Supplementary material

Unexpected diversity and high abundance of putative nitric oxide dismutase (Nod) genes in contaminated aquifers and wastewater treatment systems

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Supplementary Fig. S1. Multiple sequence alignment of selected putative Nod and qNor enzymes around the quinol-binding site and the catalytic site of qNor. Representative environmental Nods were deduced from the gene sequences generated in this study (in bold). The alignment is extended by further Nod sequences generated in this study compared to Fig. 5. The conserved residuals for quinol-binding (A) and catalytic functioning (B) in qNor are highlighted in red, whereas substitutions at these sites in putative Nod and putative Nor are shown in green. Note that the number and order of Nod sequences included in (A) and (B) are different. Accession numbers are the same as in Fig. 2. The alignment was generated with ClustalW in MEGA 6.

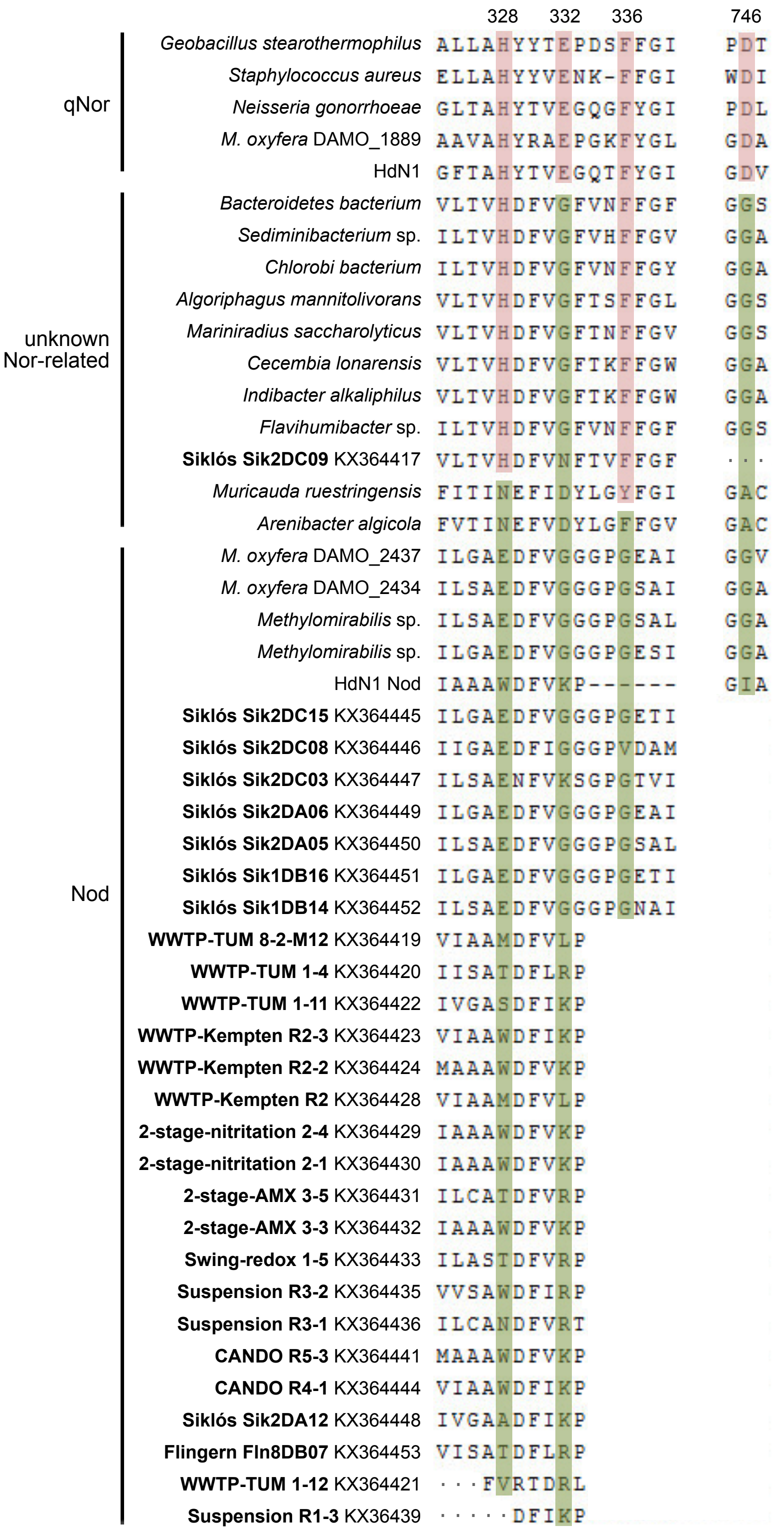
328
332
336
746
qNor
unknown Nor-related
Nod
Geobacillus stearothermophilus ALLAHYYTEPDSFFGI PDT
Staphylococcus aureus ELLAHYYVENK-FFGI WDI
Neisseria gonorrhoeae GLTAHYTVEGQGFYGI PDL
M. oxyfera DAMO_1889 AAVAHYRAEPGKFYGL GDA
HdN1 GFTAHYTVEGQTFYGI GDV
Bacteroidetes bacterium VLTVHDFVGFVNFFGF GGS
Sediminibacterium sp. ILTVHDFVGFVHFFGV GGA
Chlorobi bacterium ILTVHDFVGFVNFFGY GGA
Algoriphagus mannitolivorans VLTVHDFVGFTSFFGL GGS
Mariniradius saccharolyticus VLTVHDFVGFTNFFGV GGS
