Supplementary Information for

Manganese Peroxidase-Catalyzed Treatment of Aqueous Chlorophenols

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Table S1 Treatment efficiencies of various substrates with SBP[a] in synthetic wastewater. (Narimannejad, 2025 and Haghighatnama et al., 2026).

Substrate	Substrate concentration (mM)	SBP (U/mL)	Normalized SBP (U/mL/mM)	Reference[b]
o-cresol	1.0	0.70	0.7	Haghighatnama et al. 2026
m-cresol	1.0	0.80	0.8	
p-cresol	1.0	0.30	0.3	
Phenol	1.0	0.90	0.9	(Caza et al., 1999)
2-Chlorophenol	1.0	0.23	0.23	
3-Chlorophenol	1.0	0.65	0.65	
4-Chlorophenol	1.0	0.20	0.2	
2,4-Dichlorophenol	1.0	0.08	0.08	
Bisphenol A	0.5	0.90	0.45	
p-Anisidine	1.0	0.0018	0.0018	Kaur et al. 2021
CI Methyl Orange	0.5	0.0070	0.014	
Acid blue 113	1.0	1.52	1.52	Cordova-Villegas et al. 2019
Direct black 38	0.5	2.84	1.42	
Diclofenac	0.1	0.15	1.5	Pishyar et al. 2025
Aceclofenac	0.1	0.6	6	
Triclosan[c]	0.010	0.10	10	Li et al. 2016
Triclosan	0.017	0.05	2.9	Mashhadi et al. 2019b
Ioxynil	0.1	0.3	3.0	Zhang 2019
Bromoxynil	0.5	0.9	1.8	
Nonylphenol	0.023	0.003	0.13	Mashhadi et al. 2019b
Octylphenol	0.024	0.002	0.083	
Estrone 17β-Estradiol 17α-ethynylestradiol	0.039 each	0.12[d]	3.1	
3-Aminoquinoline	1.0	4.5	4.5	Mashhadi et al. 2019a
Pyrrole	1.0	5.0	5	Mashhadi et al. 2021
1-Hydroxybenzotriazole	1.0	0.13	0.13	
3-Aminopyrazole	1.0	3.0	3.0	
Sulfamethoxazole	0.20	4.0	20	Mashhadi et al. 2019b; Sharifzadeh et al. 2024
Sulfamethoxazole[e]	0.20	0.10	0.5	Sharifzadeh et al. 2024
Sulfamerazine[e]	0.10	0.05	0.5	Sharifzadeh et al. 2024
4,4-Methylenedianiline	0.5	0.7	1.4	Mukherjee et al. 2019
4,4-Thiodianiline	0.5	0.15	0.3	
3-Hydroxycoumarin	0.5	0.002	0.004	Ziayee Bideh et al. 2021
2-Aminobenzoxazole	0.1	3.5	35	

[a] Except as noted, all substrates were tested with the same preparation of SBP, activity assay by AAP-phenol coupling method; normalized SBP comparison devised by Kaur et al., 2021.
[b] References listed after Table S2.
[c] SBP preparation from Bio-Research Products, activity assay substrate was ABTS.
[d] These compounds treated together at the given concentrations, the SBP requirement is nominally 0.03–0.04 U/mL each.
[e] With mediator, hydroxybenzotriazole at 1.5 molar equivalent.

Table S2 Treatment initial kinetics of various SBP[a] substrates. (Haghighatnama et al., 2026).

