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Phosphorus recovery from digested chemical P removal sludge using acid solubilization and adsorption with bio-based materials

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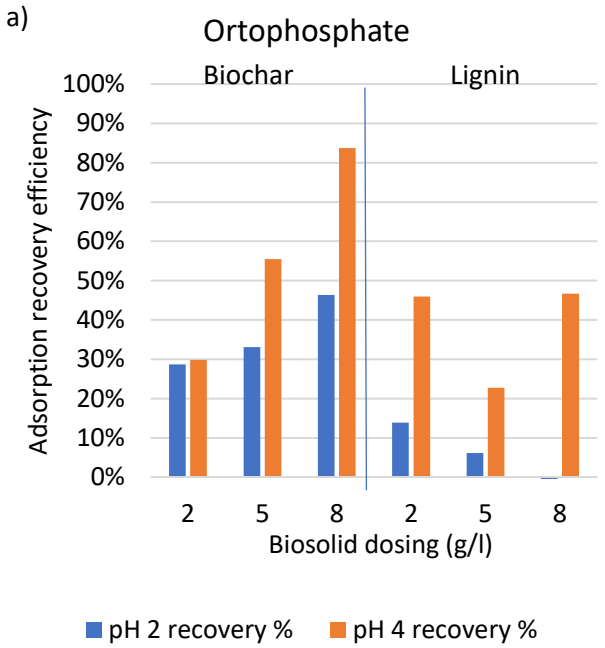
Leaching and adsorbance

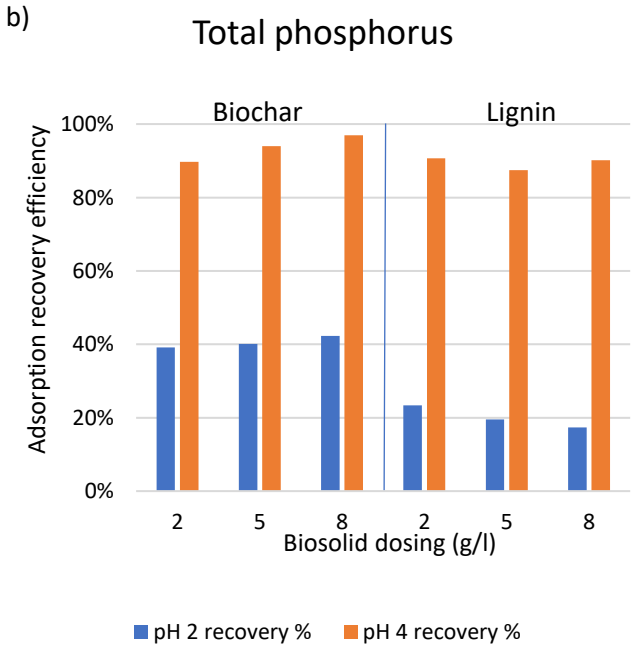
Phosphorus is separated from P and Fe rich sludge by acid leaching

- **Lower pH 2 was clearly more effective than pH 4**

Adsorbance was tested with commercial biochar and lignin powders

	P_{tot} [mg/l]	PO_4 [mg/l]
pH 2	388,0	300,9
pH 4	159,2	17,8





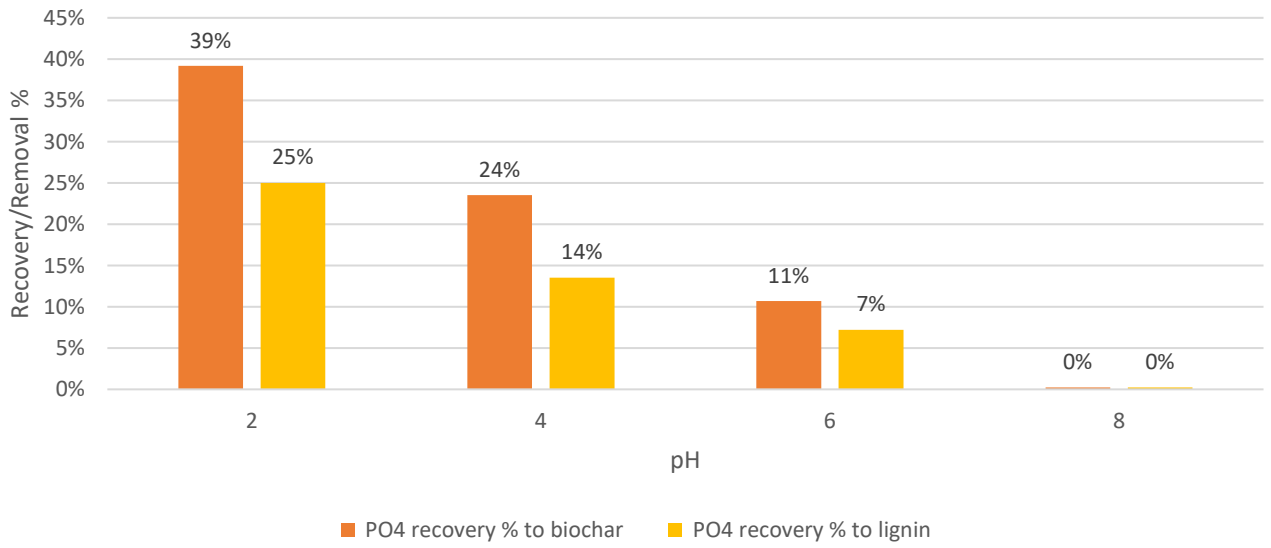
P adsorbance on biosolids was higher in higher pH

