

## Supporting Information for

### Nano-delivery in Scrolls based Nano-carriers: Efficient Constructs for Sustainable Scavenging of Heavy Metal Ions and Inactivate Bacteria

Paresh Kumar Samantaray <sup>a,b</sup>, Sonika Baloda <sup>b</sup>, Giridhar Madras <sup>c</sup>, and Suryasarathi Bose <sup>b\*</sup>

<sup>a</sup> Centre for BioSystems Science and Engineering, Indian Institute of Science, Bangalore, Karnataka, India-560012

<sup>b</sup> Department of Materials Engineering, Indian Institute of Science, Bangalore, Karnataka, India-560012

<sup>c</sup> Department of Chemical Engineering, Indian Institute of Science, Bangalore, Karnataka, India-560012

\*Email: [sbose@iisc.ac.in](mailto:sbose@iisc.ac.in)

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I. FTIR spectra of GNS encapsulated MOF

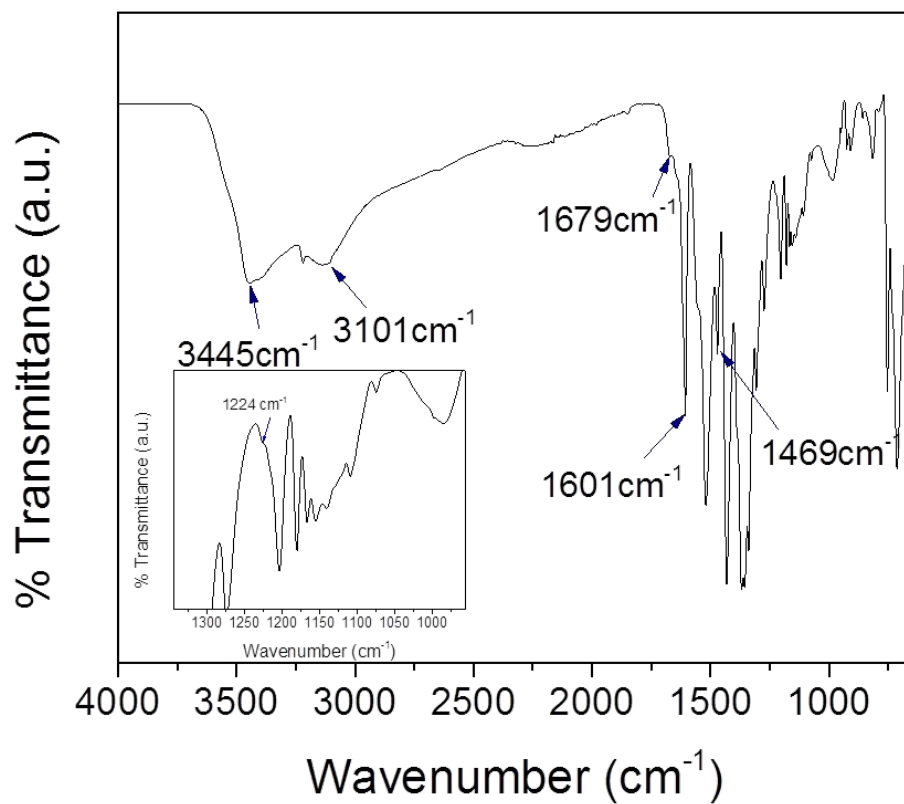


Figure S1: FTIR of the synthesized GNS encapsulated MOF. The inset shows the epoxide peak due to GO.

II. Mechanical fracture of dpGO sheets after second round of sonothermal treatment

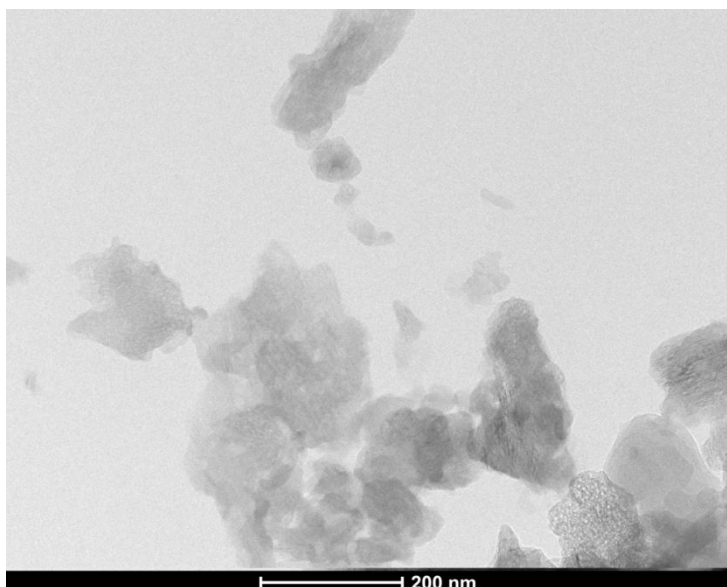


Figure S2: Cleaved dpGO sheets when subjected to second cycle of sonothermal treatment. Evidence of scrolling exist in these sheets yet due to failure of the integrity of these sheets, the scrolling is in-effective

