, $Fe^{3+}$ and tetravalent metal ion - $Pt^{+4}$, 50 µM) without addition of glyphosate. (b) UV-visible absorption spectra of MNBZ-Ag NPs in the presence of glyphosate (10 µM) using various metal ions (monovalent metal ions - $Li^{+}$, $Na^{+}$, $K^{+}$, trivalent metal ions - $Al^{3+}$, $As^{3+}$, $Cr^{3+}$, $Fe^{3+}$ and tetravalent metal ion - $Pt^{+4}$, 50 µM) as tuners. Inset is the photographic images illustrating the corresponding colorimetric response.

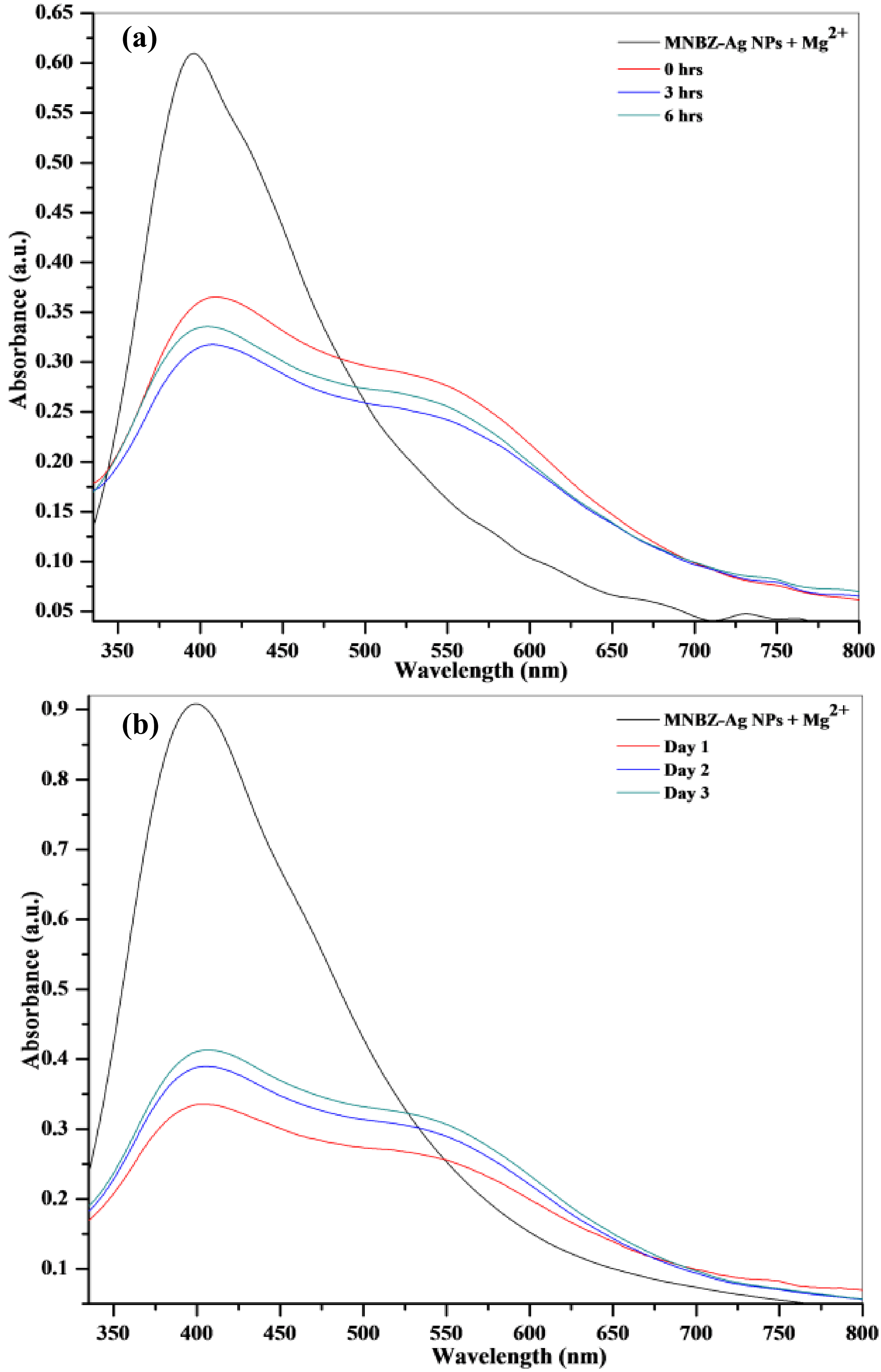


**Figure S8**. UV-visible absorption spectra of MNBZ-Ag NPs in the presence of glyphosate (1000 nM) using $Mg^{2+}$ ion as a tuner at (a) inter (for corn) and (b) intra -day (for potato).

