

**Supplemental Information**

**Understanding the antifouling mechanisms related to copper oxide and zinc oxide nanoparticles in anaerobic membranes**

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**Table S1.** The price of CuO, ZnO and Ag nanoparticles provided by Sigma-Aldrich company (US).

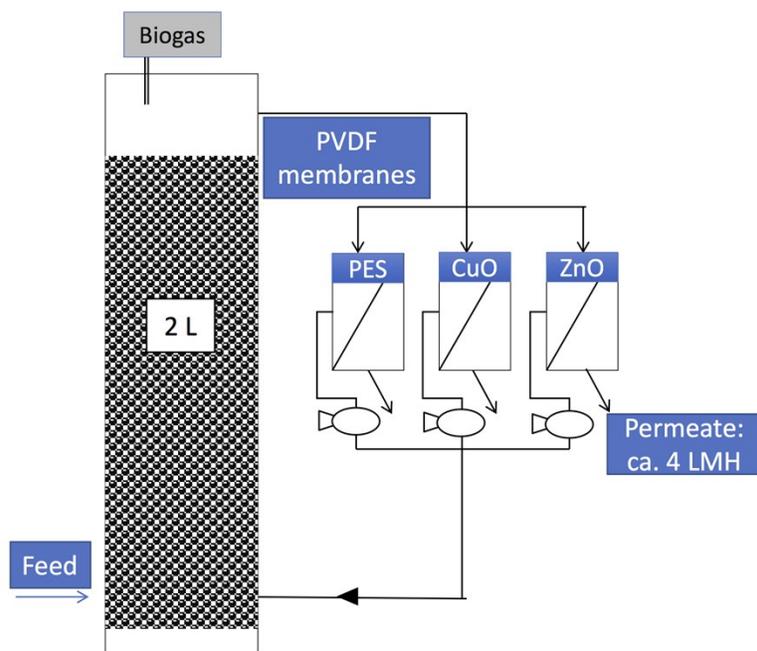
Items	Particles size (nm)	Weigh (g)	Price (\$)	Catalog
CuO	<50	5	35.8	544868-5G
ZnO	<100	10	31.7	544906-10G
Ag	<100	5	61.7	576832-5G

**Table S2.** Composition of synthetic wastewater feed in AnMBR (mg/L).

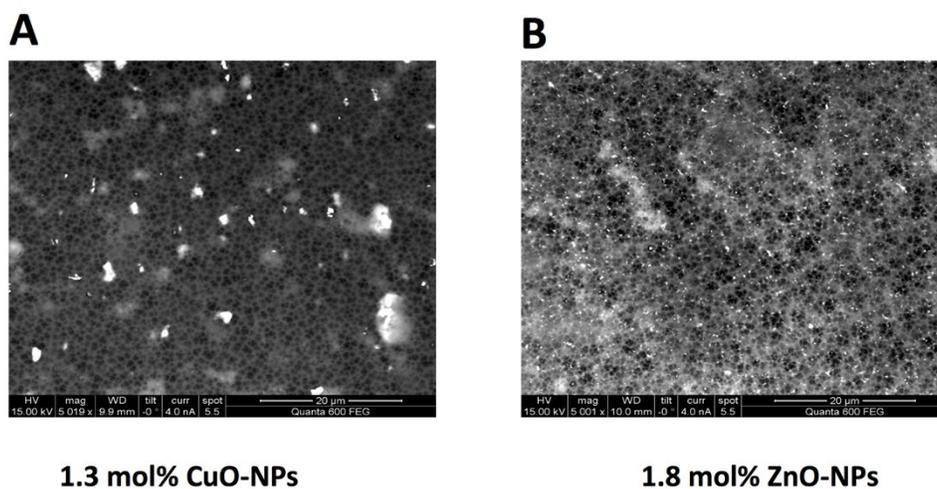
Carbon source		Nutrients and Iron		Trace Metals	
Starch	238.1	Urea	179.0	Cr(NO <sub>3</sub> ) <sub>3</sub> ·9H <sub>2</sub> O	1.50
Milk Power	226.7	NH <sub>4</sub> Cl	24.88	CuCl <sub>2</sub> ·3H <sub>2</sub> O	1.05
Yeast	101.9	MgHPO <sub>4</sub> ·3H <sub>2</sub> O	56.62	MnSO <sub>4</sub> ·2H <sub>2</sub> O	0.21
Peptone	33.97	KH <sub>2</sub> PO <sub>4</sub>	45.66	NiSO <sub>4</sub> ·6H <sub>2</sub> O	0.66
Na-acetate·3H <sub>2</sub> O	256.9	FeSO <sub>4</sub> ·7H <sub>2</sub> O	11.32	PbCl <sub>2</sub>	0.20
				ZnCl <sub>2</sub>	0.41