III. Nitrogen adsorption-desorption isotherms of GNS encapsulated  $Zn_3(BTC)_2$  MOF before and after hydration

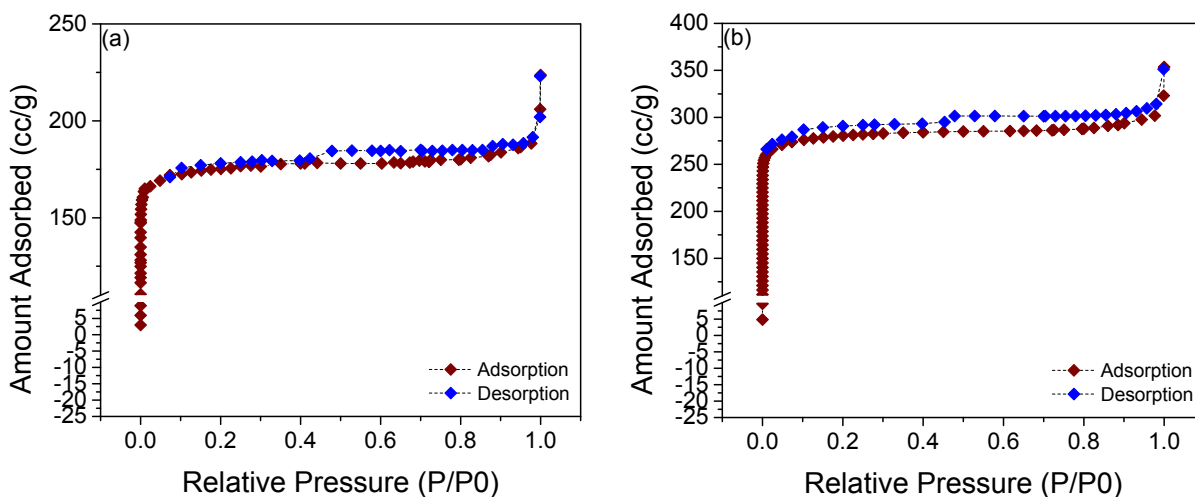


Figure S3:  $N_2$  adsorption-desorption isotherm of GNS encapsulated  $Zn_3(BTC)_2$  MOF (a) before hydration (b) after 1 h hydration