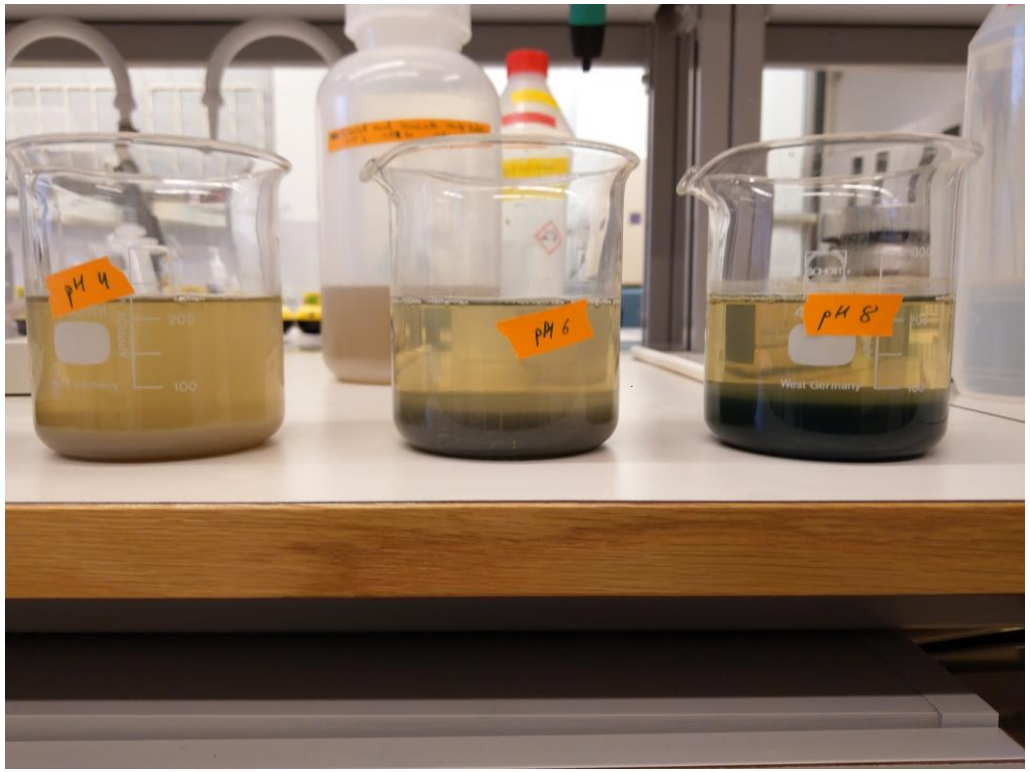
- **Optimal leaching and adsorbance pH are in conflict**

pH control along the process

pH increase after leaching at pH 2

- **The assumption that better yield of P on biosolid was wrong**
- **As pH increases, metals and P precipitate**
- **This reduces available P for adsorbance process**
- **Best yield on biosolid was still at pH 2 throughout the entire process**





