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Screening and evaluation of phenols and furans degrading fungi for the biological pretreatment of lignocellulosic biomass

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Molecules	F		Glu + F		V		Glu + V		S		Glu + S		H		Glu + H		MPF	Glu + MPF	
	2	1	2	1	2	0.5	2	0.5	2	0.25	2	0.25	2	0.25	2	0.25			
																			1 F + 0.5 V + 0.25 S + 0.25 H
Concentrations (g L ⁻¹)	-100% ± 0	-100% ± 0	-97% ± 1	-97% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-99% ± 1	-98% ± 0	-99% ± 0	-98% ± 0	-91% ± 1	-100% ± 0	-100% ± 0	1 F + 0.5 V + 0.25 S + 0.25 H
<i>Alternaria alternata</i>	-96% ± 0	-95% ± 1	-96% ± 1	-94% ± 1	-92% ± 0	-90% ± 0	-90% ± 0	-90% ± 0	-93% ± 1	-93% ± 1	-95% ± 0	-90% ± 0	-98% ± 0	-98% ± 0	-90% ± 0	-90% ± 1	-100% ± 0	-100% ± 0	-99% ± 0
<i>Alternaria tenuissima</i>	-98% ± 0	-95% ± 1	-95% ± 0	-93% ± 0	-99% ± 0	-99% ± 0	-99% ± 0	-99% ± 0	-98% ± 0	-98% ± 0	-98% ± 0	-67% ± 2	-76% ± 3	-76% ± 3	-96% ± 1	-54% ± 2	-100% ± 0	-100% ± 0	-100% ± 0
<i>Aspergillus aculeatus</i>	-96% ± 1	-93% ± 1	-93% ± 1	-92% ± 1	-93% ± 1	-93% ± 1	-93% ± 1	-93% ± 1	-90% ± 0	-90% ± 0	-95% ± 1	-90% ± 0	-100% ± 0	-100% ± 0	-94% ± 1	-90% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Aspergillus candidus</i>	-99% ± 0	-99% ± 0	-98% ± 0	-93% ± 2	-100% ± 0	-65% ± 3	-100% ± 0	-54% ± 2	-100% ± 0	-97% ± 0	-99% ± 0	-94% ± 1	-100% ± 0	-93% ± 0	-98% ± 0	-93% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Aspergillus nidulans</i>	-100% ± 0	-99% ± 0	-62% ± 5	-26% ± 3	-94% ± 1	49% ± 8	-100% ± 0	117% ± 6	-100% ± 0	32% ± 5	-73% ± 5	91% ± 8	-99% ± 0	53% ± 7	-99% ± 0	117% ± 6	-100% ± 0	-100% ± 0	-100% ± 0
<i>Aspergillus niger</i>	-100% ± 0	-98% ± 0	-99% ± 0	-85% ± 0	-100% ± 0	-3% ± 1	-99% ± 0	2% ± 1	-95% ± 2	-21% ± 1	-52% ± 1	-15% ± 1	-98% ± 0	-2% ± 1	-99% ± 0	1% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Aspergillus terreus</i>	-99% ± 1	-99% ± 0	-94% ± 1	-94% ± 1	-98% ± 0	-97% ± 0	-98% ± 0	-94% ± 0	-100% ± 0	-99% ± 0	-97% ± 1	-97% ± 1	-98% ± 0	-92% ± 0	-92% ± 0	-92% ± 0	-100% ± 0	-100% ± 0	-99% ± 1
<i>Aureobasidium pullulans var melanogenum</i>	-98% ± 0	-95% ± 0	-96% ± 0	-94% ± 0	-99% ± 0	-93% ± 1	-94% ± 0	-91% ± 0	-100% ± 0	-94% ± 1	-99% ± 0	-92% ± 1	-97% ± 0	-98% ± 0	-96% ± 0	-91% ± 0	-100% ± 0	-100% ± 0	-97% ± 1
<i>Bjerkandera adusta</i>	-52% ± 2	-41% ± 4	-50% ± 2	-37% ± 3	-99% ± 0	-29% ± 5	-100% ± 0	-12% ± 3	-53% ± 3	-20% ± 11	-54% ± 2	17% ± 10	-100% ± 0	16% ± 3	-100% ± 0	40% ± 16	-78% ± 4	-35% ± 6	-100% ± 0
<i>Byssosclamyces nivea</i>	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-93% ± 0	-91% ± 1	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Cephalorichium stemonitis</i>	-100% ± 0	-97% ± 1	-98% ± 1	-95% ± 1	-99% ± 1	-96% ± 1	-96% ± 1	-95% ± 1	-94% ± 1	-94% ± 1	-92% ± 1	-91% ± 1	-99% ± 1	-99% ± 1	-97% ± 1	-90% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Cladosporium herbarum</i>	-98% ± 0	-98% ± 0	-98% ± 0	-97% ± 0	-99% ± 0	-96% ± 0	-97% ± 0	-97% ± 0	-98% ± 0	-97% ± 0	-98% ± 0	-95% ± 0	-97% ± 0	-97% ± 0	-96% ± 0	-94% ± 0	-100% ± 0	-100% ± 0	-99% ± 0
