Supplemental Material

Bacteria Resistance to Metal Pollution in a Copper Tailing Dam Area in Northern China

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TABLE S1 Target genes and primer sequences used in this study

	gene name	Function		Primer 5'-3' forward and reverse	Product size (bp)	Annealing temperature (℃)	Reference
MRGs	*cop*A	Cu translocating ATPase	F	CGG TCT CTA CGA ATA CCG CTT CAA	300	55	Bouskill et al., 2007
			R	GAA ATA GCT CAT TGC CGA GGC GTT			
MRGs	*cop*B	Cu binding protein	F	TTC CTG CTC GAC CAG TTG GAA TAC	450	58	Bouskill et al., 2007
			R	GGT TGG TCA ACA GGA TGT CGT ACT			
MRGs	*pco*A	multi-copper oxidase	F	ATA CCA TCT TCG CAC AAT CCA	194	60	Lee et al., 2002
			R	GCT GTT ATC CAT GCC TCC C			
MRGs	*pco*C	Periplasmic protein periplasmic copper handling	F	TGT CGA TTT TAA ATA AAG CCA TTC TT	400	60	Lee et al., 2002
			R	TCA TAA TCA GGT CGT TCA TAA TAT TAC TTC			
MRGs	*pco*D	Periplasmic protein periplasmic copper handling	F	GAT ATC TGA CTC CCT GGC	734	60	Lee et al., 2002
			R	CCG TAA AAT CAA AGG GCT			
MRGs	*czc*A	Co/Zn/Cd efflux protein	F	GTT CAC CTT GCT CTT CGC CAT GTT	320	56	Bouskill et al., 2007
			R	ACA GGT TGC GGA TGA AGG AGA TCA			
MRGs	*czc*C	Outer part of a Co/Zn/Cd efflux protein (RND)	F	AGC CGY CAG TAT CCG GAT CTG AC	418	62	Roosa et al., 2014
			R	GTG GTC GCC GCC TGA TAG GT			
MRGs	*czc*D	Cation diffusion facilitator	F	TCA TCG CCG GTG CGA TCA TCA T	272	55	Roosa et al., 2014
			R	TGT CAT TCA CGA CAT GAA CC			
MRGs	*ncc*A	Inner part of a Ni/Co efflux protein (RND)	F	TTY AGC CAG GTV ACS GTS ATY TT	532	63	Roosa et al., 2014
			R	GCY GCR TCS GCR CGC ACC AGR TA			

	gene name	Function		Primer 5'-3' forward and reverse	Product size (bp)	Annealing temperature (℃)	Reference
MRGs	*pbr*T	Pb uptake protein	F	AGC GCG CCC AGG AGC GCA GCG TCT T	448	55	Roosa et al., 2014
			R	GGC TCG AAG CCG TCG AGR TA			
MRGs	*chr*B	Cr efflux protein	F	GTC GTT AGC TTG CCA ACA TC	450	57	Nie et al., 1990
			R	CGG AAA GCA AGA TGT CGA TCG			
MRGs	*ars*B	Arsenite efflux ATPase	F	GGT CTA TGC GCT GGA GCA ATT GAA	500	46	Bouskill et al., 2007
			R	TGC TGG GCA TGT TGT TCA TTA CCG			
MRGs	*ars*C	Arsenate reductase protein	F	GCA GCA TTC TTT CCG AAG CCA TGT	215	46	Bouskill et al., 2007
			R	TCG CAA ACG GTG ATG ACG ATG T			
ARGs	*tet*A	Tetracycline efflux	F	GCT ACA TCC TGC TTG CCT TC	210	55	Ng et al., 2001
			R	CAT AGA TCG CCG TGA AGA GG			
ARGs	*tet*C	Tetracycline efflux	F	CTT GAG AGC CTT CAA CCC AG	418	55	Ng et al., 2001
			R	ATG GTC GTC ATC TAC CTG CC			
ARGs	*tet*E	Tetracycline efflux	F	GTT ATT ACG GGA GTT TGT TGG	278	55	Ng et al., 2001
			R	AAT ACA ACA CCC ACA CTA CGC			
ARGs	*tet*G	Tetracycline efflux	F	GCT CGG TGG TAT CTC TGC TC	468	55	Ng et al., 2001
			R	AGC AAC AGA ATC GGG AAC AC			
ARGs	*tet*K	Tetracycline efflux	F	CGA AAA CAG ACT CGC CAA TC	169	55	Ng et al., 2001
			R	TCC ATA ATG AGG TGG GGC			
ARGs	*tet*L	Tetracycline efflux	F	TCG TTA GCG TGC TGT CAT TC	267	55	Ng et al., 2001
			R	GTA TCC CAC CAA TGT AGC CG			
ARGs	*tet*A/P	Tetracycline efflux	F	CTT GGA TTG CGG AAG AAG AG	676	55	Ng et al., 2001
			R	ATA TGC CCA TTT AAC CAC GC			

