Supporting Information

Valorisation of humic acids by hydrothermal conversion into carbonaceous materials: physical and functional properties

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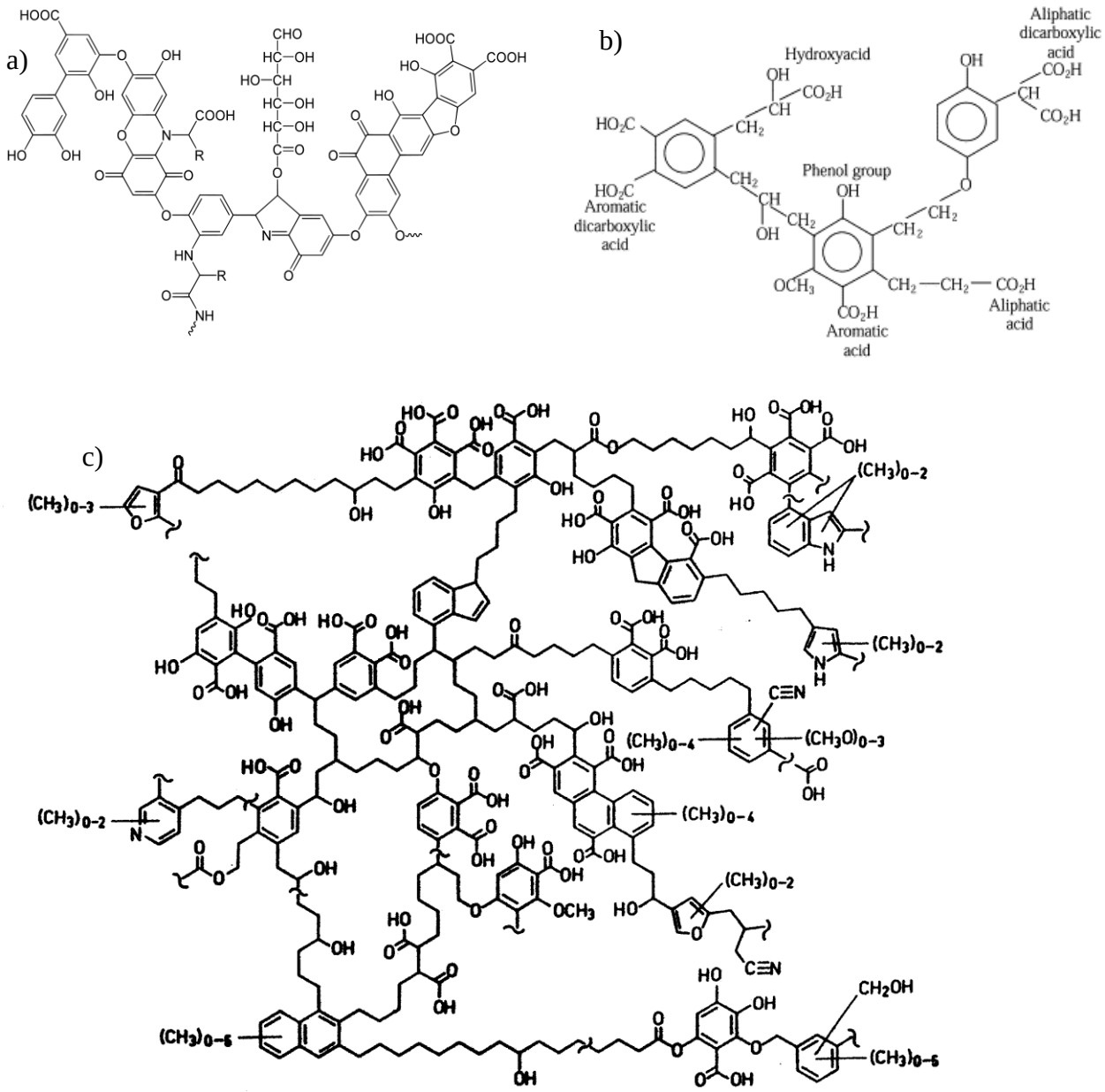

Fig. S1. Schematic structures of HA. a – Stevenson[1]; b – Duan and Gregory [2]; c – Schulten and Schnitzer [3]