#### IV. Powder X-ray spectrum overlay of GNS encapsulated $Zn_3(BTC)_2$ MOF before and after hydration

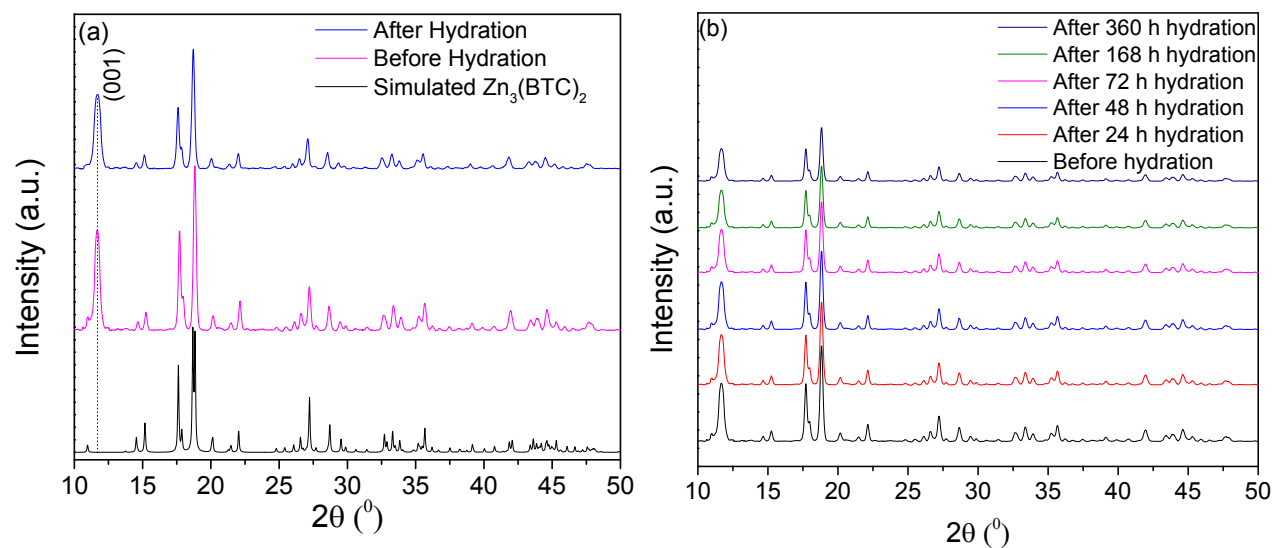


Figure S4: (a) XRD spectra of GNS encapsulated  $Zn_3(BTC)_2$  before and after 1 h hydration. (b) XRD