Distribution of inorganic elements among products from HTL of manure

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1. BACKGROUND

Manure and digestate are waste products, but also valuable carbon sources suitable as wet feedstock for Hydrothermal Liquefaction (HTL).

Nutrients and metals, contained in manure and digestate, are transfered to the products after HTL; this might affect biocrude quality.

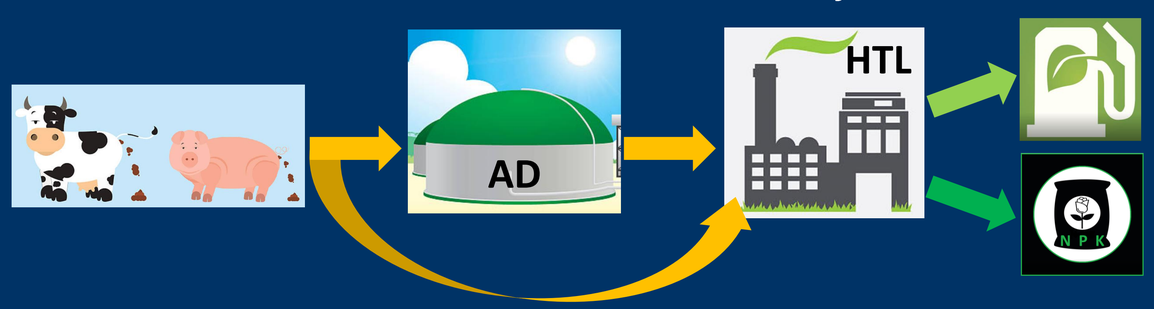
2. OBJECTIVES

Fate of nutrients and metals

Trace the presence of nutrients (N, P, K) and metals (Fe, Ni, Zn…) in HTL products and establish their distribution among the phases (solids, water phase and biocrude).

Potentials for nutrients recovery

Assess whether N, P, K can be recovered for being used as fertilizers, so that to close the nutrients cycle.



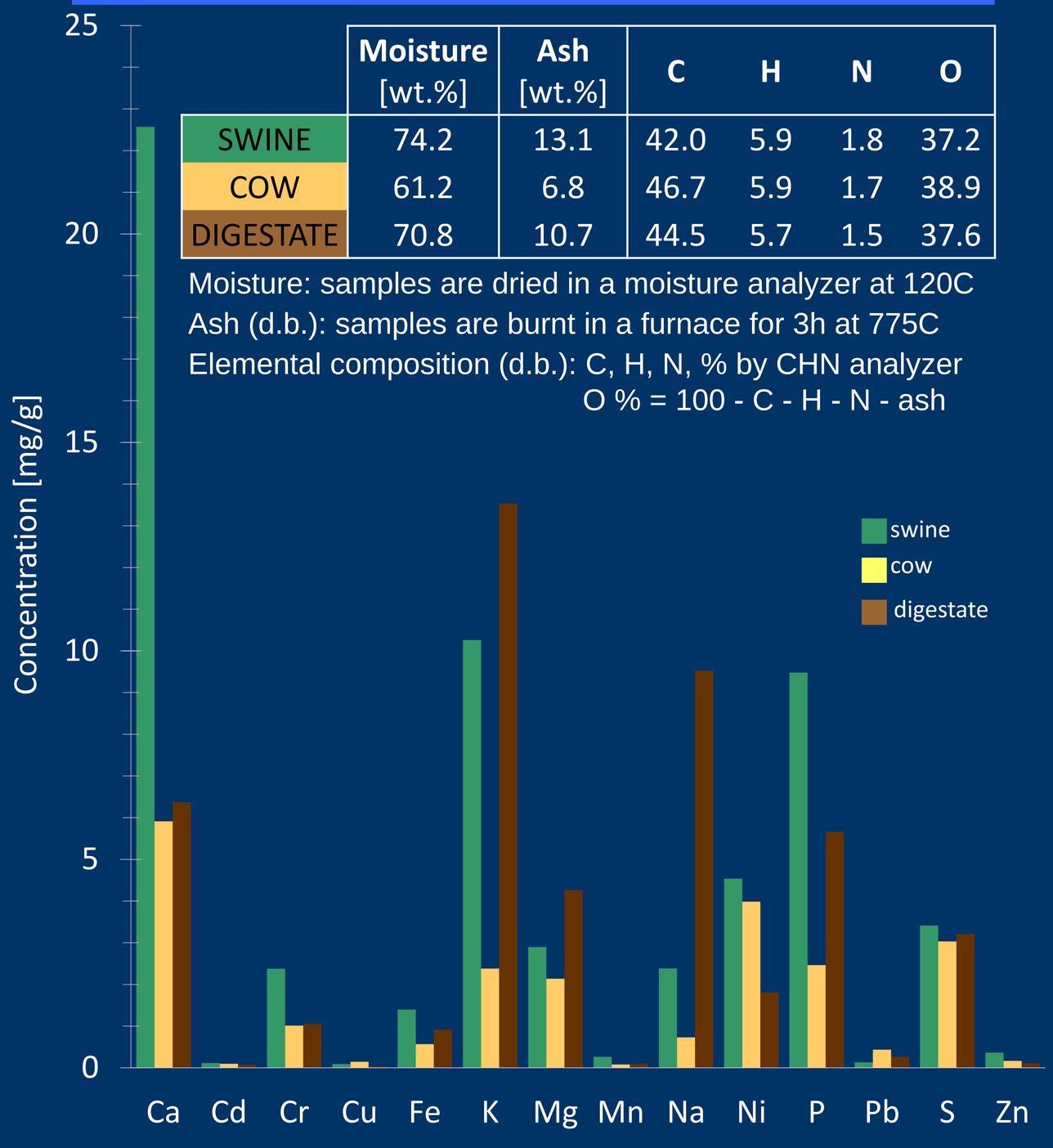
The use of manure or digestate in HTL has multiple advantages:

