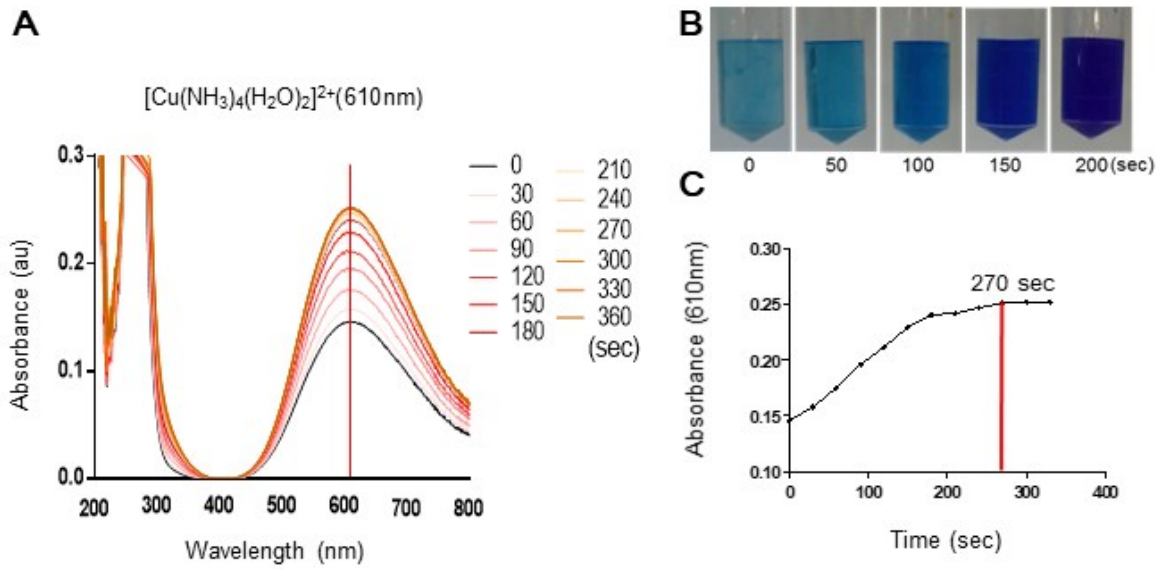
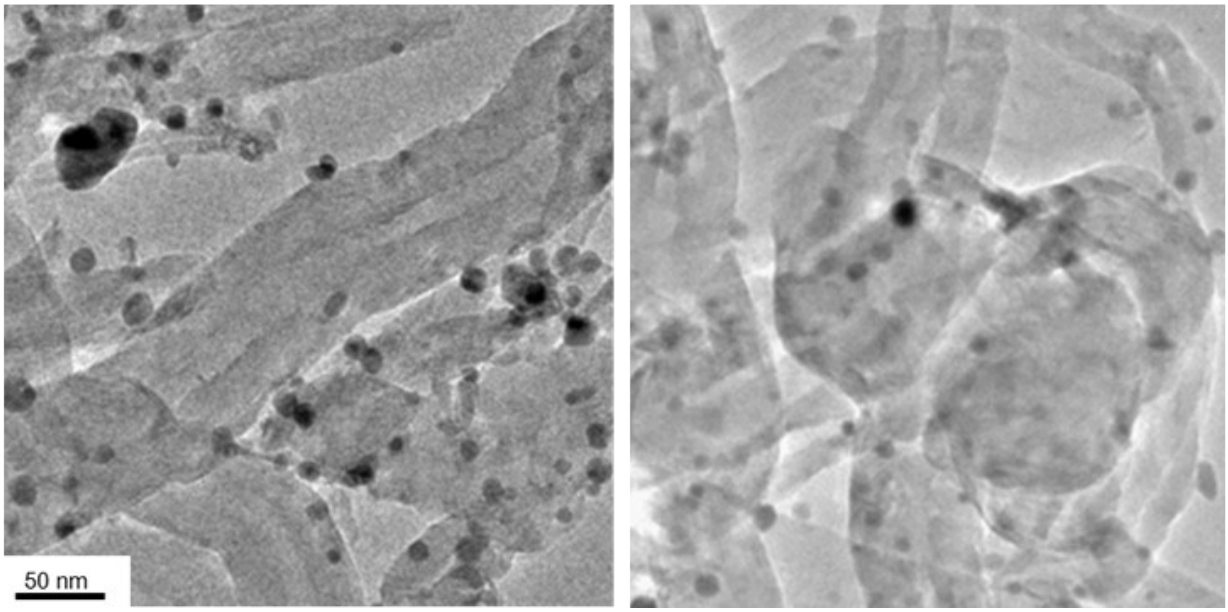
Electronic Supplementary Material (ESI) for Nanoscale.