spectra demonstrating the water stability of the MOF particles as a function of hydration.

V. Thermo-gravimetric analysis of GNS encapsulated  $Zn_3(BTC)_2$  MOF

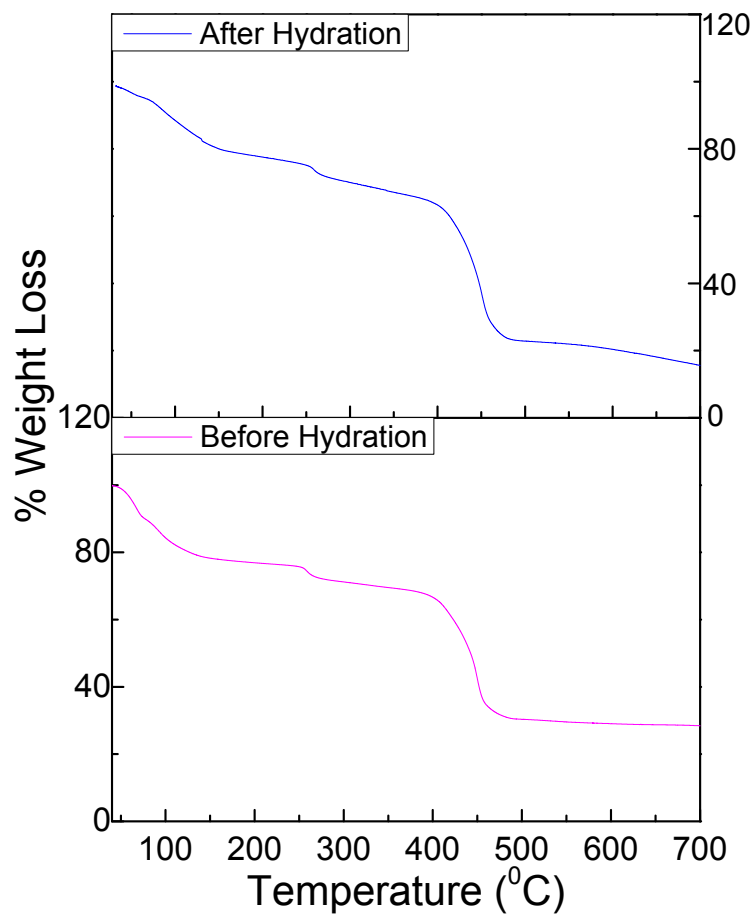
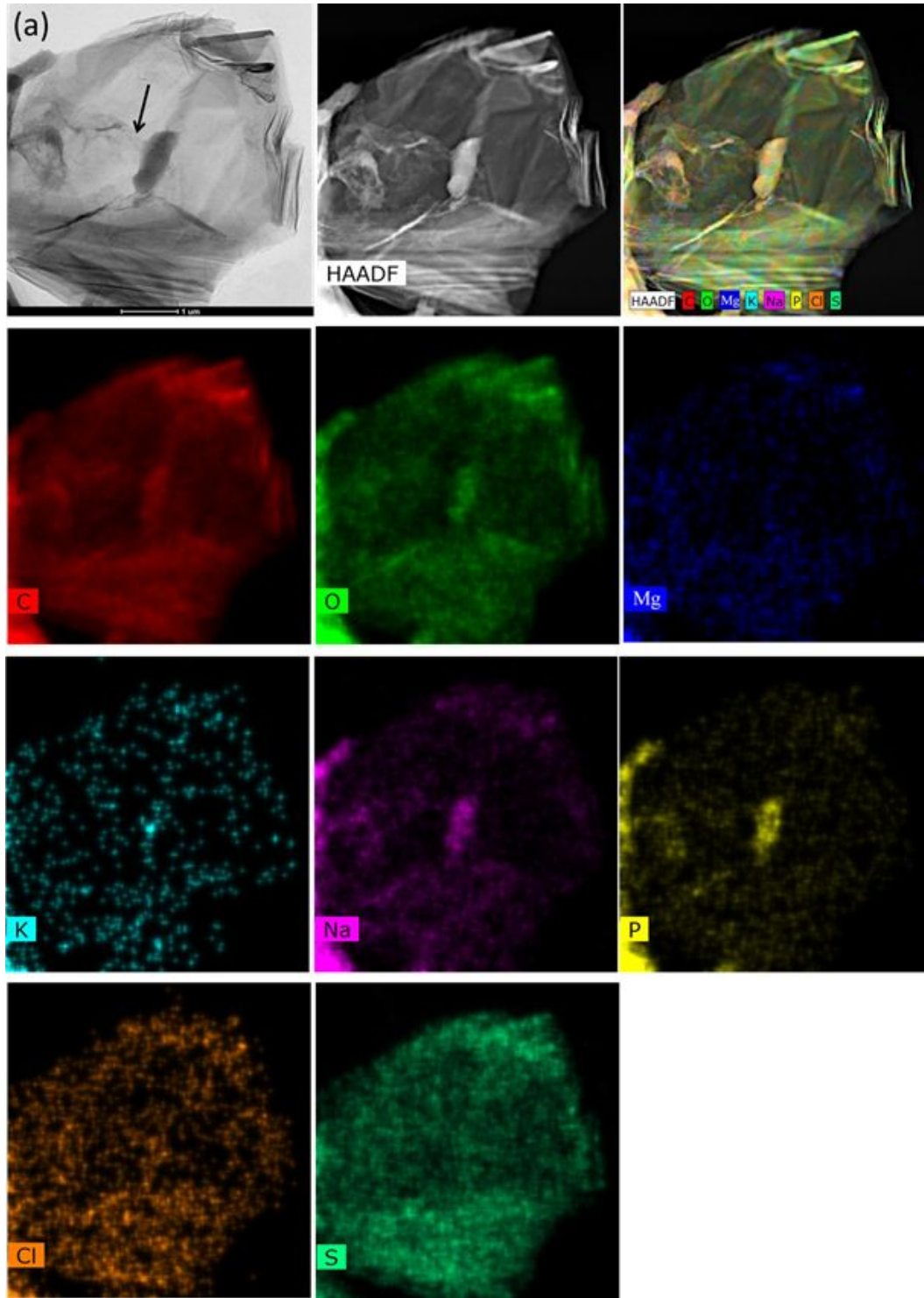