- **Waste reduction** through thermochemical conversion
- **Biocrude production** upgradable to drop-in fuel
- **Recovery of nutrients**, while they are lost when incinerating

3. FEEDSTOCKS CHARACTERIZATION

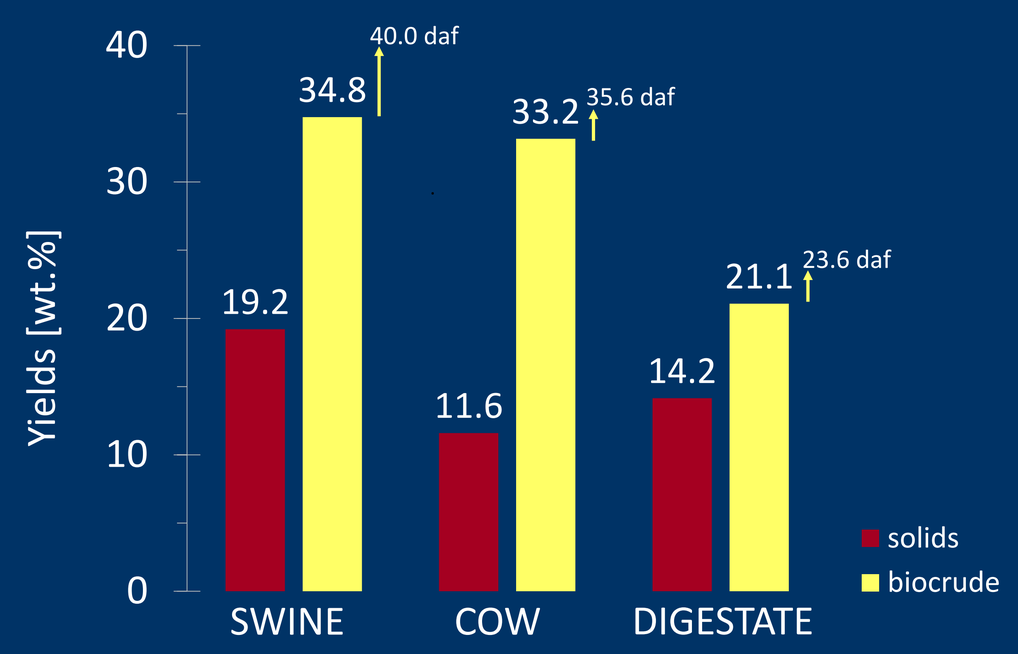
	Moisture [wt.%]	Ash [wt.%]	C	H	N	O
SWINE	74.2	13.1	42.0	5.9	1.8	37.2
COW	61.2	6.8	46.7	5.9	1.7	38.9
DIGESTATE	70.8	10.7	44.5	5.7	1.5	37.6

Moisture: samples are dried in a moisture analyzer at 120C
Ash (d.b.): samples are burnt in a furnace for 3h at 775C
Elemental composition (d.b.): C, H, N, % by CHN analyzer
O % = 100 - C - H - N - ash