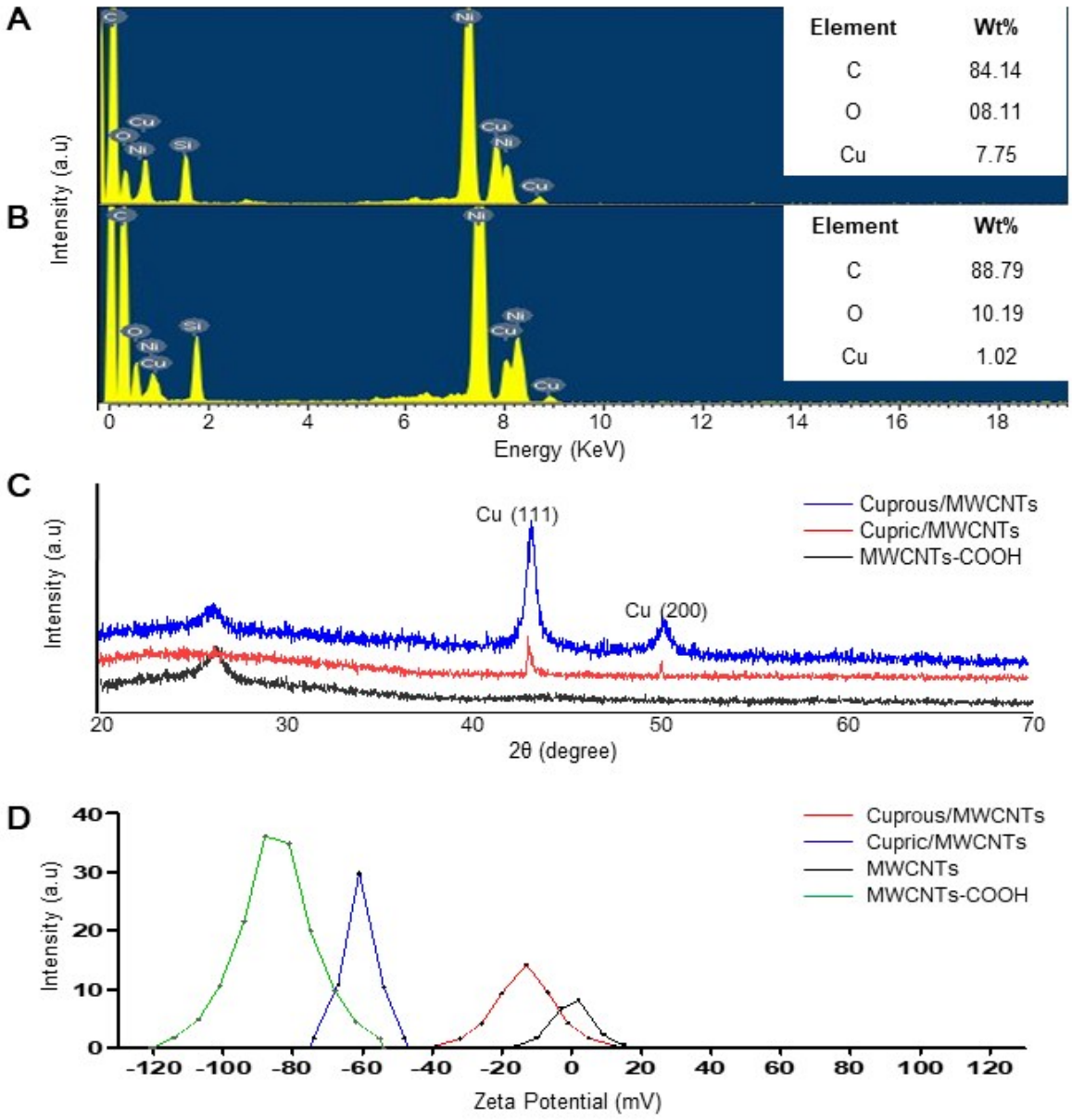

# Supplementary Information



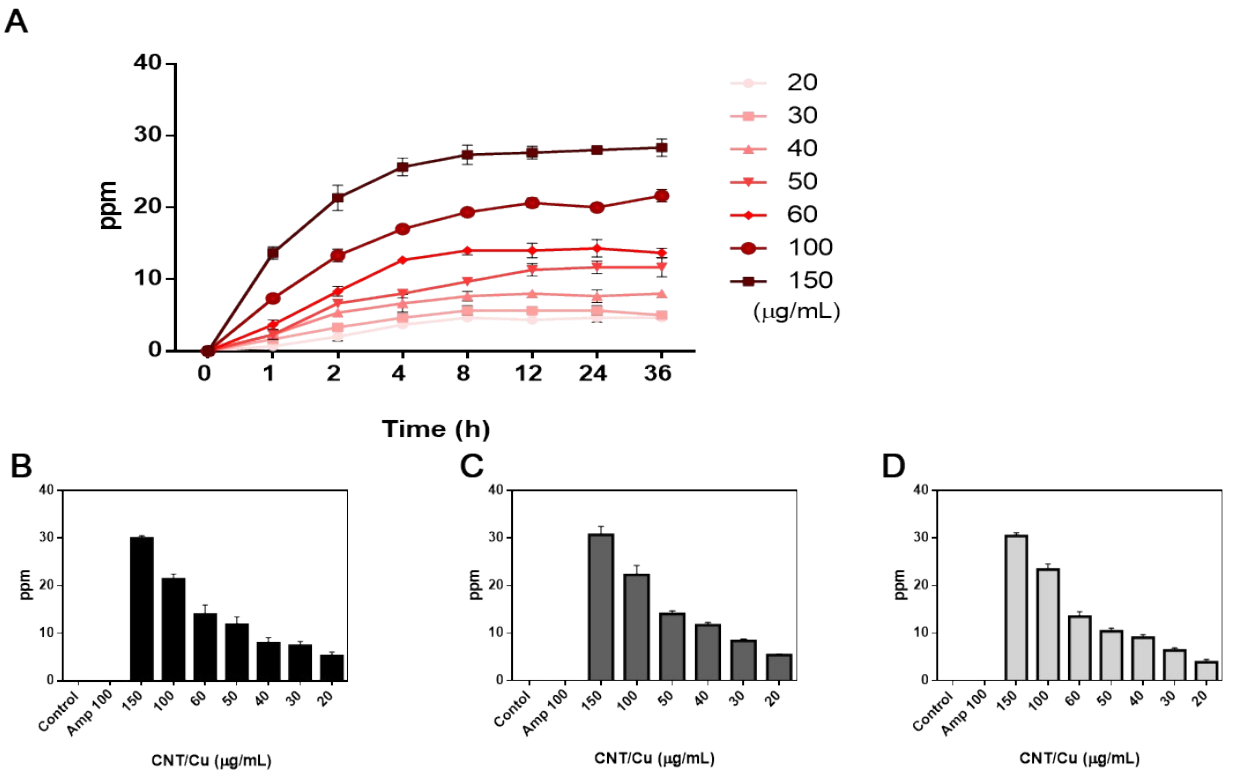

**Supporting figure 1. Measurement of oxidation time of the cuprous form. (A)** Absorbance of the cuprous form as a function of time (wavelength 200-800 nm). **(B)** Color changes of the cuprous form as a function of time. **(C)** Absorbance of the cuprous form as a function of time (wavelength 610 nm).