Figure S5: TGA of GNS encapsulated  $Zn_3(BTC)_2$  MOF before and after 1 h hydration.

VI. HAADF maps of *E.coli* with GNS encapsulated  $Zn_3(BTC)_2$  MOF post hydration



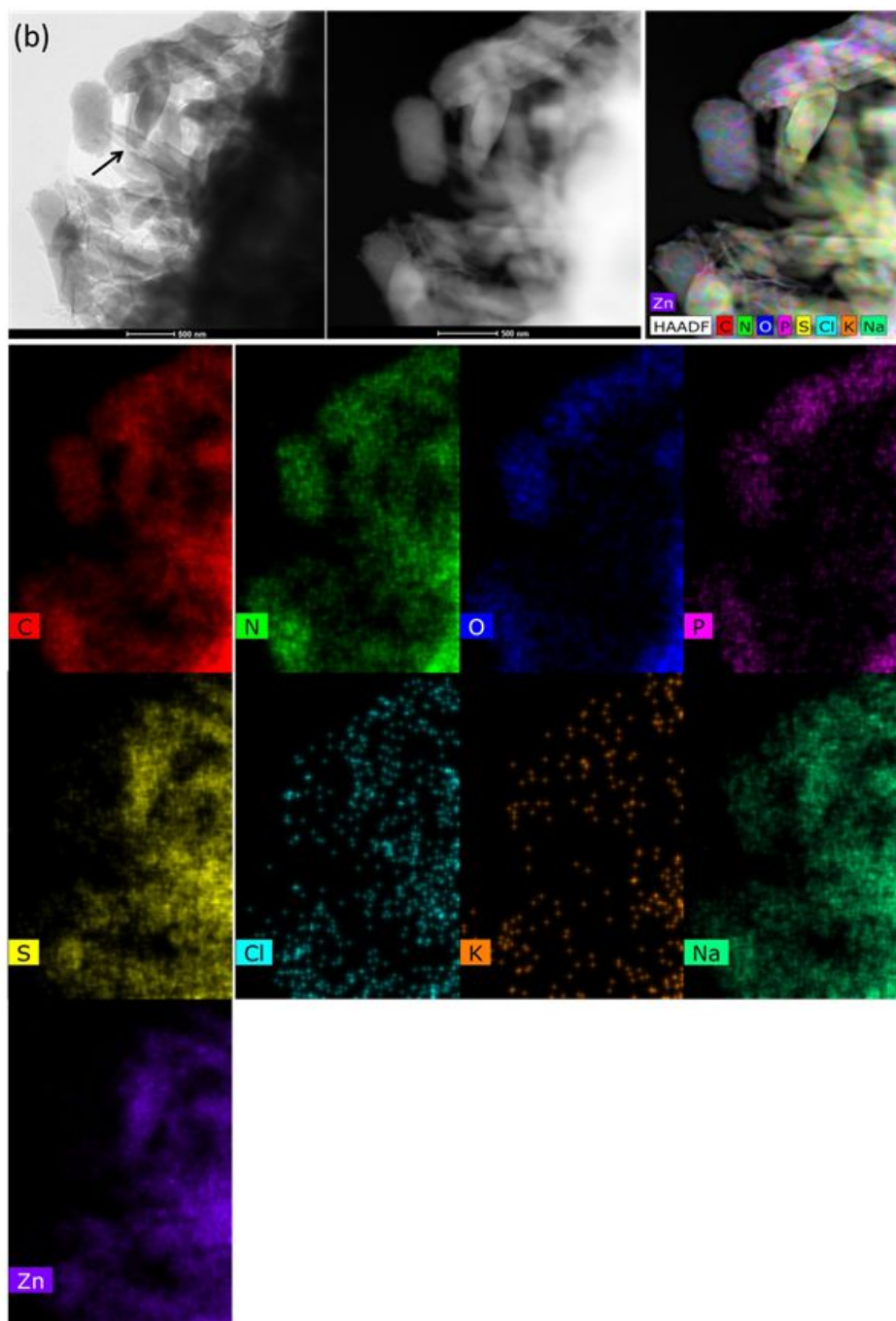


Figure S6: (a) Effect of dpGO sheets post hydration of GNS encapsulated  $Zn_3(BTC)_2$  MOFs on *E.coli* using TEM, dark-field and HAADF maps. The arrow shows intracellular leakage (b) Effect of exposed ZnMOF nanorods post hydration of GNS encapsulated  $Zn_3(BTC)_2$  MOFs on *E.coli*. The arrow shows nanorods puncturing the bacteria.



