

# Palm Kernel Meal (PKM) and Grass

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# **Palm Kernel Meal (PKM) and Grass Valorisation of non-woody biomass streams by conversion to bio-energy and bio-based products**

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# Outline

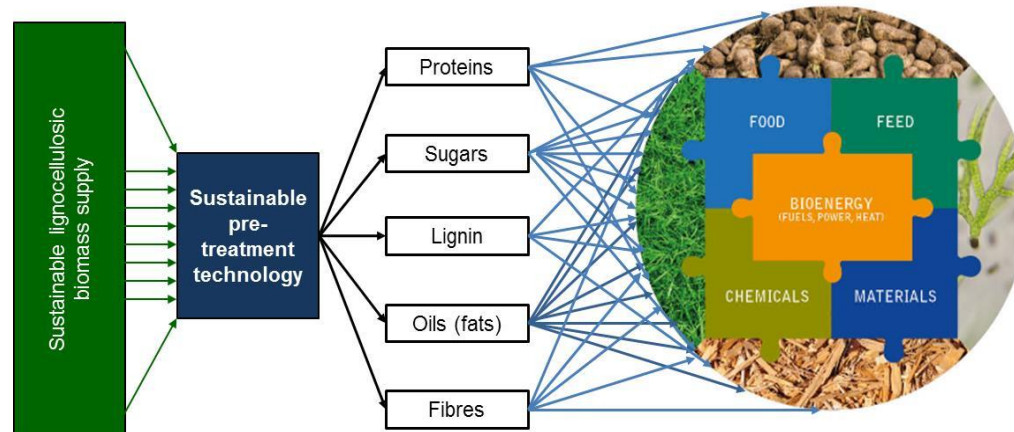
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- Project scope
- Experimental approach
- Protein extraction & characterisation: PKM
- Protein extraction & characterisation: Grass
- Fuel pellets through wet torrefaction (TORWASH<sup>®</sup>)
- Results
- Conclusions

