Study of liquid and solid product formation after hydrothermal processing of carbohydrate and aromatic biomass derivatives

PostDoc Latvia

Ance Plavniece, Kristine Meile, Kalvis Liepins, Galina Dobele and Aivars Zhurinsh
Latvian State Institute of Wood Chemistry, Dzerbenes Str. 27, LV-1006 Riga, Latvia

The aim of this study is to investigate the effect of the composition of different biomass derivatives (anhydrous sugars and phenols) on the morphology and properties of solid products and composition of liquid products obtained in the process of HTC. The study of processing of these model derivatives will contribute to the understanding of the reaction mechanisms of the synthesis processes.

. Materials and methods

1.The **biooil** is a product from the two successive pilot wood (spruce chips particle size <0,5 mm), processing processes: catalytic hydrolysis (catalyst is 0.2% sulphuric acid) where the target product is furfural and pyrolysis (370 °C) of produced lignocellulose residues in a superheated steam, where the target chemical is anhydrous sugars (1,6-anhydrosaccharide—levoglucosan).

SCAN THE QR TO LEARN MORE ABOUT BIOOIL PRODUCTION

2.Using Ion Exchange Resins, the **anhydros sugar fraction** was separated from the biooil, but the **phenol-rich fraction** remains as a by-product.

SCAN THE QR TO LEARN MORE ABOUT SEPARATION

3.The three resulting 2% feedstock solutions (biooil (BS), anhydrous sugars (AS), phenol-rich fraction (FS) were hydrothermally treated at 200, 250 and 300 °C for 4 hours.