VII. HAADF maps of *S.aureus* with GNS encapsulated  $Zn_3(BTC)_2$  MOF post hydration

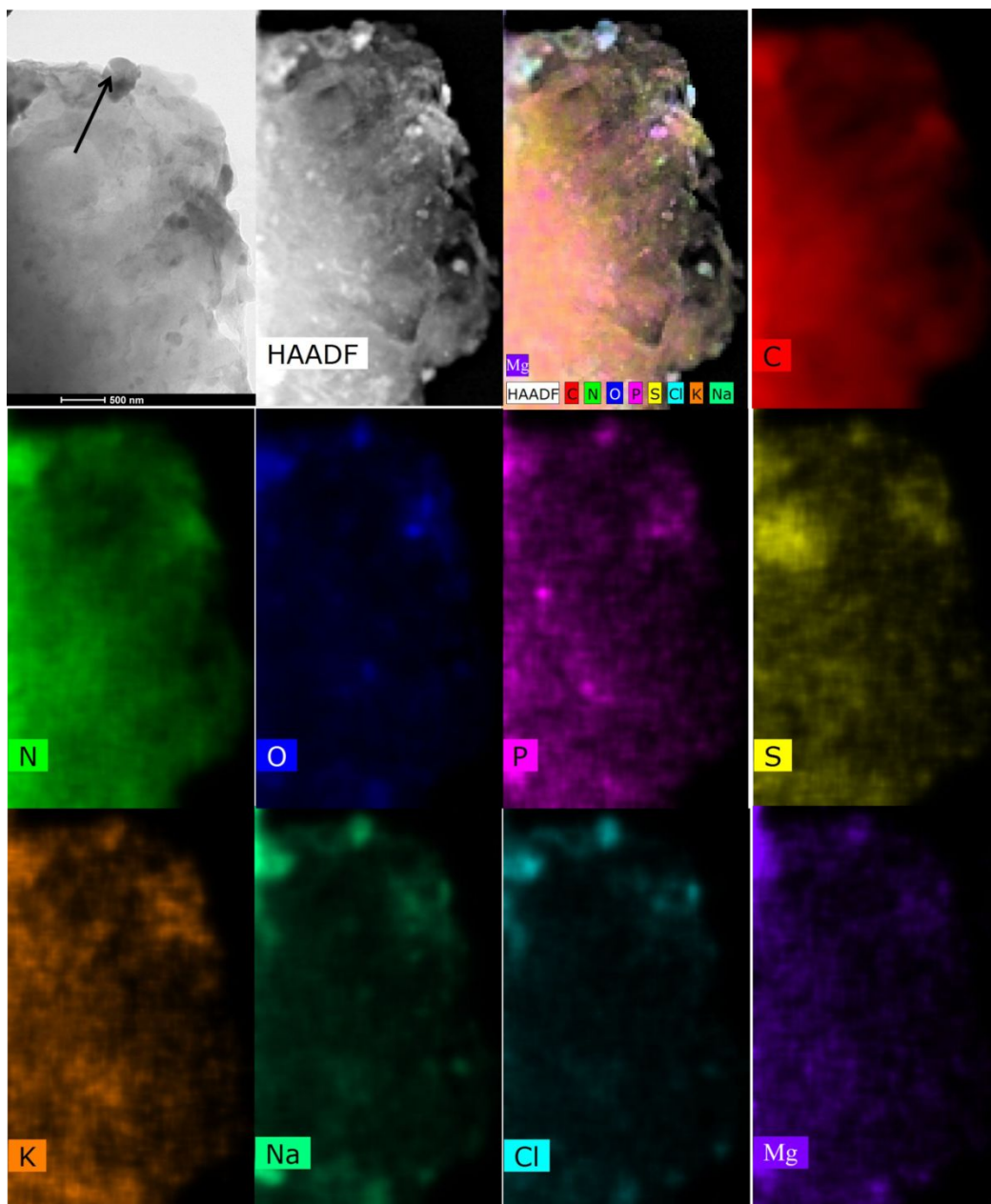


Figure S7: Effect of dpGO sheets post hydration of GNS encapsulated  $Zn_3(BTC)_2$  MOFs on *S.aureus* using TEM, dark-field and HAADF maps. The arrow shows the scissoring effect of GO sheet on bacterial cell