<i>Cladosporium xilophyllum</i>	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-97% ± 0	-96% ± 0	-94% ± 0	-100% ± 0	-100% ± 0	-99% ± 0
<i>Cladosporium cladosporioides</i>	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Cladosporium pseudocladosporioides</i>	-99% ± 0	-98% ± 1	-98% ± 0	-97% ± 0	-100% ± 0	-99% ± 0	-98% ± 0	-98% ± 0	-97% ± 0	-97% ± 0	-98% ± 0	-97% ± 0	-100% ± 0	-100% ± 0	-98% ± 1	-96% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Cladosporium sphaerospermum</i>	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-97% ± 0	-96% ± 0	-99% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Coniochaeta canina</i>	-96% ± 0	-93% ± 0	-92% ± 1	-92% ± 1	-92% ± 1	-93% ± 1	-92% ± 1	-90% ± 0	-95% ± 0	-92% ± 0	-96% ± 1	-88% ± 1	-96% ± 1	-96% ± 1	-95% ± 1	-85% ± 1	-100% ± 0	-100% ± 0	-99% ± 0
<i>Coprinopsis cinerea</i>	-96% ± 1	-95% ± 0	-99% ± 0	-93% ± 1	-95% ± 1	-96% ± 1	-95% ± 1	-91% ± 1	-95% ± 0	-92% ± 1	-95% ± 0	-91% ± 1	-96% ± 0	-92% ± 0	-92% ± 0	-90% ± 1	-98% ± 1	-100% ± 0	-94% ± 0
<i>Coriopsis gallica</i>	-100% ± 0	-98% ± 0	-99% ± 0	-95% ± 1	-100% ± 0	-97% ± 1	-97% ± 1	-95% ± 0	-95% ± 0	-94% ± 0	-96% ± 1	-92% ± 1	-96% ± 1	-92% ± 1	-92% ± 1	-90% ± 1	-99% ± 0	-100% ± 0	-97% ± 0
<i>Cyclocolea aegeria</i>	-98% ± 0	-95% ± 2	-97% ± 0	-57% ± 2	-98% ± 0	-98% ± 0	-98% ± 0	-98% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-33% ± 1	-99% ± 1	-98% ± 1	-99% ± 0	-40% ± 2	-100% ± 0	-100% ± 0	-100% ± 0
<i>Fusarium fujikuroi</i>	-100% ± 0	-92% ± 1	-100% ± 0	-74% ± 7	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-51% ± 1	-100% ± 0	-53% ± 2	-100% ± 0	-53% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Fusarium proliferatum</i>	-100% ± 0	-100% ± 0	-99% ± 0	-99% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-53% ± 1	-100% ± 0	-100% ± 0	-99% ± 0	-94% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Fusarium verticillioides</i>	-76% ± 1	-67% ± 2	-74% ± 3	-52% ± 3	-100% ± 0	-38% ± 12	-95% ± 0	-24% ± 5	-99% ± 1	-35% ± 2	-100% ± 0	-34% ± 4	-98% ± 1	-25% ± 2	-97% ± 0	-19% ± 2	-100% ± 0	-100% ± 0	-100% ± 0
<i>Ganoderma lucidum</i>	-100% ± 0	-100% ± 0	-100% ± 0	-97% ± 1	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-95% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Lecythophora hoffmannii</i>	-100% ± 0	-100% ± 0	-100% ± 0	-94% ± 0	-100% ± 0	-97% ± 1	-100% ± 0	-74% ± 3	-100% ± 0	-100% ± 0	-100% ± 0	-75% ± 4	-100% ± 0	-100% ± 0	-100% ± 0	-81% ± 3	-100% ± 0	-100% ± 0	-100% ± 0
<i>Mucor circinelloides</i>	-18% ± 1	7% ± 2	-1% ± 6	23% ± 2	-100% ± 0	-21% ± 4	-100% ± 0	11% ± 2	-83% ± 4	28% ± 2	-42% ± 3	28% ± 2	-100% ± 0	-19% ± 4	-100% ± 0	33% ± 7	-100% ± 0	-100% ± 0	-100% ± 0