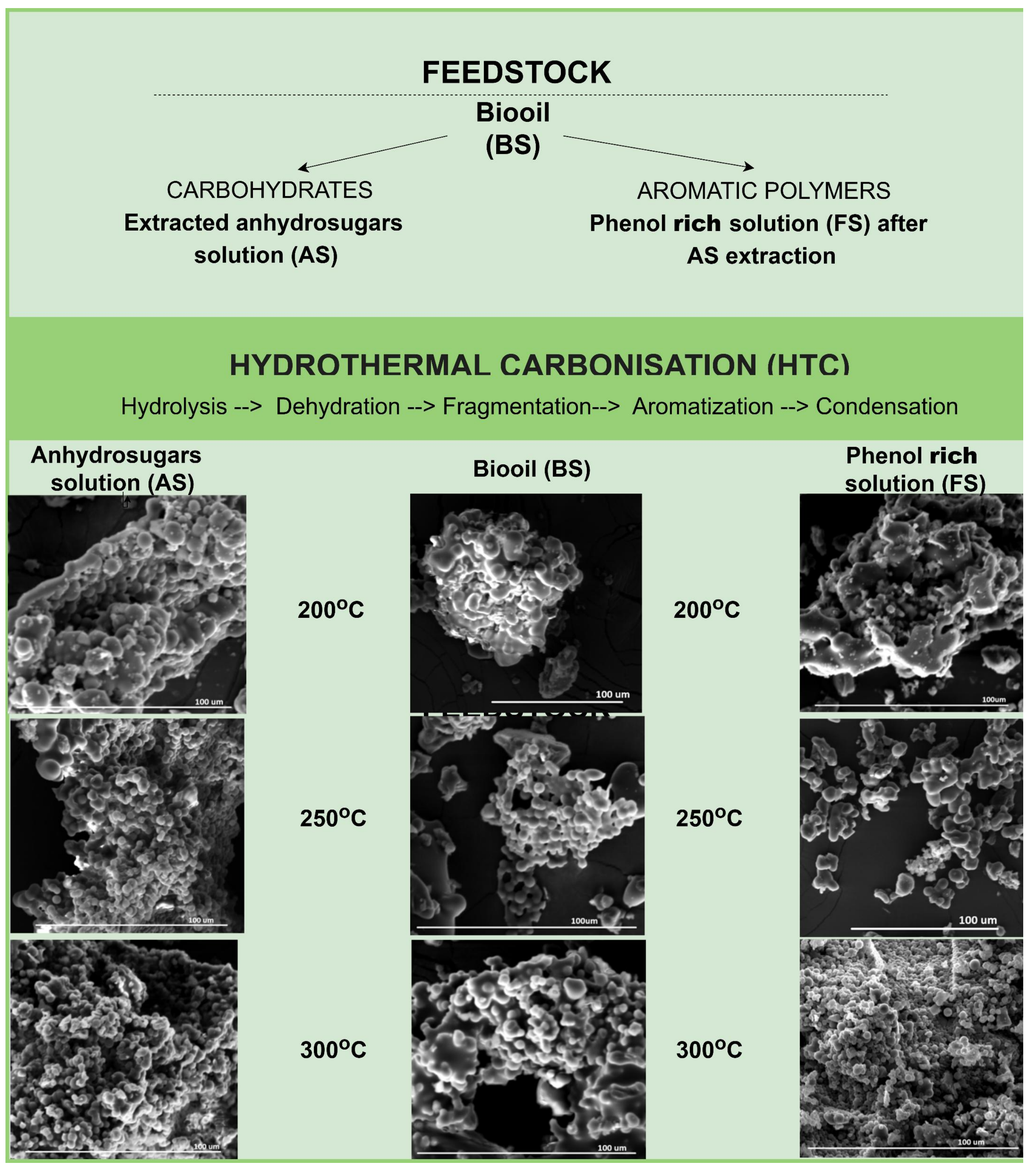


Fig. 1 Yield and elemental composition of biooil (BS), Phenol rich solution (FS) and anhydrous sugars solution (AS) and hydrothermal treated samples at different carbonisation temperatures (200, 250 and 300 °C).

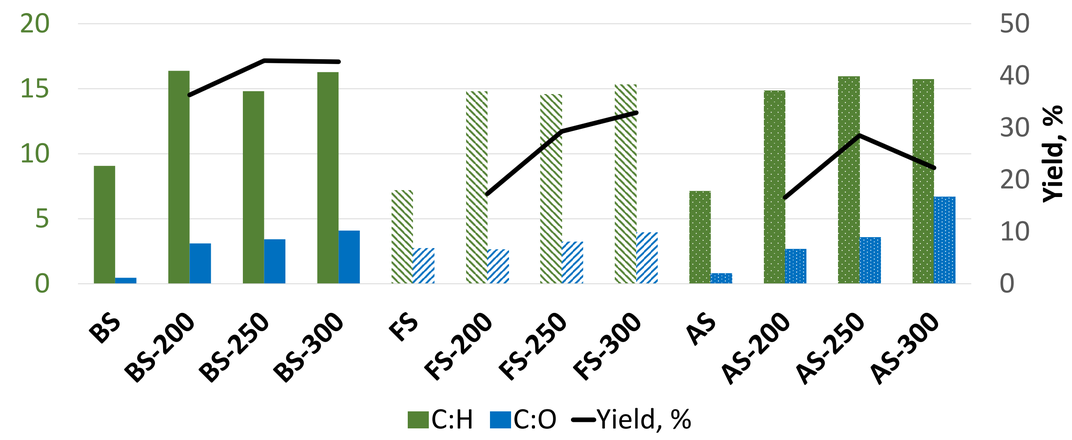
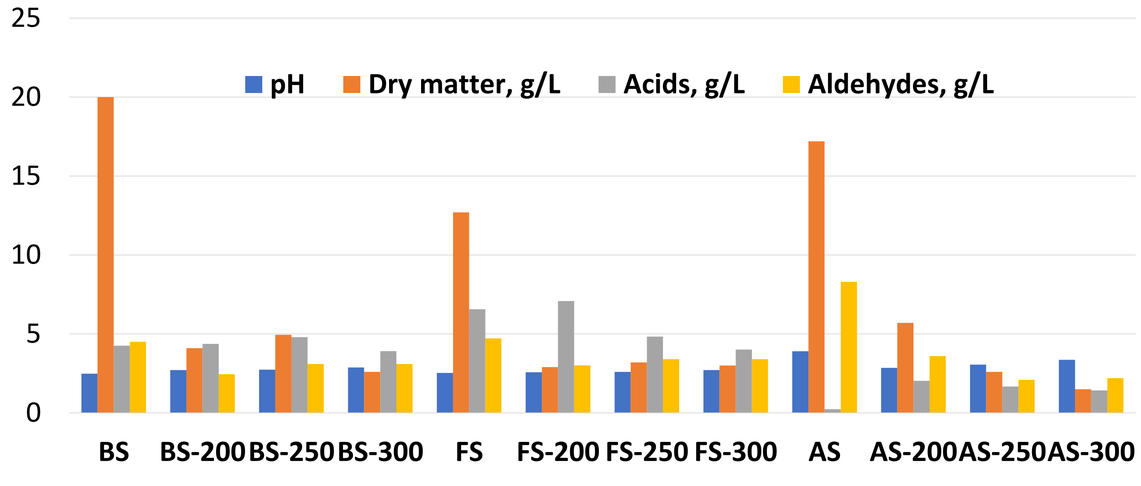