Substrate	SBP (U/mL)	Half-life (min)	Normalized half-life (min.U/mL)	Reference
o-cresol	0.70	8.70 ± 0.07	6.09 ± 0.05	Haghighatnama et al. 2026
m-cresol	0.80	1.8 ± 0.1	1.45± 0.09	
p-cresol	0.30	2.9 ± 0.3	0.86 ± 0.08	
Diclofenac	0.15	1.43 ± 0.01	0.22 ± 0.001	Pishyar et al. 2025
Aceclofenac	0.60	0.84 ± 0.05	0.49 ± 0.03	
Sulfamethoxazole	4.0	0.804 ± 0.003	3.22 ± 0.01	Sharifzadeh et al. 2024
Sulfamerazine	2.50	1.22 ± 0.01	3.05 ± 0.02	
Pyrrole	5.0	49 ± 3	246 ± 15	Mashhadi et al. 2021
Indole	0.45	26 ± 1	11.3 ± 0.5	
2-Aminothiazole	4.0	33.0 ± 0.6	132 ± 2	
2-Aminobenzothiazole	4.50	720 ± 0.01	3240 ± 0.04	
4-Aminoantipyrine	0.10	61 ± 1	6.1 ± 0.1	
Hydroxybenzotriazole	0.13	42 ± 2	4.97 ± 0.22	
2-Aminoimidazole	1.50	5.1 ± 0.2	7.7 ± 0.3	
2-Amino-benzimidazole	3.0	29.4 ± 0.6	88 ± 2	
3-Aminopyrazole	3.0	37 ± 1	108 ± 4	
3-Hydroxyquinoline	0.10	11.9 ± 0.6	1.19 ± 0.06	Mashhadi et al. 2019a
3-Aminoquinoline	4.50	15.0 ± 0.6	68 ± 3	
4,4'-Methylenebis (2-chlororaniline)	0.10	4.08 ± 0.02	0.408 ± 0.002	Mukherjee et al. 2020
4-Chloro-*o*-toluidine	0.009	11.5 ± 0.0	0.104 ± 0.0	
4,4'-Oxydianiline	0.01	1.80 ± 0.02	0.018 ± 0.0002	Mukherjee et al. 2018
p-Cresidine	0.04	12.4 ± 0.0	0.496 ± 0.0	
4,4’-Thiodianiline	0.15	0.513 ± 0.007	0.077 ± 0.001	Mukherjee et al. 2019
4,4'-Methylenedianiline	0.70	0.58 ± 0.10	0.40 ± 0.07	
Bromoxynil	0.90	3.00 ± 0.02	2.70 ± 0.02	Zhang 2019
Ioxynil	0.30	0.51 ± 0.01	0.153 ± 0.003	
3-Hydroxycoumarin	0.002	12.4 ±0.5	0.0257 ± 0.001	Ziayee Bideh et al. 2021
2-Aminobenzoxazole	3.50	129 ± 4	452 ± 14	
CI Acid Blue 113	1.50	8.8 ± 0.6	13 ± 1	Cordova Villegas et al. 2018
CI Direct Black 38	0.75	2.1 ± 0.2	1.57 ± 0.15	
p-Anisidine	0.0018	5.5 ± 0.8	0.0097 ± 0.0010	Kaur et al. 2021
CI Methyl Orange	0.007	7 ± 2	0.05 ± 0.01	

[a] all substrates tested with the same preparation of SBP; normalized half-life comparison devised by Ziayee Bideh et al., 2021.

References for Tables S1 and S2

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Table S3 Relative area ratios (%) for oligomers in enzymatic reaction mixture, directly or in aqueous-organic extract

	2-CP, areas as % of total		**3-CP**, areas as % of total		**4-CP**, areas as % of total		**2,4-DCP**, areas as % of total	
	Aqueous	Aq-organic	Aqueous	Aq-organic	Aqueous	Aq-organic	Aqueous	Aq-organic
dimer	54.7	7.8	27.6	16	77.5	11	-	73.6
dimer(-Cl-H)	-	-	4.9	3.3	11.7	0.1	-	0.1
dimer (-Cl+H)	5.8	-	1.1	-	7.8	0.1	-	1.5
trimer	39.4	38.7	8.4	18.3	-	25	-	16.8
tetramer	-	22.4	18.3	32.2	2.9	41.7	-	5.7
pentamer	-	17.8	18.6	14.8	-	17.8	-	0.55
hexamer	-	11.9	11.5	8.5	-	3.4	-	-
heptamer	-	1.3	6.2	4.1	-	0.35	-	-
octamer	-	-	3.2	2	-	0.4	-	-
nonamer	-	-	-	0.5	-	-	-	-
decamer	-	-	-	0.2	-	-	-	-

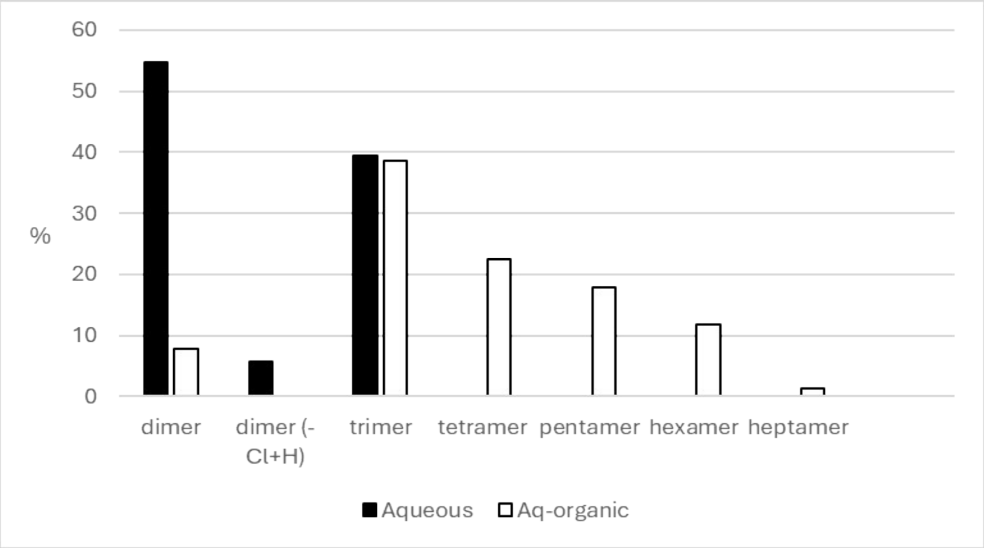

Figure S1 Oligomer distribution for 2-CP in aqueous reaction mixture and in aqueous-organic extract. The enzymatic reaction mixture was filtered directly for the aqueous sample; for the extract, the reaction mixture was diluted 4-fold with acetonitrile, vortexed for an hour, then filtered. MS peak areas (all isomers) are expressed as a % of the total set of areas for that solvent (Table S3).