**Table S3.** Sequencing depth for each sample.

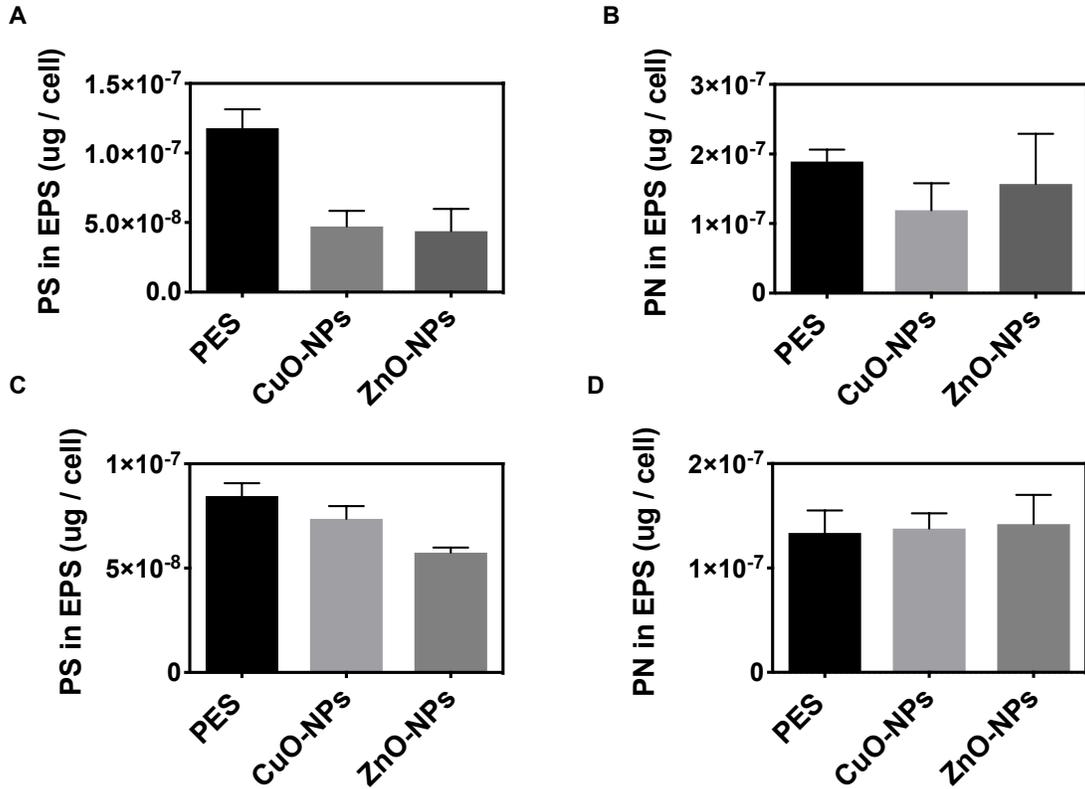
	DNA raw reads (bp)		RNA raw reads (bp)	
	Run1	Run2	Run1	Run2
PES	82416989	88870124	27519377	21330981
PES-CuO-NPs	86883185	94204493	20239675	19502843
PES-ZnO-NPs	73082064	84401898	17961716	22186750



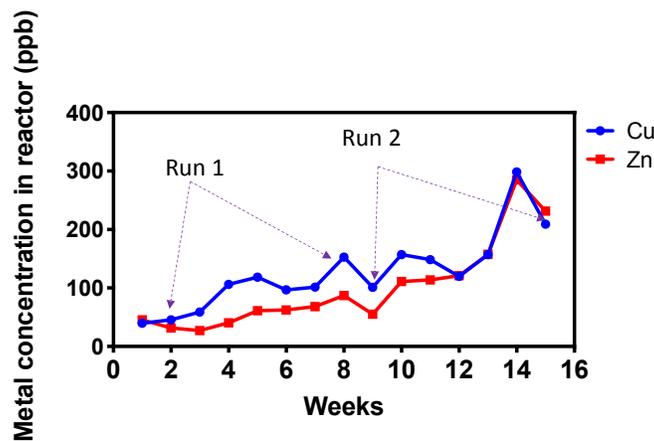
**Figure S1.** Schematic diagram of anaerobic membrane reactor configuration and membrane set-up; membranes are individually housed in cassette holders.