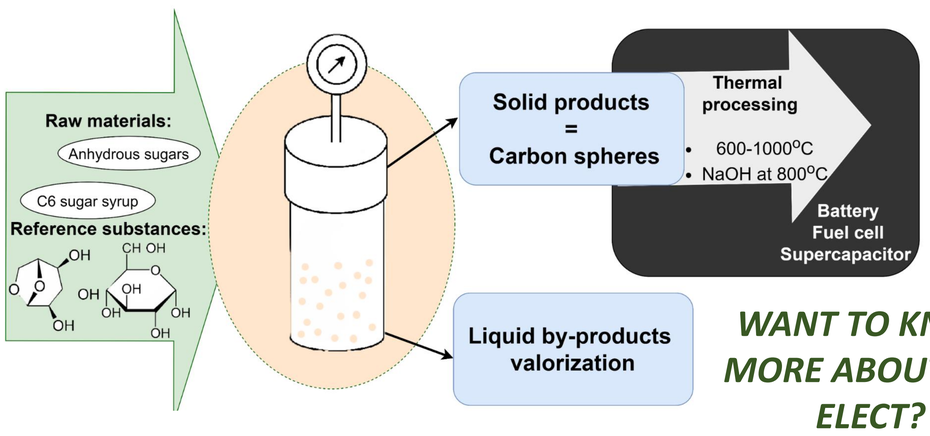
Table 1. Composition of volatile degradation products of biooil (BS), Phenol rich fraction (FS) and anhydrous sugars (AS) and hydrothermal treated samples at different carbonisation temperatures (200, 250 and 300 °C) determined by Py-GC/MS at 500 °C.

	BS	BS-200	BS-250	BS-300	FS	FS-200	FS-250	FS-300	AS	AS-200	AS-250	AS-300
Carbohydrates (Carbohydrates+Lignin derivates=100%)	**98.16**	**57.90**	**55.97**	**49.14**	**76.65**	**32.36**	**27.06**	**29.20**	**99.21**	**79.02**	**66.94**	**64.08**
Acid, Ester, Ether	6.13	19.85	22.68	16.51	28.01	9.77	9.04	11.08	4.88	14.67	11.86	12.80
Alcohol	7.77	0.37			14.25	0.36			1.03			
Aldehyde, Ketone	10.39	11.45	13.98	9.48	10.36	8.33	8.26	7.06	11.34	20.63	19.18	12.53
Cyclopentane derivates	1.02	9.32	10.99	17.36	2.45	5.05	5.75	8.04	1.35	11.63	22.65	30.79
Furan	14.76	13.28	6.39	4.85	11.33	6.20	2.68	1.58	7.17	30.29	11.97	6.80
Pyran	0.82				0.52				1.64			
Sugars	**57.27**	3.63	1.93	0.94	**9.73**	2.65	1.33	1.44	**71.80**	1.80	1.28	1.16
Lignin derivates (Carbohydrates+Lignin derivates=100%)	**1.84**	**42.10**	**44.03**	**50.86**	**23.35**	**67.64**	**72.94**	**70.80**	**0.79**	**20.98**	**33.06**	**35.92**
Phenyl and benzyl derivates	0.12	21.10	24.06	29.82	1.09	16.40	19.45	29.40	0.05	12.47	23.57	28.93
Guaiacyl derivates	1.72	22.00	19.97	21.04	22.26	51.24	53.49	41.40	0.74	8.51	9.49	6.99

Fig. 2 pH, dry matter, acids and aldehydes concentration of biooil (BS), Phenol rich solution (FS) and anhydrous sugars solution(AS) and liquid products after hydrothermal carbonisation.



Hydrothermal processing as a platform for valorization of value added solid and liquid biomass based products (HTCelect)



WANT TO KNOW MORE ABOUT HTC ELECT? SCAN ME!

Preliminary BATTERY tests

Negative case

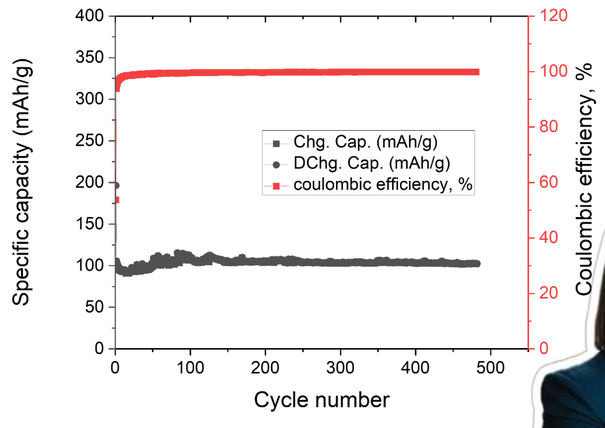
Spring

Spacer and Anode-sodium

Separator

Cathode with active component

Positive case



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ANCE PLAVNIECE
E-mail: ance.plavniece@kki.lv
Latvian State Institute of Wood Chemistry,
27 Dzerbenes Street, Riga, Latvia, LV-1006 www.kki.lv