Electronic Supplementary Information

Effect of irrigation water type and other environmental parameters on CeO₂ nanopesticide- clay colloid interactions

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Section S-1

Table-1 Synthetic Fresh water and hard water composition

Major ion concentration	Synthetic fresh water	Synthetic hard water
Na^+ (μmol/L)	250	670
Ca^{2+} (μmol/L)	263	1230
Mg^{2+} (μmol/L)	60	410
K^+ (μmol/L)	25	110
Cl^- (μmol/L)	280	680
NO_3^- (μmol/L)	30	100
SO_4^{2-} (μmol/L)	115	600
$H_2PO_4^-$ (μmol/L)	-	30
HCO_3^- (μmol/L)	386	2000
pH	7.4	8.2
DOM (mg/L)	1	1
Total IS	$0.9 \times 10^{-3} M$	$4 \times 10^{-3} M$

Section S-2

Table-2 Water composition and in-situ parameters of Hoogly river water, West Bengal, India

Water parameter	River water
Location	22.9316^0 N
	88.4092^0 E
pH	8.3
Dissolved oxygen (mg/L)	7.4
TDS (mg/L)	258
Conductivity (µS)	427
TOC (mg/L)	1.85
Na$^+$ (μmol/L)	573.9
K$^+$ (μmol/L)	63.95
Mg^{2+} (μmol/L)	226.3
Ca^{2+} (μmol/L)	464.1
Cl$^-$ (μmol/L)	694.9
SO$_4$$^{2-}$ (μmol/L)	216.5
NO$_3$$^-$ (μmol/L)	38.7
HCO$_3$$^-$ (μmol/L)	1229.3
Total IS	$2.2 \times 10^{-3} M$

Section S-3

Attachement efficiency calculation

Aggregation kinetics of CeO_2 NPs was obtained from the initial rate of change of hydrodynamic daimeter with time, measured by time resolved DLS measurments. Attachement efficiency (α), was used to quantify the aggregation kinetics of CeO_2 NPs that can be measured by normalizing the aggregation rate constant in the reaction limited regime (K_{slow}) to the rate constant in diffusion limited regime (K_{fast}) and Critical Coaugulation Concentration (CCC) is the value of salt concentration at which aggregation is maximum, where α approaches to 1 [1]. Stability ratio (W) for CeO_2 NPs is measured as inverse of attachement effeciency and given as:

$$Stability\ ratio\ (W) = \frac{1}{\alpha} = \frac{K_{fast}}{K_{slow}}$$

Section S-4

Table-3 Zeta potential of suspension mixture in environmental water samples at 25°C

S.No.	Water type	Measured zeta potential (in mV)
1.	DI	-29.9 ± 3.18
2.	Synthetic Fresh water	-20.5 ± 5.5
3.	Synthetic Hard water	-3.9 ± 3.1
4.	River water	-0.8 ± 1.1

Reference:

1.   Raza, G.; Amjad, M.; Kaur, I.; Wen, D., Stability and Aggregation Kinetics of Titania Nanomaterials under Environmentally Realistic Conditions. *Environmental Science & Technology* **2016,** *50* (16), 8462-8472.