a - Adapted with permission from Stevenson, F. J., *Humus chemistry: genesis, composition, reactions*. John Wiley & Sons: New York, 1994. Copyright 1994 John Wiley and Sons.
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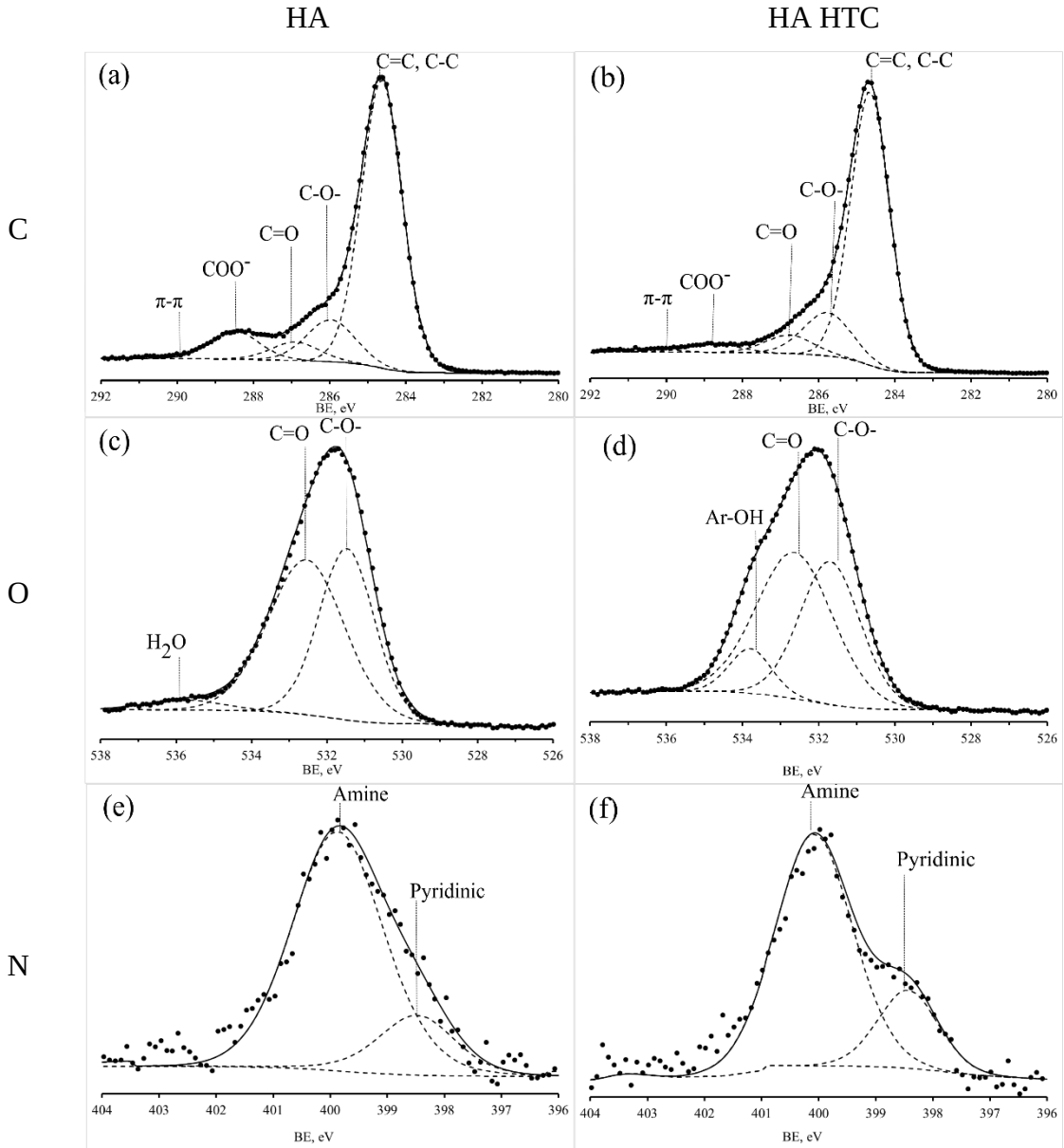

Fig S2. XPS of HA and HA after HTC treatment. a - C1s of HA; b - C1s of HA HTC; c - O1s of HA; d - O1s of HA HTC; e - N1s of HA; f - N1s of HA HTC

Table S1. Assignment of FTIR bands

Region, cm^{-1}	Assignment	Reference
3700-3600	Inorganic Al and Si	4, 5
3060	Aromatic C	6, 7
3000-2800	Aliphatic CH_2 and CH_3, Methoxy	6, 7
1705	Ketones, esters	6, 7
1670	amides, quinones, or H-bonded conjugated ketones,	6
1590	COO-	8
1445	Aliphatic C-H, methylene, methyl	6, 9, 10
1374	-CO-CH3, O-H, C-O, methyl bonding	6
1280	O-H alcohol, C-O-C arylether	6, 9, 11
1100-1015	C-O of polysaccharides, Si-O, Aromatic C-H, C-O of alcohol, C-O-C or arylethers	6, 11, 12
950-630	Aromatic C-H	6
630-400	Inorganic Al and Si	4, 5

Table S2. Assignment of NMR bands

Assignment	Region (ppm)	Association	Reference
(a)	0-44	Unsubstituted saturated alkyl	13-19
(b)	44-60	Alkyl with O an N substituents	
(c)	60-93	Single bonded alkyl with O	
(d)	93-110	Double bonded alkyl with O	
(e)	110-140	Aromatic with alkyl or proton substituents	
(f)	140-164	Oxygen substituted aromatic	
(g)	164-190	Carboxyl, ester and amide	
(h)	190-220	Aldehydes and ketones	

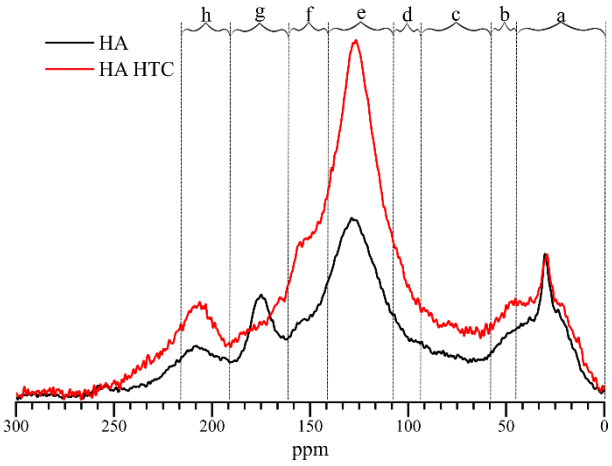

Fig S3. NMR CP MAS HPDEC of HA and HA after HTC treatment

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