<i>Paecilomyces variotii</i>	-95% ± 1	-94% ± 2	-95% ± 3	-92% ± 3	-97% ± 1	-90% ± 2	-95% ± 1	-90% ± 1	-98% ± 1	-93% ± 1	-93% ± 1	-92% ± 1	-92% ± 1	-92% ± 1	-91% ± 1	-92% ± 2	-98% ± 1	-100% ± 0	-98% ± 1
<i>Penicillium roqueforti</i>	-100% ± 0	-100% ± 0	-100% ± 0	-99% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-98% ± 1	-99% ± 1	-97% ± 1	-99% ± 0	-93% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Phanerochaete chrysosporium</i>	-97% ± 0	-96% ± 0	-95% ± 0	-96% ± 1	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-99% ± 1	-100% ± 0	-97% ± 1	-100% ± 0	-94% ± 1	-96% ± 1	-91% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Pleurotus ostreatus</i>	-96% ± 1	-96% ± 1	-95% ± 1	-91% ± 1	-100% ± 0	-93% ± 0	-100% ± 0	-91% ± 1	-94% ± 1	-94% ± 1	-94% ± 1	-91% ± 1	-100% ± 0	-90% ± 2	-95% ± 1	-90% ± 2	-99% ± 0	-100% ± 0	-98% ± 0
<i>Porostereum/Lopharia spadicea</i>	-100% ± 0	-100% ± 0	-100% ± 0	-63% ± 4	-100% ± 0	-98% ± 0	-100% ± 0	-99% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-53% ± 1	-100% ± 0	-71% ± 0	-100% ± 0	-65% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Purpureocillium liliacinum</i>	-100% ± 0	-97% ± 0	-100% ± 0	-98% ± 0	-100% ± 0	-98% ± 0	-99% ± 0	-57% ± 0	-100% ± 0	-97% ± 0	-98% ± 0	-74% ± 1	-100% ± 0	-65% ± 3	-98% ± 1	-55% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Syncephalastrum racemosum</i>	-100% ± 0	-92% ± 1	-92% ± 2	-92% ± 1	-100% ± 0	-100% ± 0	-100% ± 0	-64% ± 1	-100% ± 0	-55% ± 2	-100% ± 0	-53% ± 2	-100% ± 0	-82% ± 1	-98% ± 0	-54% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Trametes gibbosa</i>	-98% ± 1	-95% ± 0	-96% ± 0	-94% ± 0	-98% ± 1	-93% ± 0	-100% ± 0	-94% ± 1	-92% ± 1	-99% ± 0	-96% ± 1	-90% ± 1	-99% ± 0	-96% ± 1	-96% ± 1	-91% ± 1	-100% ± 0	-100% ± 0	-100% ± 0
<i>Trametes pubescens</i>	-100% ± 0	-100% ± 0	-100% ± 0	-95% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-93% ± 0	-100% ± 0	-87% ± 1	-100% ± 0	-66% ± 2	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0	-100% ± 0
<i>Trametes versicolor</i>	-96% ± 1	-94% ± 1	-93% ± 0	-93% ± 0	-100% ± 0	-87% ± 1	-100% ± 0	-73% ± 1	-100% ± 0	-96% ± 0	-92% ± 1	-92% ± 1	-99% ± 0	-92% ± 1	-98% ± 1	-90% ± 1	-100% ± 0	-100% ± 0	-93% ± 0
<i>Trichoderma asperellum</i>	-100% ± 0	-100% ± 0	-100% ± 0	-97% ± 1	-100% ± 0	-97% ± 1	-100% ± 0	-60% ± 2	-100% ± 0	-68% ± 2	-100% ± 0	-56% ± 1	-99% ± 0	-77% ± 1	-100% ± 0	-61% ± 2	-100% ± 0	-100% ± 0	-100% ± 0
<i>Trichoderma harzianum</i>	-100% ± 0	-100% ± 0	-94% ± 2	-94% ± 2	-100% ± 0	-100% ± 0	-100% ± 0	-76% ± 2	-100% ± 0	-66% ± 2	-100% ± 0	-68% ± 2	-100% ± 0	-60% ± 2	-100% ± 0	-55% ± 3	-100% ± 0	-100% ± 0	-100% ± 0
<i>Umbelopsis/Mortierella isabellina</i>	-98% ± 0	-97% ± 0	-94% ± 1	-94% ± 1	-96% ± 1	-97% ± 0	-97% ± 0	-66% ± 1	-99% ± 0	-90% ± 1	-98% ± 0	-59% ± 2	-99% ± 0	-99% ± 0	-98% ± 1	-57% ± 2	-100% ± 0	-100% ± 0	-100% ± 0

SPECIES