VIII. SEM images of GNS encapsulated  $Zn_3(BTC)_2$  MOF after exposing to *E.coli* & *S.aureus* contaminated water

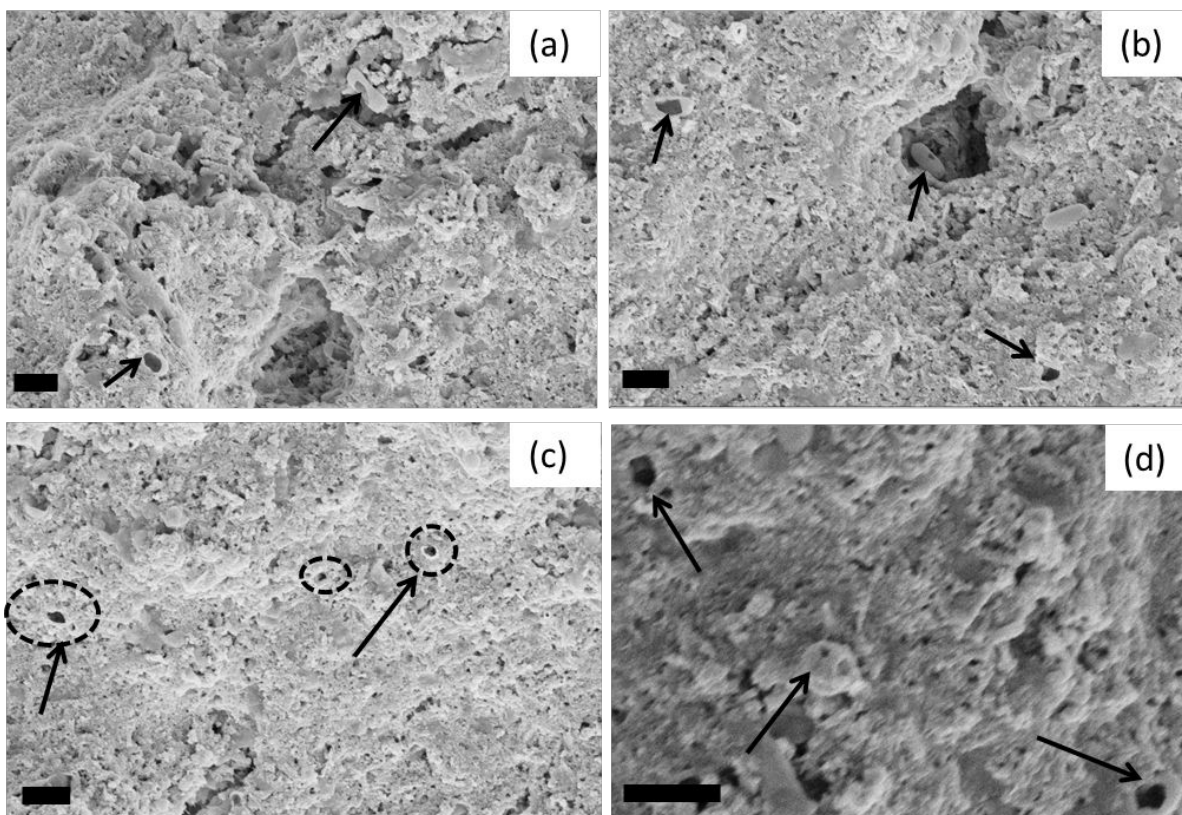


Figure S8: (a) and (b) Bactericidal response of GNS delivered  $Zn_3(BTC)_2$  MOF after being exposed to *E.coli* while (c) and (d) shows the response for *S.aureus*. The arrows illustrate the fate of bacteria after intracellular leakage; an indication of evasive response of the  $Zn_3(BTC)_2$  MOF on bacteria. Circles have been marked to distinguish the bacteria from background in case of *S.aureus*. Scale bar is 2  $\mu m$ .

## IX. Handheld filtration system with GNS encapsulated $Zn_3(BTC)_2$ MOF

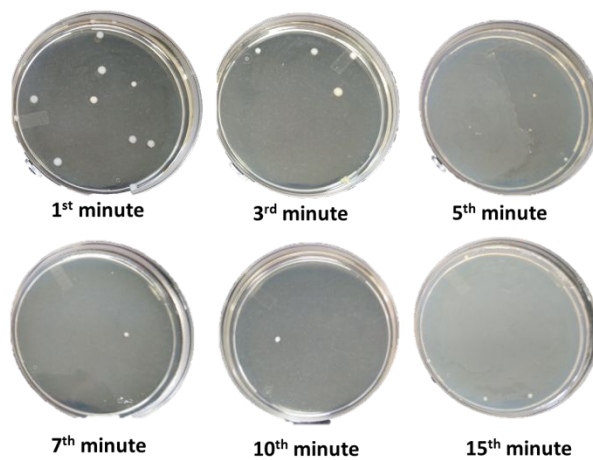
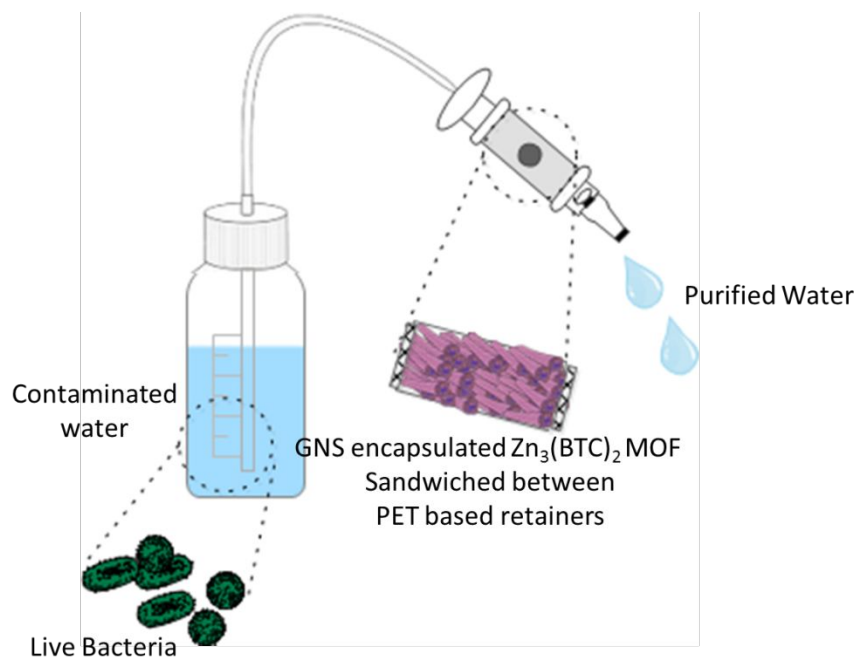