	gene name	Function		Primer 5'-3' forward and reverse	Product size (bp)	Annealing temperature (℃)	Reference
ARGs	*tet*S	protection	F	CAT AGA CAA GCC GTT GAC C	667	55	Ng et al., 2001
			R	ATG TTT TTG GAA CGC CAG AG			
ARGs	*tet*X	unkown	F	CAA TAA TTG GTG GTG GAC CC	468	58	Ng et al., 2001
			R	TTC TTA CCT TGG ACA TCC CG			
ARGs	*tetM*	protection	F	ACA GAA AGC TTA TTA TAT AAC	171	45	Aminov et al., 2001
			R	TGG CGT GTC TAT GAT GTT CAC			
ARGs	*tetO*	protection	F	ACG GAR AGT TTA TTG TAT ACC	171	45	Aminov et al., 2001
			R	TGG CGT ATC TAT AAT GTT GAC			
ARGs	*tet*Q	protection	F	AGA ATC TGC TGT TTG CCA GTG	169	55	Aminov et al., 2001
			R	CGG AGT GTC AAT GAT ATT GCA			
ARGs	*tet*T	protection	F	AAG GTT TAT TAT ATA AAA GTG	169	40	Aminov et al., 2001
			R	AGG TGT ATC TAT GAT ATT TAC			
ARGs	*tet*W	protection	F	GAG AGC CTG CTA TAT GCC AGC	168	60	Aminov et al., 2001
			R	GGG CGT ATC CAC AAT GTT AAC			
ARGs	*tet*B/P	protection	F	AAA ACT TAT TAT ATT ATA GTG	169	40	Aminov et al., 2001
			R	TGG AGT ATC AAT AAT ATT CAC			
ARGs	*sul*I	protection	F	CGC ACC GGA AAC ATC GCT GCA C	163	56	Pei et al., 2006
			R	TGA AGT TCC GCC GCA AGG CTC G			
ARGs	*sul*II	protection	F	TCC GGT GGA GGC CGG TAT ATG G	191	61	Pei et al., 2006
			R	CGG GAA TGC CAT CTG CCT TGA G			
ARGs	*sul*III	protection	F	TCC GTT CAG CGA ATT GGT GCA G	128	60	Pei et al., 2006
			R	TTC GTT CAC GCC TTA CAC CAG C			

	gene name	Function		Primer 5'-3' forward and reverse	Product size (bp)	Annealing temperature (℃)	Reference
ARGs	*qnr*A	unkown	F	TCA GCA AGA GGA TTT CTC A	516	50	Kehrenberg et al., 2006
			R	GGC AGC ACT ATG ACT CCC A			
ARGs	*qnr*B	unkown	F	TCG GCT GTC AGT TCT ATG ATC G	469	54	Kehrenberg et al., 2006
			R	TCC ATG AGC AAC GAT GCC T			
ARGs	*qnr*S	unkown	F	TGA TCT CAC CTT CAC CGC TTG	566	58	Kehrenberg et al., 2006
			R	GAA TCA GTT CTT GCT GCC AGG			
ARGs	*ere*A	deactivate	F	AAC ACC CTG AAC CCA AGG GAC G	420	52	Sutcliffe et al., 1996
			R	CTT CAC ATC CGG ATT CGC TCG			
ARGs	*ere*B	deactivate	F	AGA AAT GGA GGT TCA TAC TTA CCA	546	52	Sutcliffe et al., 1996
			R	CAT ATA ATC ATC ACC AAT GGC A			
ARGs	*mph*A	deactivate	F	AAC TGT ACG CAC TTG C	837	52	Sutcliffe et al., 1996
			R	GGT ACT CTT CGT TAC C			
ARGs	$bla_{\text{CTX-M}}$	deactivate	F	ATG TGC AGY ACC AGT AAR GT	593	50	Shahid, 2010
			R	TGG GTR AAR TAR GTS ACC AGA			
ARGs	bla_{TEM}	deactivate	F	KAC AAT AAC CCT GRT AAA TGC	936	58	Shahid, 2010
			R	AGT ATA TAT GAG TAA ACT TGG			
ARGs	bla_{SHV}	deactivate	F	TTT ATC GGC CYT CAC TCA AGG	930	58	Shahid, 2010
			R	GCT GCG GGC CGG ATA ACG			
ARGs	bla_{ampC}	deactivate	F	CCC CGC TTA TAG AGC AAC AA	634	58	Shahid, 2010
			R	TCA ATG GTC GAC TTC ACA CC			
MGE	*int*I1	integrase	F	CTG GAT TTC GAT CAC GGC ACG	473	60	Hardwick et al., 2010
			R	ACA TGC GTG TAA ATC ATC GTC G			

	gene name	Function		Primer 5'-3' forward and reverse	Product size (bp)	Annealing temperature (℃)	Reference
MGE	*tnp*A	transposase	F	CCG ATC ACG GAA AGC TCA AG	101	60	Han et al., 2016
			R	CCG ATC ACG GAA AGC TCA AG			

MRGs: metal resistance genes. ARGs: antibiotic resistance genes. MGE: mobile gene elements.

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