Cecembia lonarensis VLTVHDFVGFTKFFGW GGA
Indibacter alkaliphilus VLTVHDFVGFTKFFGW GGA
Flavihumibacter sp. ILTVHDFVGFVNFFGF GGS
Siklós Sik2DC09 KX364417 VLTVHDFVNFTVFFGF · · ·
Muricauda ruestringensis FITINEFIDYLGYFGI GAC
Arenibacter algicola FVTINEFVDYLGFFGV GAC
M. oxyfera DAMO_2437 ILGAEDFVGGGPGEAI GGV
M. oxyfera DAMO_2434 ILSAEDFVGGGPGSAI GGA
Methylomirabilis sp. ILSAEDFVGGGPGSAL GGA
Methylomirabilis sp. ILGAEDFVGGGPGESI GGA
HdN1 Nod IAAAWDFVKP------ GIA
Siklós Sik2DC15 KX364445 ILGAEDFVGGGPGETI
Siklós Sik2DC08 KX364446 IIGAEDFIGGGPVDAM
Siklós Sik2DC03 KX364447 ILSAENFVKSGPGTVI
Siklós Sik2DA06 KX364449 ILGAEDFVGGGPGEAI
Siklós Sik2DA05 KX364450 ILSAEDFVGGGPGSAL
Siklós Sik1DB16 KX364451 ILGAEDFVGGGPGETI
Siklós Sik1DB14 KX364452 ILSAEDFVGGGPGNAI
WWTP-TUM 8-2-M12 KX364419 VIAAMDFVLP
WWTP-TUM 1-4 KX364420 IISATDFLRP
WWTP-TUM 1-11 KX364422 IVGASDFIKP
WWTP-Kempten R2-3 KX364423 VIAAWDFIKP
WWTP-Kempten R2-2 KX364424 MAAAWDFVKP
WWTP-Kempten R2 KX364428 VIAAMDFVLP
2-stage-nitritation 2-4 KX364429 IAAAWDFVKP
2-stage-nitritation 2-1 KX364430 IAAAWDFVKP
2-stage-AMX 3-5 KX364431 ILCATDFVRP
2-stage-AMX 3-3 KX364432 IAAAWDFVKP
Swing-redox 1-5 KX364433 ILASTDFVRP
Suspension R3-2 KX364435 VVSAWDFIRP
Suspension R3-1 KX364436 ILCANDFVRT
CANDO R5-3 KX364441 MAAAWDFVKP
CANDO R4-1 KX364444 VIAAWDFIKP
Siklós Sik2DA12 KX364448 IVGAADFIKP
Flingern Fln8DB07 KX364453 VISATDFLRP
WWTP-TUM 1-12 KX364421 · · · FVRTDRL
Suspension R1-3 KX36439 · · · · · DFIKP

