

Supporting Information

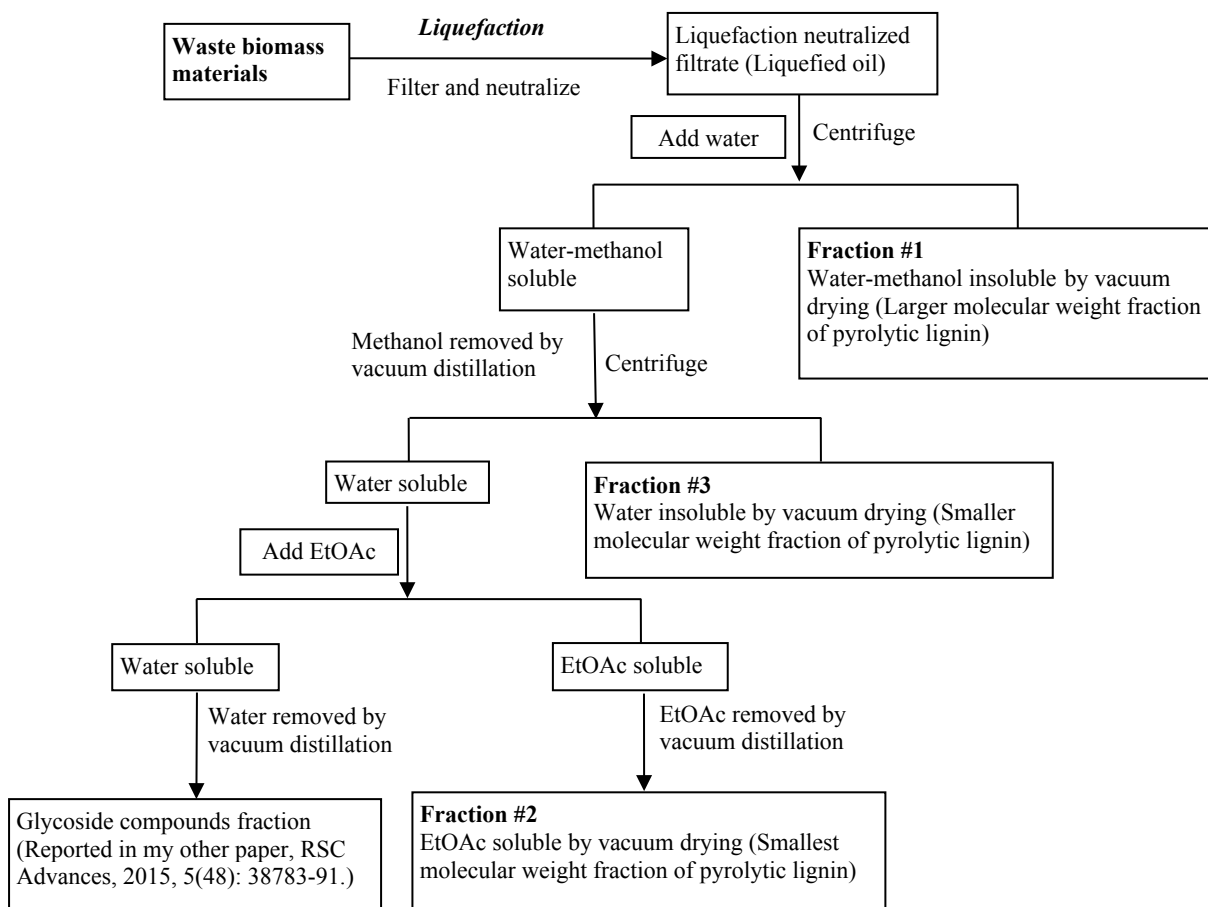


Fig. 1 Flowchart for phenolic compounds fractions separated from liquefied oil.

