Electronic Supplementary Material (ESI) for Environmental Science: Nano.

Table 1. A non-exhaustive list of studies assessing the toxicity to nanoceria to aquatic and terrestrials organisms

organism	Nanoceria source	Particle size	surface coating	Media	Hydrodynamic diameter (nm)	ZP in media	exposure length	measured endpoint	Effect concentration	Ref
Escherichia coli	Purchased powder (Rhodia)	7 nm	uncoated	nutrient broth on LB Petri Dishes (Difco LB Agar, Miller (Luria-Bertani))	aggregation	positive charge	overnight	growth	no influence of nanoceria	1
	Purchased powder (Rhodia)	7 nm	uncoated	KNO3 "washed" E. coli suspension	aggregation	positive charge	3 hours	survival (counting colony forming units (CFU))	>90 % below 0.9 mg/l 50 % for 5 mg/l 100 % mortality 230 mg/l	1
	Purchased powder (Rhodia)	7 nm	uncoated	Pure water and moderately hard reconstituted water	aggregation	positive charge	24 h	survival tests : colony forming units, live/dead test	10% survival at 100 mg/l in pure water	2
Cyanobacterium Synechocystis PCC6803	Purchased powder (Rhodia)	7 nm	uncoated	Pure water and moderately hard reconstituted water	aggregation	positive charge	10 days	survival tests : colony forming units, live/dead test	No effect 100 mg/l in reconstituted water, 20 % survival at 60 mg/l in pure water (explained by indirect nanoceria effect)	2
cyanobacterium *Anabaena* CPB4337	purchased powder (Sigma Aldrich)	*< 50 nm BET: 22 nm*	uncoated	AA/8 + nitrate, pH 7.5	between 416 and 1693	-0.03 ± 0.16	72/96 h	inhibition photosynthesis	inhibited (0.01–100 mg/l)	3
	purchased powder (Sigma Aldrich and OECD)	10 nm (BET: 12 nm)	uncoated	Pure water, pH 6	575	+ 0.4 ± 0.8	24h	inhibition of constitutive luminescence	EC50: 6.3 mg/l	4
		25 nm (BET 13 nm)	uncoated	Pure water, pH 6	158	+ 22.4 ± 1.3	24h	inhibition of constitutive luminescence	EC50: 0.56 mg/l	4

		50 nm (BET: 22nm)	uncoated	Pure water, pH 6	218	+ 18.7 ± 0.8	24h	inhibition of constitutive luminescence	EC50: 0.27 mg/l	[4]
		60 nm (BET: 28 nm)	uncoated	Pure water, pH 6	210	+ 0.7 ± 1.1	24h	inhibition of constitutive luminescence	EC50: 7.5 mg/l	[4]
		10 nm (BET: 12 nm) 25 nm (BET 13 nm) 50 nm (BET: 22nm) 60 nm (BET: 28 nm)	uncoated	cyanobacterium culture media AA/8 + N diluted 1/10 in water buffered with HEPES ph 6	164-185	negative < -27.5	1, 4, 24h	inhibition of constitutive luminescence	EC50 > 100 mg/l EC10 : between 0.008 and 0.089 mg/l	[4]
Pseudokirchneriella subcapitata	purchased powder (Sigma Aldrich and OECD)	10 nm (BET: 12 nm)	uncoated	OECD algal growth medium	499	-12.5 ± 0.9	72/96h	growth inhibition (optical density, cell counting and ATP)	EC50 OD - 12.8 mg/l cell counting: 29.6 mg/l ATP: 12.3mg/l	[4]
	purchased powder (Sigma Aldrich and OECD)	25 nm (BET 13 nm)	uncoated	OECD algal growth medium	2107	-15.5 ± 1	72/96h	growth inhibition (optical density, cell counting and ATP)	EC50 OD - 0.95 mg/L cell counting: 9.7 mg/L ATP: 5.3mg/l	[4]
Pseudokirchneriella subcapitata	purchased powder (Sigma Aldrich and OECD)	50 nm (BET: 22nm)	uncoated	OECD algal growth medium	1546	-16 ± 0.9	72/96h	growth inhibition (optical density, cell counting and ATP)	EC50 OD - 0.88 mg/l cell counting: 4.4 mg/l ATP: 2.4 mg/l	[4]
	purchased powder (Sigma Aldrich and OECD)	60 nm (BET: 28 nm)	uncoated	OECD algal growth medium	1599	-10.9 ± 0.3	72/96h	growth inhibition (optical density, cell counting and ATP)	EC50 OD - 8.96 mg/l cell counting: 16.4 mg/l ATP: 8.5 mg/l	[4]

	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	OECD media	462-552	between -15 and -19.6 mV	72h	growth inhibition	EC10 between 2.6 and 5.4 mg/l EC50 between 10.2 and 19.1 mg/l LOEC: 5.6 mg/l NOEC : 3.2 mg/l	[5]
	purchased powder (Sigma Aldrich)	*nominal size < 50 nm* *BET: 22 nm*	uncoated	OECD AGM pH 8	between 369 and 1634 (increase with nanoceria concentration)	-16.0 ± 0.9	72 h	inhibition photosynthesis	slight stimulation at low concentrations (0.01 - 1 mg/l) and strong inhibition at the highest concentrations (10 - 100mg/l).	[3]
	purchased powder (Sigma Aldrich)	nominal size: 10 -20 nm TEM: 7-25 nm	uncoated	US EPA medium pH 6.5±0.1.	190 ± 30	−13 to −18	72 h	inhibition of algal growth rate	inhibition at 1 mg/l EC50: 10 mg/l	[6]
Chironomus riparius	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	24h	mortality	10 % for 1 mg/l of 15 nm nanoceria, 15 % for 1 mg/l of 30 nm nanoceria	[7]
	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	24h	growth	no effect at 1 mg/l	[7]
	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	24h	reproduction	no effect at 1 mg/l	[7]
Daphnia magna	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	96 h	survival	no effect at 10 mg/l	[8, 9]
	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	96 h	moulting	inhibition at 10 mg/l	[8, 9]
	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	96 h	growth	inhibition at 0.01 and 10 mg/l (no inhibition measured at 0.1 and 1 mg/l)	[8, 9]

