Supplementary Information

The Influence of Ionic and Nonionic Surfactants on the Colloidal Stability and Removal of CuO Nanoparticles from Water by Chemical Coagulation

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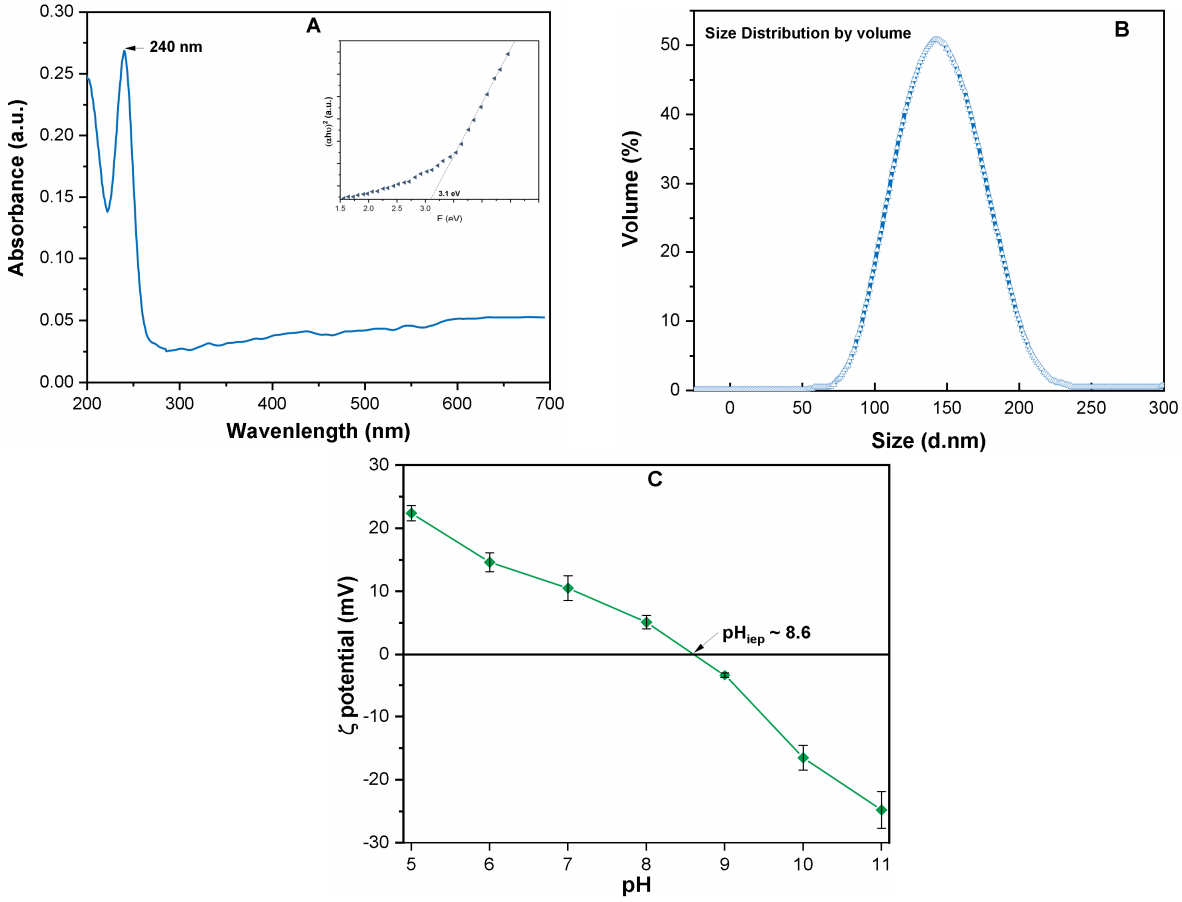
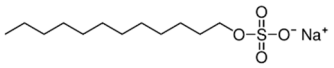
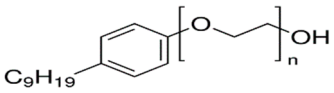


Figure S1. (A) UV-Vis spectra of (10 mg/L) CuO NPs in DI waters; (B) Size distribution by the intensity of CuO NPs in DI; (C) ζ potential of CuO NPs as a function of pH.

Table S1. Physicochemical properties of CuO NPs used in the current study.

Parameter	Unit	Value
Density	g/cm^3	6.372
Vendor-reported size	nm	<50
DLS HDD measured in DI water (n = 10) see Figure S1B	Nm	225±38
BET specific surface area measured (n = 3)	m^2/g	29 ± 3
pH_{iep} see Figure S1C		8.6
Zeta potential in DI water (pH = 7)	(mV)	+12.5 ± 1.6
Purity by ICP-MS	wt %	98.81
Moisture content by TGA	wt %	1.15

Table S2. Properties of surfactants used in the present study.

Surfactant Type	Molecular weight (g/mol)	Chemical Structure	Formula
SLS (Anionic)	288.38		$CH_3(CH_2)_{11}OSO_3Na$
NP-9 (Nonionic)	616.82		$C_9H_{19}C_6H_4(OCH_2CH_2)_9OH$

Materials and methods

1.1. Synthetic water preparation

The synthetic freshwater and domestic wastewater were prepared in the DI water according to previously described methods [1–4]. All salts used were ACS reagent grade and purchased from local suppliers. Before use all waters were filtered through 0.45 μm glass fiber filter and stored in the dark at 4 °C.

Table S3. Natural and synthetic water characteristic.

Parameter	Unit	Tap water	Fresh water	Industrial Wastewater	Domestic Wastewater
pH [a]	-	7.02	6.90	7.56	7.81
Conductivity [a]	us/cm	82.42	119	619	2280
IS	mM/L	0.002	0.79	8.90	34.0
TOC	mg/L	ND	4.5	35	25
HCO_3	mg $CaCO_3$ /L	>80	12	-	56
PO_4	mg/L	-	0.64	ND	2.71
Na^+	mg/L	0.31	0	15.0	325.3
K^+	mg/L	0.06	1.20	7.53	38.59
Cu	mg/L	-	0	0.39	0.08
Fe	mg/L	-	0	ND	0.35
Mg^{2+}	mg/L	0.19	3.49	27.1	77.0
As	mg/L	-	0	68.52	0
Ca^{2+}	mg/L	0.81	1.50	16.11	119.90
Cl^-	mg/L	0.24	6.61	22.40	501
SO_4^{2-}	mg/L	-	0	10.52	310
Sb	mg/L	-	0	58.77	0

-: Not Measured, ND = Not detected, [a] Measured in lab.

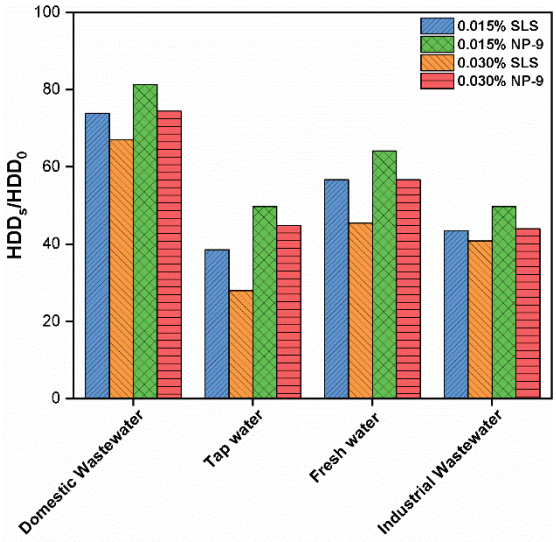


Figure S2. Size ratio of CuO NPs with and without surfactant in various environmental waters.

References

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