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Effects of Bio and Epoxidised Oil on Physical and Biological Properties of Treated Wood

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Problem Statement

- Because of public concern about the use of arsenic, the restriction or ban of chromium and arsenic containing preservatives in the EU countries and the US.
- Furthermore, copper-containing formulations have also very high aquatic toxicity, introducing further environmental concern in addition to Cr and As.



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Objectives

- To determine the effects of oils on physical and biological properties of wood materials
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- For this purpose, two types of oils were used.
 - bio-oils obtained from either heat treatment process
 - or pyrolysis process of annual plant.
 - Epoxidised linseed oil was also used.



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Results- bio-oils obtained from heat treatment



WA & TS%

Treatments	Retention (kg m ⁻³)	Retention	
		10 min	48 h
10% bio-oil	46.37 (2.01)	27.75 ^{ca} (0.98) ^b	59.61 ^d (0.09)
10% bio-oil + ELO	44.33 (2.02)	1.91 ^a (0.01)	20.99 ^b (0.67)
20% bio-oil	99.05 (2.74)	14.53 ^b (2.20)	43.03 ^c (1.51)
20% bio-oil + ELO	100.79 (0.83)	1.93 ^a (0.20)	21.29 ^a (0.24)
Only ELO	202.50 (24.04)	1.59 ^a (0.47)	26.53 ^b (1.40)
Control	-	56.77 ^d (2.38)	75.05 ^e (2.26)
Tangential swelling (%)			
10% bio-oil	46.37 (2.01)	5.37 ^{ca} (0.05) ^b	6.10 ^a (0.10)
10% bio-oil + ELO	44.33 (2.02)	0.42 ^a (0.14)	5.48 ^a (0.13)
20% bio-oil	99.05 (2.74)	3.77 ^b (0.37)	6.12 ^a (0.11)
20% bio-oil + ELO	100.79 (0.83)	0.25 ^a (0.10)	5.39 ^a (0.01)
Only ELO	202.50 (24.04)	0.37 ^a (0.08)	5.37 ^a (0.08)
Control	-	5.92 ^d (0.19)	6.04 ^a (0.67)

Biological properties of bio-oils

Treatment	Weight losses (%)			
	Test		Control	
	Average	St.D.	Average	St.D.
<i>Trametes versicolor</i>				
10% bio-oil	2.23	0.40	16.03	2.73
10% bio-oil + ELO	6.10	1.00	14.59	1.76
20% bio-oil	1.35	0.38	18.13	4.71
20% bio-oil + ELO	3.41	0.31	15.58	1.39
<i>Coniophora puteana</i>				
10% bio-oil	1.53	0.79	27.19	5.52
10% bio-oil + ELO	2.43	1.82	30.17	5.70
20% bio-oil	1.44	0.74	29.61	5.84
20% bio-oil + ELO	4.90	3.10	22.46	1.23

Results- bio-oils obtained from pyrolysis process



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Treatment	Retention (kg m ⁻³)	Retention (kg m ⁻³)	
		15 min	48 h
20% bio-oil + ELO	104.99 (8.01)	4.84 ^{a*} (1.63) ^{**}	36.78 ^a (2.47)
20% bio-oil	102.24 (3.32)	31.30 ^c (2.82)	70.82 ^b (3.18)
10% bio-oil + ELO	49.91 (1.18)	6.19 ^{ab} (0.93)	40.00 ^a (0.94)
10% bio-oil	48.30 (1.88)	42.22 ^d (0.73)	79.96 ^c (0.53)
Control	-	63.77 ^e (1.97)	89.94 ^o (3.83)
TS %			
20% bio-oil + ELO	104.99 (8.01)	0.47 ^{a*} (0.1) ¹	5.09 ^{ab} (0.17)
20% bio-oil	102.24 (3.32)	4.88 ^c (0.06)	5.25 ^{bc} (0.19)
10% bio-oil + ELO	49.91 (1.18)	0.72 ^a (0.14)	4.92 ^a (0.03)
10% bio-oil	48.30 (1.88)	5.08 ^c (0.23)	5.42 ^{cd} (0.31)
Control	-	5.75 ^d (0.15)	6.15 ^e (0.17)