Fig S1 A

Group	Sequence	508 … 512	559 560	581
qNor	*Geobacillus stearothermophilus*	IIHLWVEG	GHHY	LEV
	Staphylococcus aureus	IVHLWVEG	GHHY	LEV
	Neisseria gonorrhoeae	VVHLWVEG	LHHL	LEV
	M. oxyfera DAMO_1889	IVHLWVEG	GHHW	MEV
	HdN1	VVHLWVEG	FHHL	LEV
unknown Nor-related	*Bacteroidetes bacterium*	VIHMWAEA	SHNF	LQV
	Sediminibacterium sp.	VIHMWAEA	SHNF	LQV
	Chlorobi bacterium	VIHMWAEA	SHNF	LQV
	Algoriphagus mannitolivorans	VVHMWVEA	SHNF	LQV
	Mariniradius saccharolyticus	VVHMWVEA	SHNF	LQV
	Cecembia lonarensis	VVHMWVEA	SHNF	LQV
	Indibacter alkaliphilus	VVHMWVEA	SHNF	LQV
	Flavihumibacter sp.	VVHMWAEA	SHNF	LQV
	WWTP-Kempten R2-7 KX364416	VIHMWVEA	AHNF	. . .
	Siklós Sik2DC09 KX364417	VIHMWAEA	SHNF	. . .
	Muricauda ruestringensis	VVHMWVEA	SHNF	LQF
	Arenibacter algicola	VVHMWVEA	SHNF	LQF
Nod	*M. oxyfera* DAMO_2437	NIHMWVEV	SHNF	MQV
	M. oxyfera DAMO_2434	NIHMWVEV	SHNF	MQV
	Methylomirabilis sp.	NIHMWVEV	SHNF	MQV
	Methylomirabilis sp.	NIHMWVEV	SHNF	MQV
	HdN1 Nod	VVHMWVEV	SHNF	LQV
	WWTP-Kempten R2-3 KX364423	TVHMWVEV	SHNF	LQV
	WWTP-Kempten R2-2 KX364424	VVHMWVEV	SHNF	LQV
	Siklós Sik2DA12 KX364448	VVHMWVEV	SHNF	LQV
	Siklós Sik2DA06 KX364449	NIHMWVEV	SHNF	MQV
	Siklós Sik2DA05 KX364450	NIHMWVEV	SHNF	MQV
	WWTP-TUM M16-4 KX364418	VAHMWVEV	AHNF	
	WWTP-TUM M12-8-2 KX364419	VVHMWVEV	SHNF	
	WWTP-TUM 1-12 KX364421	VVHMWVEA	SHNF	
	WWTP-Kempten R2-8 KX364425	VVHMWVEA	SHNF	
	WWTP-Kempten R2-2 KX364426	TVHMWVEV	SHNF	
	WWTP-Kempten R2-1 KX364427	VVHMWVEV	AHNF	
	2-stage-nitritation 2-4 KX364429	VVHMWVEV	SHNF	
	Suspension R3-22 KX364434	VVHMWVEV	SHNF	
	Suspension R3-2 KX364435	TVHMWVEV	SHNF	
	Suspension R1-7 KX364437	VVHMWVEV	AHNF	
	Suspension R1-5 KX364438	VVHMWVEV	SHNF	
	Suspension R1-3 KX364439	VVHMWVEV	SHNF	
	CANDO R5-6 KX364440	VVHMWVEV	SHNF	
	CANDO R5-2 KX364442	VVHMWVEV	SHNF	
	CANDO R4-12 KX364443	VVHMWVEV	AHNF	
	CANDO R4-1 KX364444	TVHMWVEV	SHNF	
	Siklós Sik2DC15 KX364445	NIHMWVEV	SHNF	
	Siklós Sik2DC08 KX364446	NIHMWVEV	SHNF	
	Siklós Sik2DC03 KX364447	TVHMWVEV	SHNF	

Fig S1 B