	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	21 days	survival	no mortality at 0; 0.1; 1; 3 mg/l but 100% mortality at 10 mg/l	[8, 9]
	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	21 days	moulting	no differences below the toxic dose (10mg/l)	[8, 9]
	purchased powder (Sigma Aldrich)	nominal size <25 nm XRD: 11.5 ± 0.2 nm	uncoated	reconstituted hard water (US EPA)	3958 ± 1955	-10 mV	21 days	growth	no differences	[8, 9]
	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	96h	mortality	10 % mortality for 1 mg/l of 15 nm nanoceria no mortality for 1 mg/l of 30 nm nanoceria	[7]
	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	96h	growth	no effect at 1 mg/l	[7]
	synthesized	15 nm and 30 nm	uncoated	no data - OECD guidelines	no data	no data	96h	reproduction	no effect at 1 mg/l	[7]
Daphnia magna	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	Elendt medium	425-549	between -3.9 and -9.1 mV	21 days	survival	EC50 between 36.9 and 71.1 mg/l NOEC 32 - 56 mg/l	[5]
	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	Elendt medium	425-549	between -3.9 and -9.1 mV		reproduction	EC10 between 8.8 and 20 mg/l EC50 between 20.5 and 42.7 mg/l LOEC 18 - 32 mg/l NOEC <18 and 18 mg/l	[5]
	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	Elendt medium	425-549	between -3.9 and -9.1 mV	48h	immobility	no acute toxicity up to 1000 mg/l	[5]
Thamnocephalus platyurus	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	EPA medium	467-758	-	24h	mortality	no acute toxicity up to 5000 mg/l	[5]

embryos of zebrafish *Danio rerio*	purchased powder (Umicore)	14, 20, and 29 nm	uncoated	zebra fish medium	441-543	-	24, 48, 72h	mortality, hatching, scoliosis, oedeme	no acute toxicity up to 200 mg/l	5
zebrafish *Danio rerio*	purchased powder (Sigma)	nominal size <25 nm 10.2 ± 0.78 nm (TEM)	uncoated	synthetic freshwater	aggregation	no data	14 days	uptake	significant uptake in liver for zebrafish exposed to 500 µg/l but no significant uptake in fish exposed to 5000 µg /l no Ce detected in gill, brain, skin	10
Caenorhabditis elegans	synthesized	8.5 ± 1.5 nm (TEM) 38.3 nm (DLS)	hexamethyleneteramine (HMT)	nematode growth media (NGM) agar		45.6 in H_2O		lifespan	significant decrease from 172 ng/L (12 % decrease) to 1720 ng/l	
	purchased powder (Nanostructured & Amorphous Materials, TX)	53.34 ± 3.12 (DLS)	uncoated	moderately hard reconstituted water	not measured - nanoceria aggregated	negative (variable) (-3.36 µm cm/s in H_2O)	3 days	growth	growth inhibition from 2.5 to 75.0 mg/l	11
	synthesized	15 nm and 45 nm (TEM)	uncoated	K- medium (0.032M KCl, 0.051M NaCl, Williams and Dusenbery, 1990)	stable and uniform (data not shown)			stress-response gene expression, growth, fertility, and mortality	80 % and 100 % for 1 mg/l of 15 nm and 40 nm nanoceria	12
	synthesized	3.99 ± 0.71 nm (TEM)	dextran coating	moderately hard reconstituted water	17.8 (volume weighted diameter)	-9.3 (PZC=6)	48h	mortality	16.7 % for 1000 mg/l for L1 stage C. elegans	13
	synthesized	3.99 ± 0.71 nm (TEM)	dextran coating	moderately hard reconstituted water + 7 mg/l humic acid	17.99 (with 35 mg/l HA)	no data	48h	mortality	<6.7 % up to 1000 mg/l	13
	synthesized	3.62 ± 0.8 nm (TEM)	dextran functionalized with carboxymethyl groups	moderately hard reconstituted water	13.9 (volume weighted diameter)	-31.5	48h	mortality	LC50 272 and 15.5 mg/l for L3 and L1 C. elegans stage respectively	13
	synthesized	3.62 ± 0.8 nm (TEM)	dextran functionalized with	moderately hard reconstituted water + 7 mg/l humic acid	14.23 (with 35 mg/l HA)	no data	48h	mortality	<6.7 % up to 1000 mg/L nanoceria	13

			carboxymethyl groups							
	synthesized	3.65 ± 0.69 nm (TEM)	dextran functionalized with diethylaminoethyl groups	moderately hard reconstituted water	15.3 (volume weighted diameter)	28.5	48h	mortality	3.3 % for 1000 mg/l for L1 stage *C. elegans*	13
	synthesized	3.65 ± 0.69 nm (TEM)	dextran functionalized with diethylaminoethyl groups	moderately hard reconstituted water + humic acid	aggregation; aggregates size depend on the ratio HA-nanoceria	between 30 and - 30 depending on HA concentration	48h	mortality	HA addition decreased mortality up to 500 mg/l	13

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