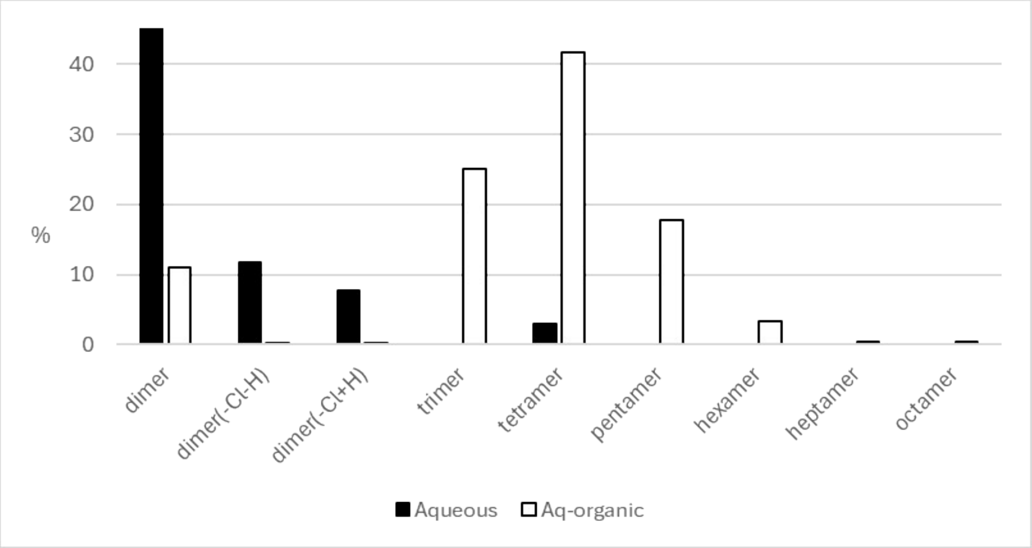

Figure S2 Oligomer distribution for 4-CP in aqueous reaction mixture and in aqueous-organic extract. The enzymatic reaction mixture was filtered directly for the aqueous sample; for the extract, the reaction mixture was diluted 4-fold with acetonitrile, vortexed for an hour, then filtered. MS peak areas (all isomers) are expressed as a % of the total set of areas for that solvent (Table S3).

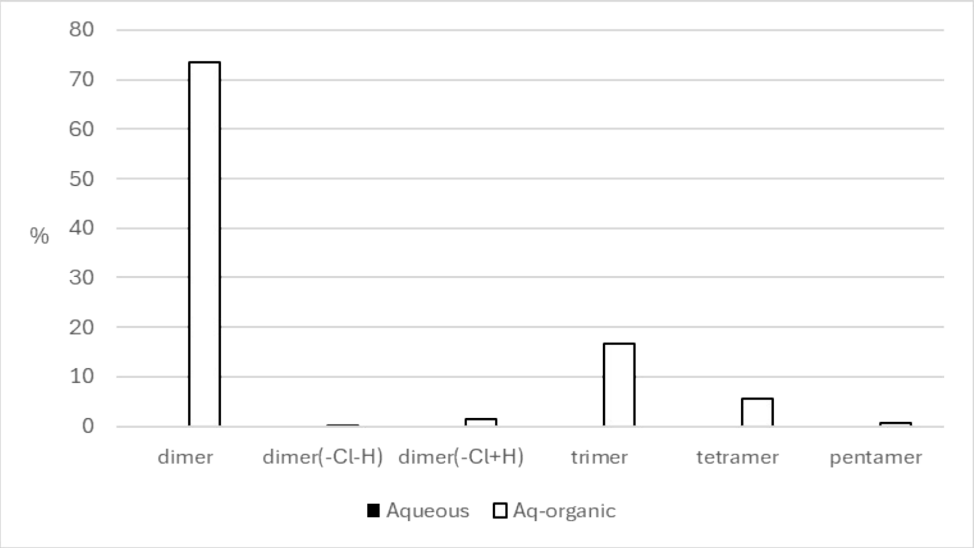

Figure S3 Oligomer distribution for 2,4-CP in aqueous reaction mixture and in aqueous-organic extract. The enzymatic reaction mixture was filtered directly for the aqueous sample; for the extract, the reaction mixture was diluted 4-fold with acetonitrile, vortexed for an hour, then filtered. MS peak areas (all isomers) are expressed as a % of the total set of areas for that solvent (Table S3).