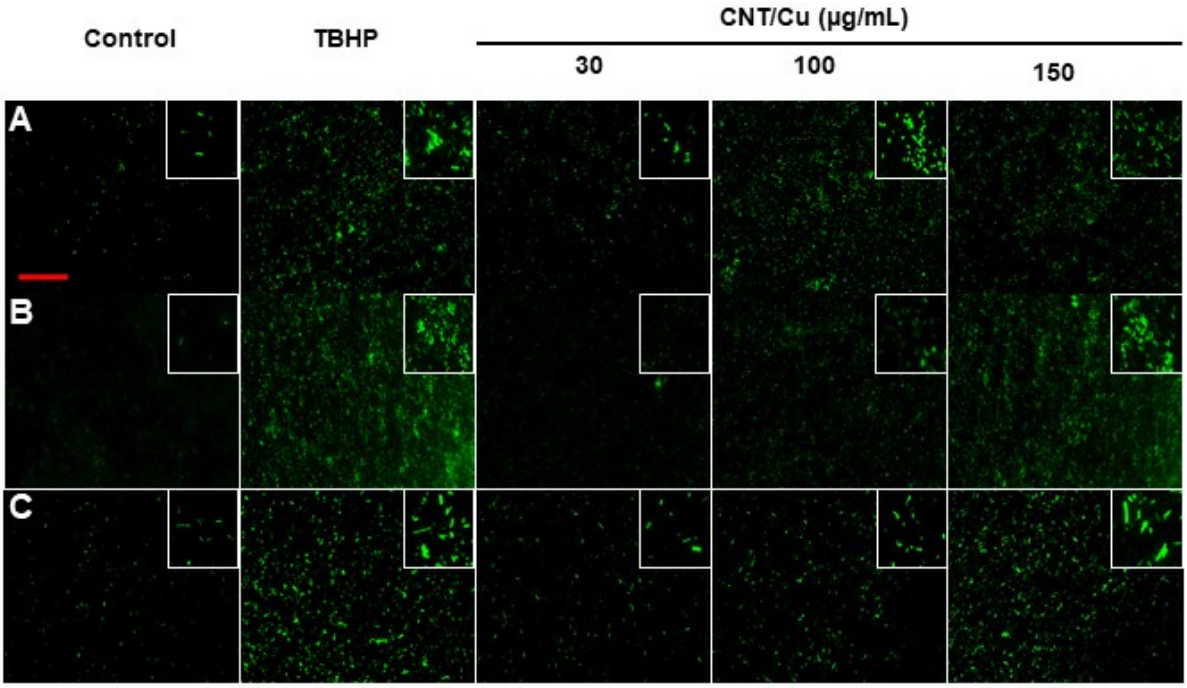

**Supporting figure 2.** TEM images of the Cu/MWCNTs that were prepared with 3 mg of cuprous chloride.



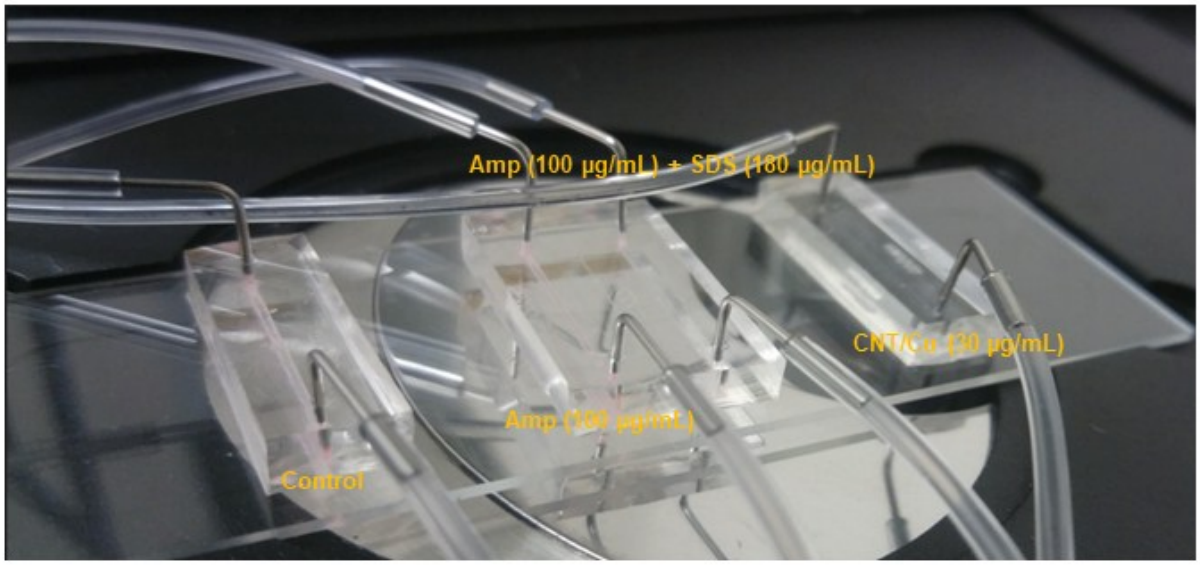

**Supporting figure 3. Physicochemical characterization of the cupric/MWCNTs and cuprous/MWCNTs. EDS element pattern of the (A)** Cuprous/MWCNTs **(B)** Cupric/MWCNTs. **(C)** XRD pattern of cupric/MWCNTs, cuprous/MWCNTs and acidified MWCNTs. **(D)** Zeta potential distribution of the cupric/MWCNTs, cuprous/MWCNTs, MWCNTs and MWCNTs-COOH.