Figure S9: The top shows the schematics of handheld filtration system equipped with 1 g GNS encapsulated  $Zn_3(BTC)_2$  MOF. A feed of 1000 CFU/mL of bacteria was taken as the contaminated water where for first two minutes water was discarded to flush off unwanted contamination. After which the timer was set and the squeeze bottle was pressed for 15 minutes wherein periodically water was collected in a safety cabinet and plated. Bottom shows the time lapse plate results of the same. It can be concluded that the water output from the faucet was free from bacteria.

X. Reusability of MOF nanoparticles:

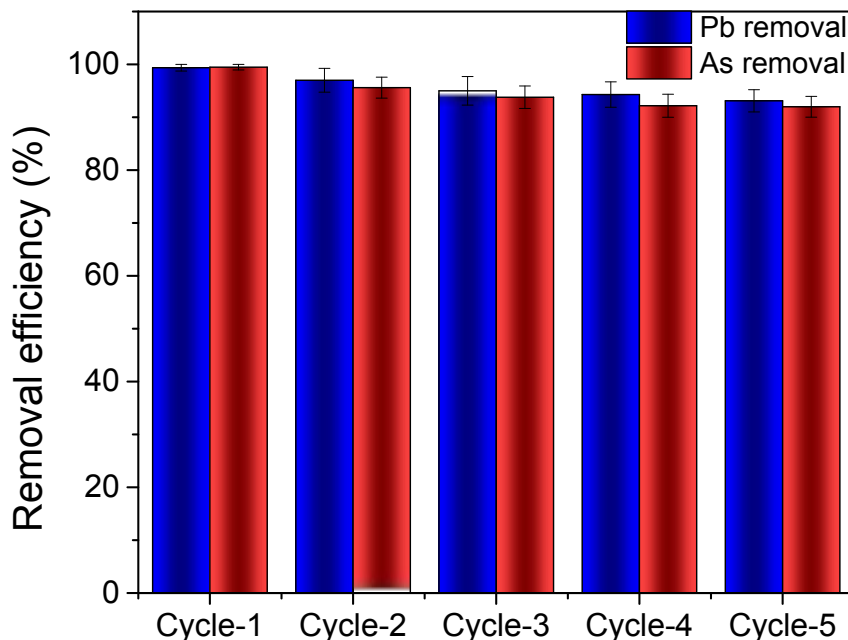


Figure S10: Reusability of GNS encapsulated  $Zn_3(BTC)_2$  MOF for 5- adsorption and desorption cycles.

XI. Real-time water remediation with spiked heavy metal contaminants

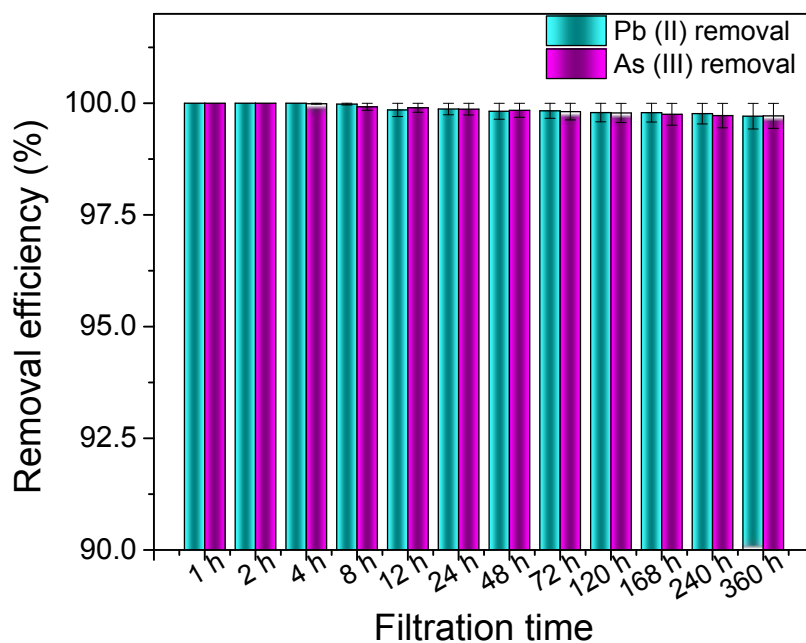


Figure S11: Real-time water remediation studies performed on tap water for a period of 15 days spiked with As (III) and Pb (II) contaminants.