1. Phosphorus Concentrations in Environmental Samples

1.9 Charcoal

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Coal originates from organic material by the geochemical process coalification at high pressure, high temperatures and exclusion of air. Millions of years ago, as peat accumulated biomass in moors has been converted to brown (mostly Tertiary) and black (mostly Carboniferous / Permian period) coal after burying with sediments. The type of coal is defined by their carbon concentration in ash and water free dry matter (65-75 % brown coal (or lignite), 75-91 % black coal) (Kölling & Schnur 1977 cites in Franck & Knop 1979). P concentrations in coal can be very important for some applications; e.g. for steel production P concentration has to be as low as possible (da Silva Machado et al. 2010).

Biochar is coal from recent biomass, converted to "char" by pyrolysis. Dependent on original biomass, wood char, bone char and digestate char can be distinguished. In comparison to bone char the TP concentrations in wood char is low (table 1.9-1). Generally, TP concentrations of all biochar vary with their origin and P concentrations increase with increasing pyrolysis temperature (Titiladunayo et al. 2012, Funke et al. 2013). Poultry, which is optimized for a low mass has low P concentrations. TP concentrations in bone char are also affected by remaining meat to the bone (e.g. Zwetsloot et al. 2015).

Table 1.9-1 TP concentrations (g kg^{-1} dry $matter^{-1}$) in charcoal and pyrolysis temperature for recent biomass (°C); (DM = dry matter)

Type	Origin	pyrolysis temperature (°C)	TP (mg kg^{-1} DM^{-1})	Reference
Brown coal (lignite)	Brazil		0.218	da Silva Machado et al. (2010)
	outside Brazil		5.633-7.161	
Black coal	Australia		0.02-5.87	Riley et al. (1990)
			0.32[1]	
Wood char	Iroko-wood	400	0.070	Titiladunayo et al. (2012)
	Apa-wood	400	0.031	
		500	0.042	
		600	0.051	
		700	0.058	
		800	0.062	
Bone char	Cattle	400	134	Warren et al. (2009)
	Poultry	350	83	Zwetsloot et al. (2015)
	Bone with remaining meat	60-750	33-110	
	purified bones		86-153	
Digestate char	Ash free wheat straw	190-250	1-2	Funke et al. (2013)

References

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