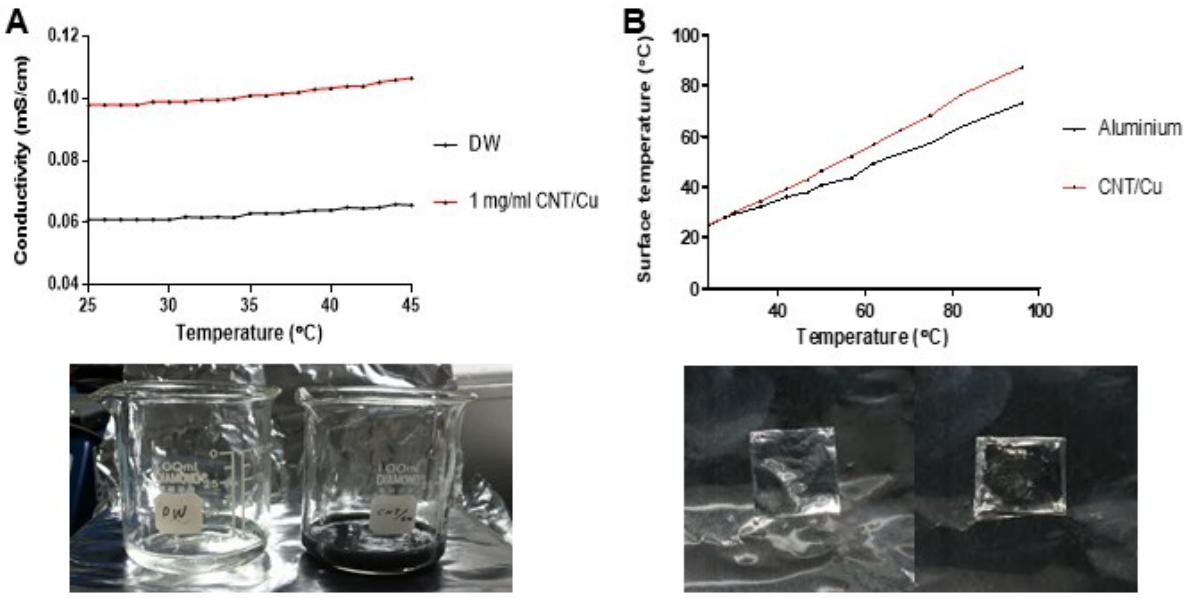

**Supporting figure 4. (A)** Concentration of released copper ions from various concentrations of the Cu/MWCNTs at each time. **Concentration of released copper ions from Cu/MWCNTs as a function of surface charge of (B)** *Methylobacterium* spp., **(C)** *Sphingomonas* spp., **(D)** *Escherichia coli*, The concentrations were analyzed by ICP-AES in a Spectro Arcos instrument (Control; no treated with CNT/Cu, Amp 100; Ampicillin 100 μg/mL).




**Supporting figure 5. Representative photomicrographs depicting ROS generation in (A)** *Methylobacterium* spp., **(B)** *Sphingomonas* spp. and **(C)** *Escherichia coli*, after treatment with the mentioned concentration. (Scale bar = 100 µm, Control; no treated with CNT/Cu, TBHP; tert-Butyl hydroperoxide)




**Supporting figure 6**. **Removal of biofilm prepared in the PDMS chip** (Control; no treated with CNT/Cu, Amp; Ampicillin 100 µg/mL, SDS: sodium dodecyl sulfate; 180 µg/mL, CNT/Cu with various concentration).




**Supporting figure 7**. **(A)** Variation of electrical conductivities (top), sample picture (bottom) and **(B)** Thermal conductivities of Cu/MWCNTs (top) suspension based on water and coated on aluminum plate as a function of time (bottom

## Tables

### Supporting Table 1. Information of PCR primers used in the study

| Target | Primer | Sequences (5′–3′) | Product size (bp) | Annealing tem |
|---|---|---|---|---|
| 16S rRNA | Forward | GAT CGG CCC GCG TCT GAT TAG | 234 | 60 |
| | Reverse | CCG TCA TTA TCG TCC CGG ACA | | |
| mxaF | Forward | GAG CAG AAG GAC AAG GAC GG | 142 | 64 |
| | Reverse | CCG ACT TGA ACA CGT TGA CC | | |