4. EXPERIMENTAL RESULTS

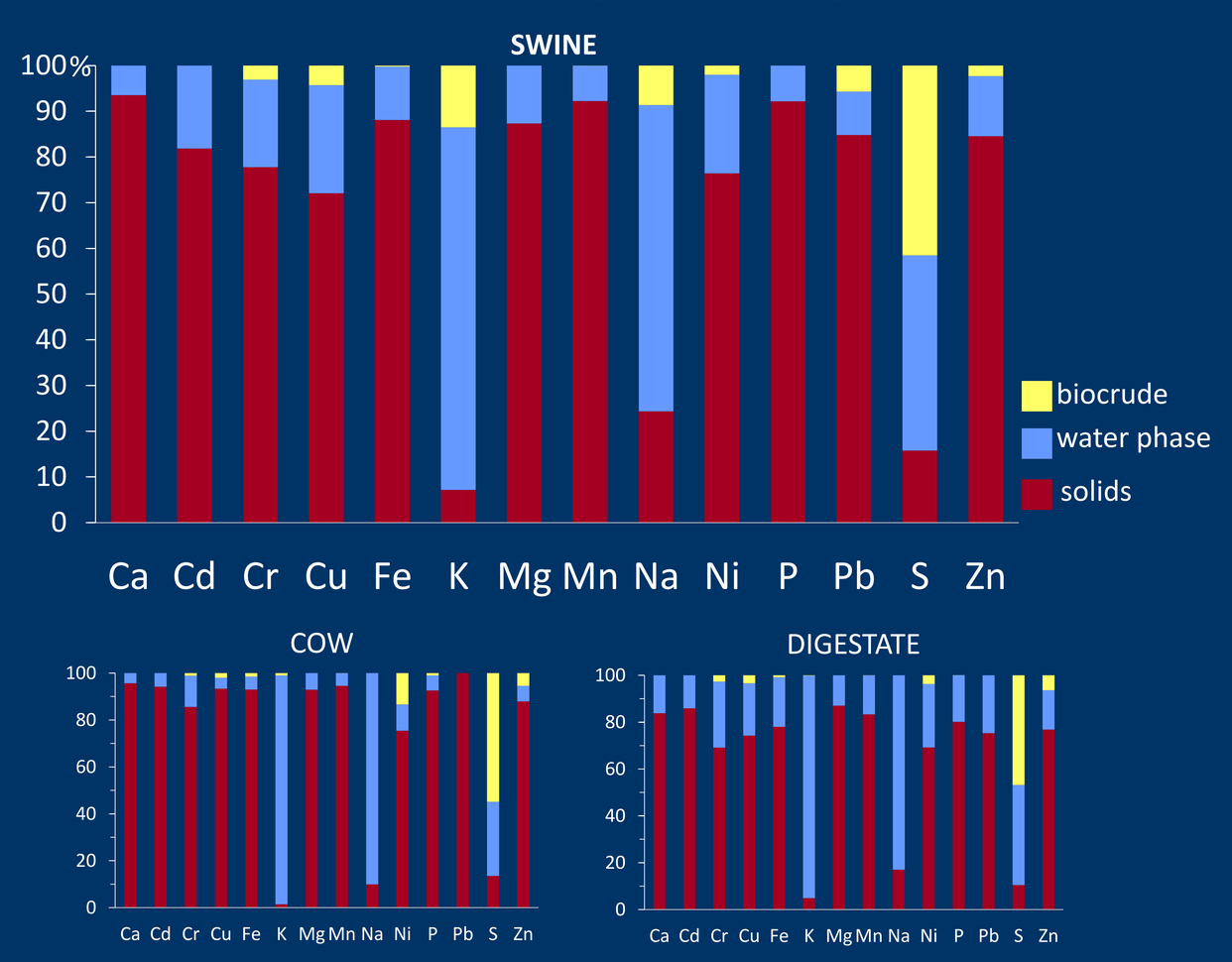
Yields (d.b.) in solids and biocrude after HTL (400C, 15min)



Elemental composition of solids and biocrudes

	C	H	N	O+ash	C	H	N	O
SWINE	22.0	1.0	0.6	76.4	74.4	9.5	2.6	13.5
COW	51.5	3.0	1.2	44.3	76.3	8.8	2.4	12.5
DIGESTATE	44.3	2.7	1.3	51.7	75.9	8.7	2.6	12.9

Normalized distribution of inorganics among HTL products



5. CONCLUSIONS

- Most inorganics, including Phosphorus (P), are almost exclusively recovered in the solids (>80%). This facilitates their extraction and re-use as fertlizers.
- Potassium (K) and Sodium (Na) are instead primarly concentrated in the water phase (>70%).
- Nearly half of the Sulfur (S) is found in the biocrude; also Nitrogen (N) tends to concentrate in the oil. An increased amount of S and N in the oil negatively affects its quality.

6. ACKNOWLEDGEMENTS

Innovationsfonden
Grant no. 1305-00030B
INBIOM
INNOVATION NETWORK FOR BIOMASS