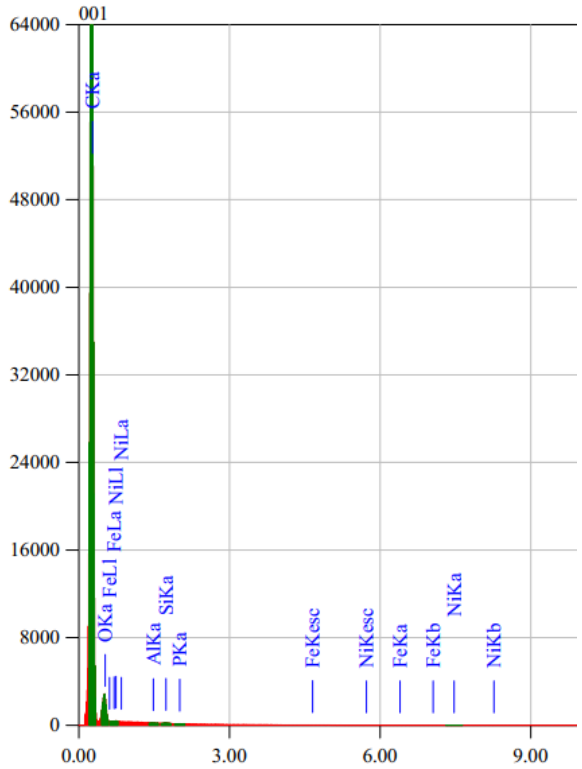
Loaded biosolid

Loaded material was analysed with SEM-EDS and FT-IR

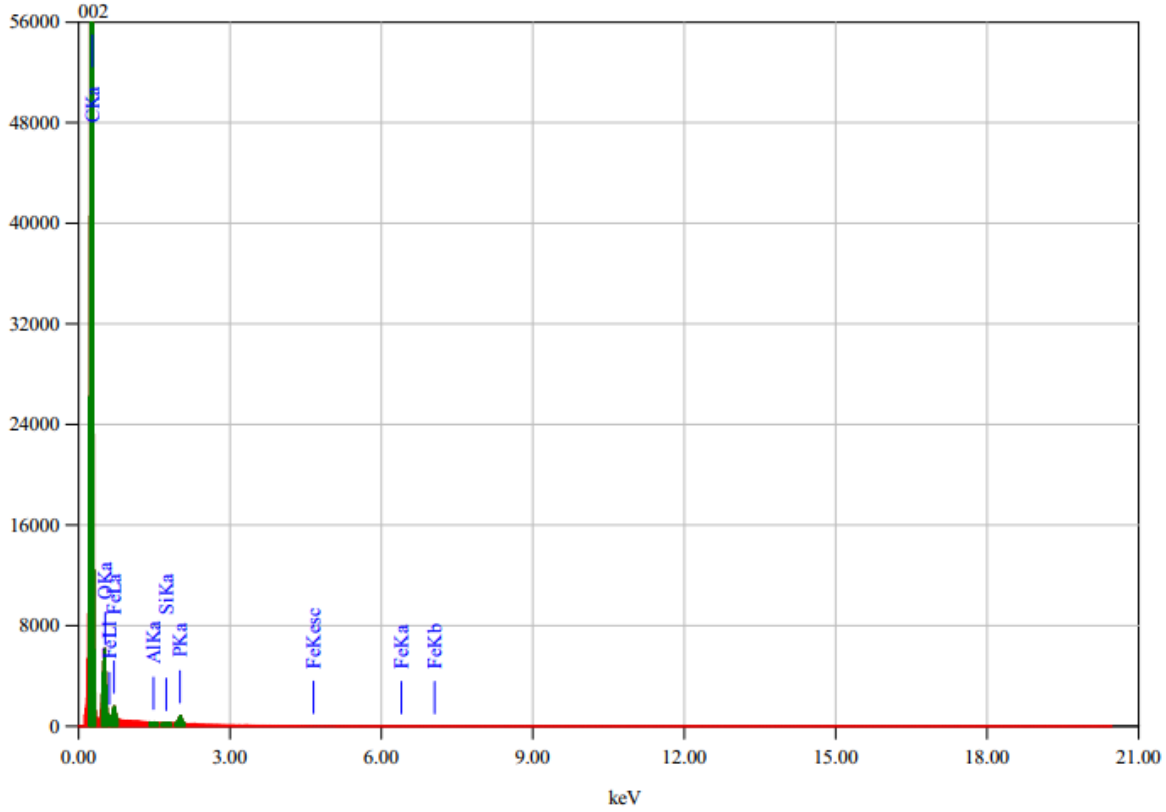
- **Loaded material has significantly higher P and Fe content**

	Mass%	
Element	Raw	Loaded
C	98.05	87.63
O	1.94	3.92
Al	0	0.03
Si	0.01	0.01
P	ND	1.34
Fe	ND	7.07
Total	100	100

