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Chromatographic approaches for determination of low-molecular mass aldehydes in bio-oil

Catherine Tessini[a], Niels Müller[b], Claudia Mardones[a], Dietrich Meier[c], Alex Berg[b], Dietrich von Baer[a,*]

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In the context of phenol/formaldehyde resin formulation, the aldehyde fraction of bio-oil is very important. Additionally, the toxicity of some volatile aldehydes, especially formaldehyde (Permissible exposure limit (PEL) in air at working places is 0.75 $mg\,L^{-1}$ [5]) demands their quantification in bio-oil. The presence of hydroxyacetaldehyde (glycolaldehyde), formaldehyde and acetaldehyde in bio-oil, has been previously described [2–4,6]. Determination of hydroxyacetaldehyde has been carried out using direct injection to a gas chromatograph coupled to a mass selective detector for identification of compounds and flame ionization detector coupled to the system (GC/MS/FID) for quantification [6]. Other aldehydes, as propionaldehyde and different substituted furaldehydes, can also be detected and quantified using this system [6].

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Are these the most representative references?

ISI search: Chromatograph* + aldehyde* + bio-oil (topic)

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Detailed characterization of the pyrolytic liquids obtained by pyrolysis of sawdust

Ali Sınağ*, Burçin Uskan, Selen Gülbay

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On the other hand, quantification of formaldehyde and acetaldehyde in bio-oil has not been deeply achieved yet. Determination of these aldehydes in bio-oil using high performance liquid chromatography (HPLC) preceded by derivatization with 2,4-dinitrophenylhydrazine (DNPH) has been mentioned in only one reference, without enough information about the analytical quality of the obtained results [7]. This approach has been widely described

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In a recent study, Sinag et al. [] used ion chromatography to analyze the bio-oil obtained from sawdust and reported that the contents of formaldehyde and acetaldehyde were dependent on the pyrolysis temperature.

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Table 5
Determination of aldehyde-PFBHA oxime in bio-oil samples, by two optimized method.

Bio-oil samples	Formaldehyde (wt%)		Acetaldehyde (wt%)		Propionaldehyde (wt%)	
	D-HS	OFD-HS-SPME	D-HS	OFD-HS-SPME	D-HS	OFD-HS-SPME
1	1.6 ± 0.3	1.9 ± 0.2	0.08 ± 0.03	0.03 ± 0.01	0.03 ± 0.02	0.012 ± 0.007
2	0.8 ± 0.2	1.3 ± 0.3	0.03 ± 0.01	0.01 ± 0.01	ND	LD > LQ
3	1.8 ± 0.3	2.2 ± 0.2	ND	0.03 ± 0.01	ND	LD > LQ
4	0.9 ± 0.1	1.7 ± 0.2	0.09 ± 0.04	0.12 ± 0.07	ND	0.04 ± 0.01
5	1.1 ± 0.3	1.7 ± 0.2	0.07 ± 0.01	0.04 ± 0.01	ND	0.010 ± 0.005
6	3.2 ± 0.5	3.6 ± 0.4	ND	0.05 ± 0.01	ND	0.023 ± 0.007
7	2.1 ± 0.4	2.4 ± 0.3	0.06 ± 0.01	0.02 ± 0.01	ND	0.014 ± 0.003
8	2.3 ± 0.4	2.0 ± 0.2	0.11 ± 0.04	0.03 ± 0.01	ND	0.010 ± 0.003

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showing a *p*-value higher than 0.05. Finally, in Table 5 the quantitative results for aldehydes in different bio-oil samples are shown.

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It is interesting to note that the contents of formaldehyde and acetaldehyde (in these bio-oil samples derived from ??) are similar to the values reported by Sinag et al. [] (for sawdust-derived bio-oil), which ranged (as a function of pyrolysis temperature) from 0.0 to 2.6% and 0.04 to 0.17%, respectively.