The three phenolic compounds fractions were obtained from liquefied waste mason pine with the process shown in Fig. 1. There were two steps to prepare three phenolic compounds fractions from waste biomass materials including liquefaction and separation. The liquefaction of waste biomass materials was reaction with 60 g mason pine powders, 420 g methanol, 1.5 g sulfuric acid, and the mixtures were heated at 200 °C and kept for 30 min in an autoclave. The liquefied product was a yellowish powder consisted of many compounds. After the liquefaction, three phenolic compounds fractions could be largely separated from liquefied products by addition of water and organic solvent with other stepwise methods, such as extraction, centrifugation and distillation. Deionized water was added into liquefaction neutralized filtrate (liquefied oil) with the weight ratio of 3:10, insoluble pyrolytic lignin with high molecular weight in water will precipitate by centrifuge of mixture liquid. Then, the methanol was removed by distillation of the mixture liquid under vacuum at 50 °C, after which the lower molecular weight fraction of pyrolytic lignin will be separated out. Furthermore, about 20 g ethyl acetate (EtOAc) was added into the mixture liquid (mixture liquid to EtOAc with the weight ratio of 1:1) while the methanol was removed completely, the liquefied oil mixtures were separated into water soluble phase and EtOAc soluble phase. Distilled the EtOAc soluble phase under vacuum at 45 °C to remove the EtOAc, and the lowest molecular weight fraction of pyrolytic

lignin will be separated. These three phenolic compounds fractions of pyrolytic lignin are phenols separated from liquefied oil (Fig. 1). The three parts of phenolic compounds were diluted with acetone for GC-MS analysis.

The main components of three phenolic compounds fractions from liquefied waste mason pine were investigated in detail and were shown in Table 1. Various phenols and their derivatives were detected in the product, such as guaiacol, 2-methoxy-4-propyl phenol, 4-ethyl-2-methoxyphenol, 4-ethylguaiacol, and 3-methylcatechol. This result indicated the polymeric lignin in mason pine had been effective depolymerized into low molecules products during the liquefaction process.

Table 1 The main components of three phenolic compounds fractions and depolymerized lignin.

Retention time(min)	Identification by GC-MS	Percentage (wt%)			Depolymerized lignin
		Phenolic compounds fractions	1#	2#	
—	Total phenolic compounds	77.59	81.76	80.19	78.86
10.19	Phenol	0.69	4.72	1.27	1.21
10.77	2-Methylphenol	0.17	7.36	2.79	2.34
15.48	Guaiacol	1.28	6.33	4.89	3.02
17.35	4-Methylphenol	0.78	7.15	6.19	5.66
18.09	3-Methyl-4-ethylphenol	1.17	9.35	5.42	4.72
19.46	4-Ethyl-2-methoxyphenol	5.09	8.25	7.19	5.36
23.27	4-Ethylguaiacol	3.31	7.14	8.57	6.98
24.50	Phenol 4-carboxylate	2.50	—	3.20	10.17
26.15	3-Methylcatechol	7.28	14.39	13.25	9.92
27.66	4-Methyl-2,6-diisopropyl phenol	10.13	6.67	4.94	8.21
28.36	4-Hydroxy-3-methoxyphenyl-2-ethanol	15.45	0.84	4.92	7.19
29.47	2-Methoxy-4-propyl phenol	10.03	6.29	5.13	5.02
30.80	4-Acetylguaical	5.33	3.27	7.69	2.93
31.82	4-Propyl cyclohexane-phenol	5.18	—	3.76	1.92
33.35	3,5-Dimethoxy-4-methylphenol	11.20	—	0.98	4.21
—	Others	10.51	11.98	8.58	10.78
7.39	2-Methoxy-furan	—	2.04	—	—
8.17	Methyl levulinate	—	—	0.14	—
10.94	1,1,3-Trimethyl-cyclohexane	—	2.21	—	0.54
17.64	3-Methyl-cyclohexane	2.40	3.27	1.21	3.58
29.60	1-Methylene-3-(1-methylethenyl)-cyclohexane	1.26	2.11	—	1.48
30.57	2,5-Dimethyl-2,4-hexadiene	4.29	—	1.84	2.14
31.28	Methyl octanoate	2.55	—	4.30	0.32
32.65	1,1-Dimethoxy-2-phenylpropane	—	—	1.09	—
35.51	Tridecanoic acid methyl ester	—	2.35	—	2.72
—	Uncertain compounds	11.91	6.23	11.23	9.36