Raw commercial biochar



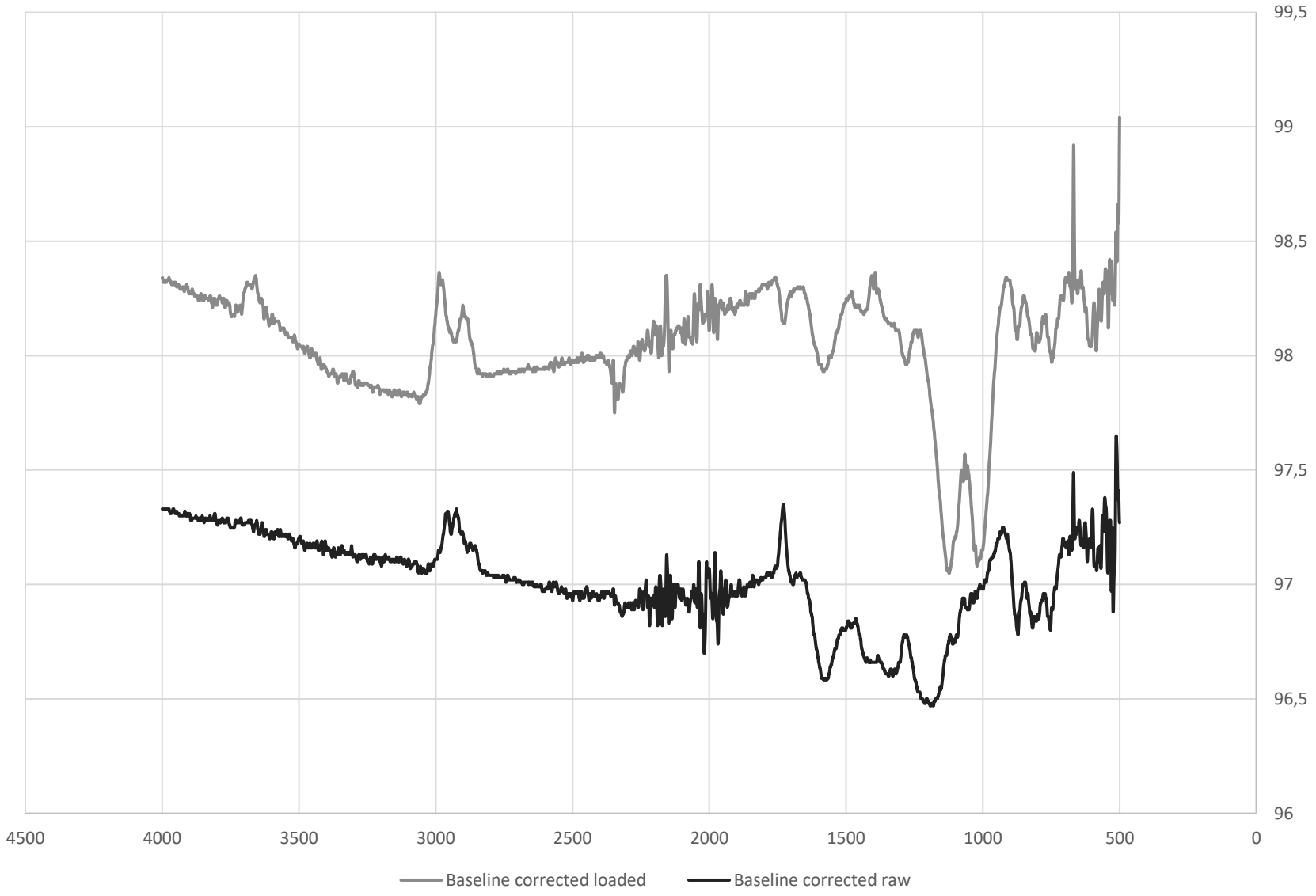
Loaded biochar



Loaded biosolid

Loaded material was analysed with SEM-EDS and FT-IR

- **Peaks shown in the range of 1000-1100 indicate presence of P**



Conclusions & motivation

P adsorbance on biosolids after acid leaching is a viable process with preliminary recovery efficiencies around 20 %

Biochar works slightly better than lignin – in some cases lignin even released P into the solution

Team is continuing to work with process optimization and new materials.

The motivation is to enable economic P recycling with carbon-based materials to amend the agricultural soils.

Thank you for your attention!

Looking forward to your questions!