Combining protein extraction and anaerobic digestion to produce feed, fuel and fertilizer from green biomass – An organic biorefinery concept

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**ORGANOFINERY CONCEPT – SEPARATION EFFICIENCIES**
- **Press cake and brown juice** after protein extraction accounted for more than 90% of fresh biomass with 61-81% of VS found in the press cake and 7-11% of VS in the brown juice—energy potential for biogas production.
- Recovery of crude proteins in the **protein concentrate** was more than 15%.

![Separation of total mass, VS and crude protein into the output fractions.](image)

**SPECIFIC METHANE YIELDS**
- The specific methane yield of the **press cake** from red clover and clover grass was 70% and 90% of the fresh biomass (331 and 344 mL-CH\(_4\)/g-VS, respectively).
- The **press cake** presented enough nutrients to ensure a successful anaerobic digestion.

![Specific methane yield (mL-CH\(_4\)/g-VS) during 55 days of AD.](image)

- High specific methane yield of **brown juice** due to high content of easily degradable organic matter. Low pH (4-5), may need pH control.
- Some substrate inhibition at high substrate loading.

![Specific methane yield (mL-CH\(_4\)/g-VS) of brown juice after 15 and 55 days of anaerobic digestion for 2 different substrate loadings (S/I ratio of 1 and 0.5).](image)

**THE PROTEIN CONCENTRATE – ORGANIC POULTRY FEED**
- Crude protein content in the concentrate is around 40% (dry matter basis).
- Amino acid profile of **protein concentrate** comparable with current organic poultry feed.

**BIOGAS POTENTIAL RECOVERY**
- Up to 85% of the methane potential of the fresh crops is still preserved in the residual fractions after protein refining (Fig. 4).
  - 41-69% of the potential methane of the fresh crop is recovered in the **press cake**.
  - 10-16% of the potential methane of the fresh crop is recovered in the **brown juice**.
- The digestate will be used as organic fertilizer.

![Methane yield of the fresh biomass (m\(^3\)/t) and of the residual biomass fractions after the biorefinery process (m\(^3\)/t of fresh crop).](image)

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