Treatment	Oil retention (kg m ⁻³)	Weight loss treated, (%)	Weight loss control, (%)
<i>Trametes versicolor</i>			
20% bio-oil + ELO	106.67 (2.61)**	0.99 ^{a*} (0.98)	19.52 (2.60)
20% bio-oil	108.26 (0.61)	1.87 ^{ab} (0.58)	20.25 (1.61)
10% bio-oil + ELO	54.13 (1.97)	1.48 ^b (1.15)	15.90 (3.98)
10% bio-oil	52.8 (1.44)	6.88 ^c (3.20)	21.13 (3.09)
<i>Postia placenta</i>			
20% bio-oil + ELO	104.53 (3.79)	1.14 ^a (0.74)	34.37 (4.88)
20% bio-oil	108.53 (1.82)	1.26 ^a (0.39)	41.6 (11.00)
10% bio-oil + ELO	54.13 (1.02)	1.49 ^a (1.33)	33.9 (3.63)
10% bio-oil	52.8 (0.43)	5.14 ^b (3.16)	32.4 (3.66)
<i>Gloeophyllum trabeum</i>			
20% bio-oil + ELO	102.13 (3.93)	1.75 ^{a*} (1.60)	37.35 (7.73)
20% bio-oil	106.41 (2.80)	2.39 ^{ab} (0.35)	28.39 (6.56)
10% bio-oil + ELO	53.06 (1.26)	3.90 ^b (1.75)	34.73 (5.31)
10% bio-oil	52.8 (1.30)	3.90 ^b (0.44)	27.48 (7.36)
<i>Coniophora puteana</i>			
20% bio-oil + ELO	106.13 (3.31)	0.89 ^{a*} (1.68)	52.12 (2.71)
20% bio-oil	105.6 (2.80)	2.60 ^a (0.55)	54.26 (2.25)
10% bio-oil + ELO	52.4 (1.59)	2.14 ^a (0.47)	54.91 (3.75)
10% bio-oil	52.26 (1.15)	2.99 ^a (0.48)	57.07 (4.13)



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Conclusions

- The decay resistance of the wood samples treated with 20 % bio-oil obtained from both a pyrolysis process and a heat treatment process against white (*T. versicolor*) and brown rot (*P. placenta*) fungi was very effective (less than 3 % weight loss) (Temiz *et al.* 2013a; 2013b).
- Tangential swelling of control samples remained higher than all treated samples. A secondary treatment with ELO further reduced tangential swelling, but the effect was somewhat limited (Temiz *et al.* 2013a; 2013b).



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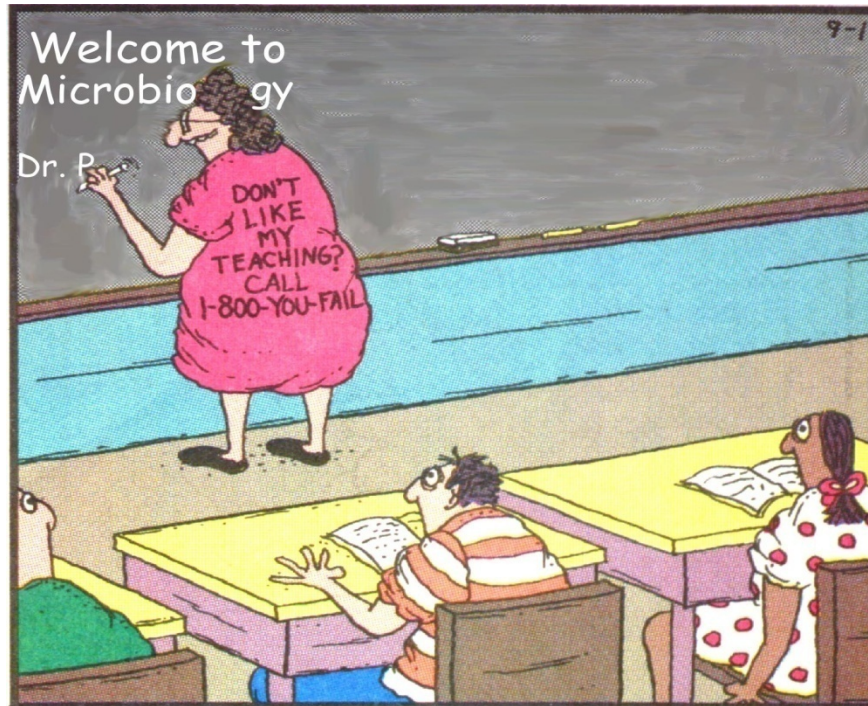
Thank you



COST Action FP1407 1st Conference "Life Cycle Assessment, EPDs and modified wood" Koper, Slovenia
August 25th– August 26th, 2015



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