**Table S1**. Extraction efficiency of glyphosate and its recovery ranges from potato and corn using water, MeOH and EtOH as extracting solvents at inter- and intra- day using MNBZ-Ag NPs as a probe and $Mg^{2+}$ ion as a tuner.

| Analyte | Solvent | Added (nM) | Intra-day | | | | Inter-day | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Found (nM)[a] | Recovery [b] | Precision[c] | Accuracy [d] | Found (nM)[a] | Recovery [b] | Precision [c] | Accuracy[d] |
| Potato | Water | 500 | 503±0.41 | 100.6 | 0.8 | +0.6 | 501±0.01 | 100.3 | 1.8 | + 0.3 |
| | | 750 | 739±0.49 | 98.6 | 1.5 | -1.4 | 753±0.01 | 99.7 | 1.3 | +0.4 |
| | | 1000 | 999±0.01 | 99.9 | 1.3 | -0.11 | 985±0.91 | 98.5 | 1.8 | -0.4 |
| Corn | Water | 500 | 518±0.44 | 103.7 | 1.3 | +3.6 | 500±0.10 | 99.9 | 1.9 | +1.1 |
| | | 750 | 749±0.99 | 99.9 | 1.9 | -0.1 | 745±0.11 | 99.4 | 2.2 | -0.6 |
| | | 1000 | 981±0.11 | 98.1 | 1.3 | -1.9 | 1001±0.67 | 100.1 | 0.8 | +0.1 |
| Potato | MeOH | 500 | 498±0.61 | 99.6 | 1.2 | +0.2 | 501±0.83 | 100.2 | 1.7 | + 0.3 |
| | | 750 | 750±0.42 | 100.0 | 1.2 | +0.4 | 742±0.21 | 98.9 | 1.8 | +0.3 |
| | | 1000 | 1004±0.55 | 100.4 | 0.8 | +0.9 | 998±0.61 | 99.8 | 1.8 | -0.4 |
| Corn | MeOH | 500 | 499±0.73 | 99.8 | 1.0 | -0.1 | 508±0.24 | 101.6 | 0.5 | +1.1 |
| | | 750 | 752±0.21 | 100.2 | 0.4 | +0.3 | 749±0.05 | 99.9 | 0.1 | -0.1 |
| | | 1000 | 1008±0.90 | 100.8 | 0.9 | +0.8 | 997±0.89 | 99.7 | 1.5 | -0.3 |
| Potato | EtOH | 500 | 421±0.31 | 84.8 | 1.1 | -15.7 | 436±0.77 | 85.9 | 2.9 | -12.7 |
| | | 750 | 671±0.12 | 89.5 | 2.7 | -10.5 | 695±0.31 | 92.7 | 2.8 | -10.5 |
| | | 1000 | 895±0.11 | 89.5 | 0.8 | +10.5 | 889± 0.52 | 88.9 | 0.7 | -11.1 |
| Corn in | EtOH | 500 | 394±0.77 | 76.9 | 2.9 | -21.1 | 374±0.24 | 73.2 | 0.8 | -25.1 |
| | | 750 | 535±0.10 | 71.3 | 2.8 | -28.7 | 576±0.39 | 76.8 | 1.1 | -23.1 |
| | | 1000 | 725±0.21 | 72.5 | 1.3 | -27.6 | 774±0.86 | 77.5 | 1.3 | -22.5 |

[a]Mean±standard deviation (n = 3). [b] % Recovery = (Found concentration/known concentration)×100,
[c] Precision was calculated (RSD, %) from standard deviation/mean×100, [d]Accuracy was calculated from (found concentration−known concentration)/known concentration×100.