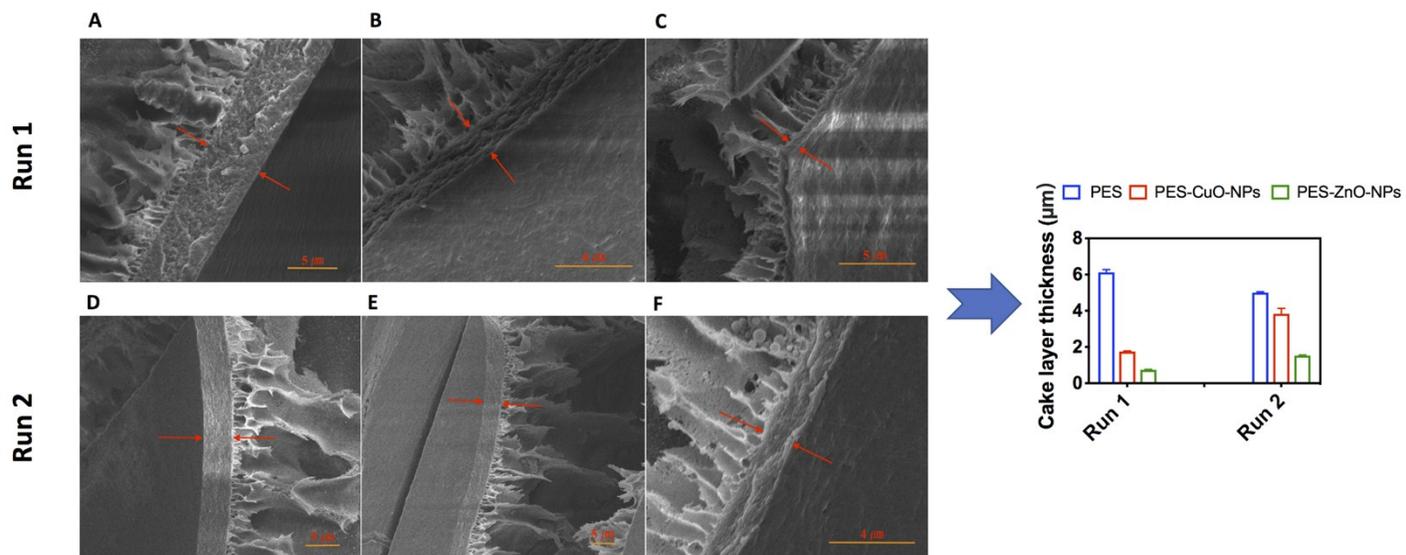
**Figure S2.** Surface images of membranes obtained by scanning electron microscopy. (A) PES-CuO-NPs membrane and (B) PES-ZnO-NPs membrane.



**Figure S3.** Extracellular polymeric substance (EPS) content normalized by cells in biofilm attached on PES, PES-CuO-NPs and PES-ZnO-NPs membranes. (A) Polysaccharides (PS) content in Run 1, (B) Protein (PN) content in Run 1, (C) PS content in Run 2, and (D) PN content in Run 2. Run 1 and 2 are two biological independent experimental runs.



**Figure S4.** Metals concentration in the AnMBR during the operation by ICP-MS. Run 1 and 2 are two biological independent experimental runs.



**Figure S5.** Cross-sectional images of membranes obtained by scanning electron microscopy. (A) PES, (B) PES-CuO-NPs and (C) PES-ZnO-NPs membranes in run 1; (D) PES, (E) PES-CuO-NPs and (F) PES-ZnO-NPs membranes in run 2. Run 1 and 2 are two biological independent experimental runs.