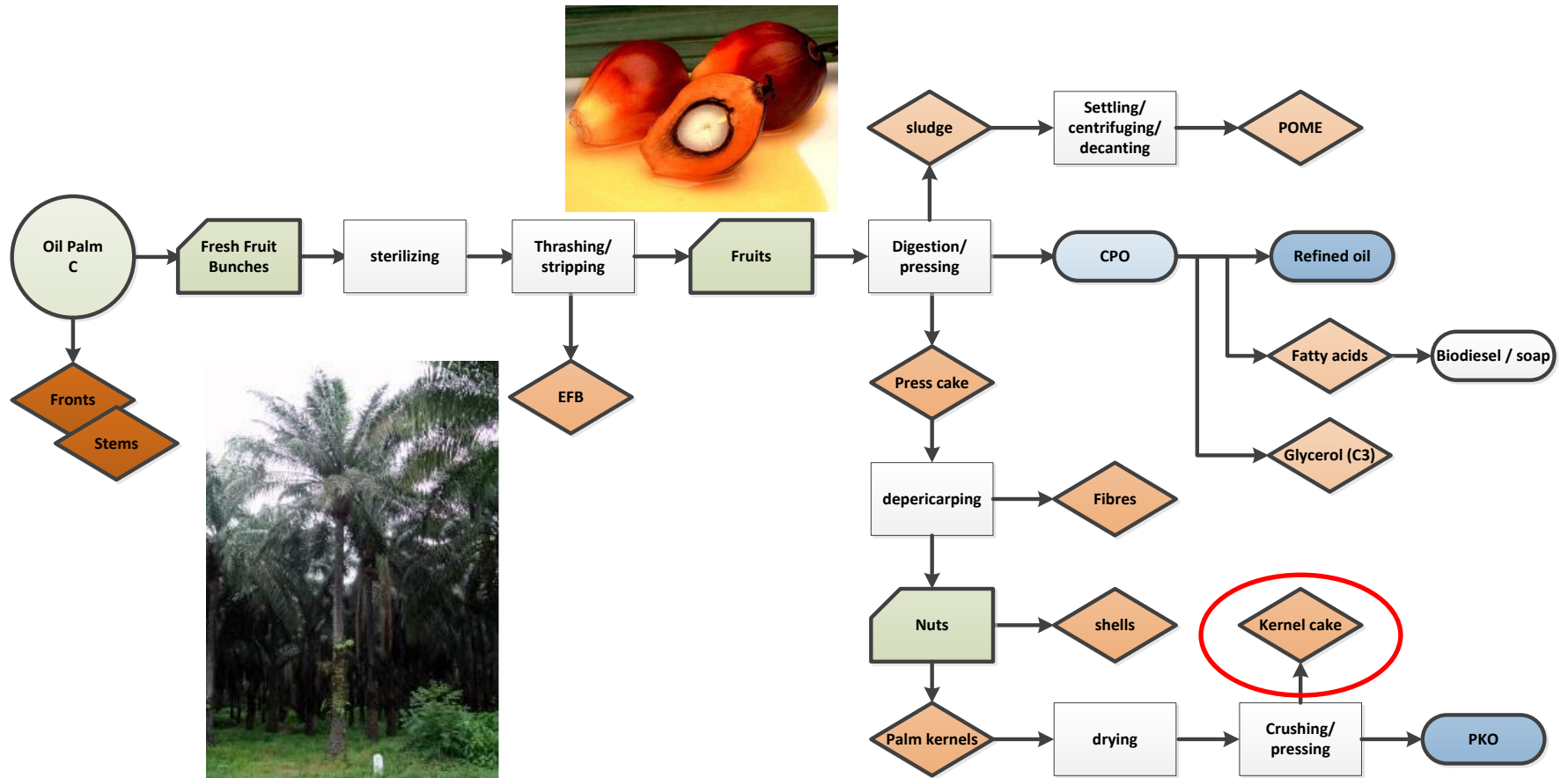
# Project scope

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- Optimal utilisation of the “molecular capital” in biomass
- Develop biorefinery concepts for non-woody biomass based on a cascaded and combined protein extraction and wet torrefaction (TORWASH<sup>®</sup>) for production of high-quality solid energy carriers



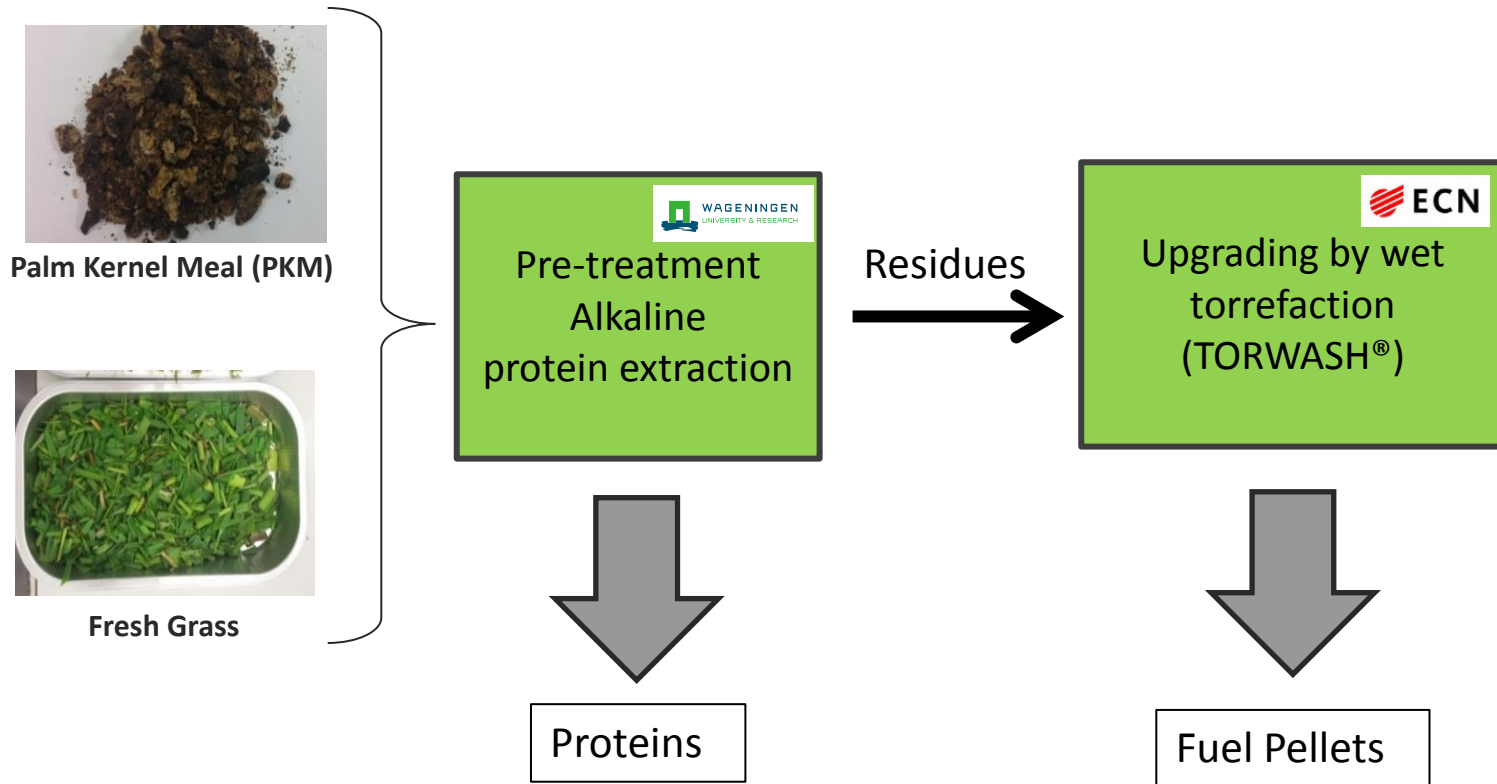
# PKM: By-product of palm-oil industry





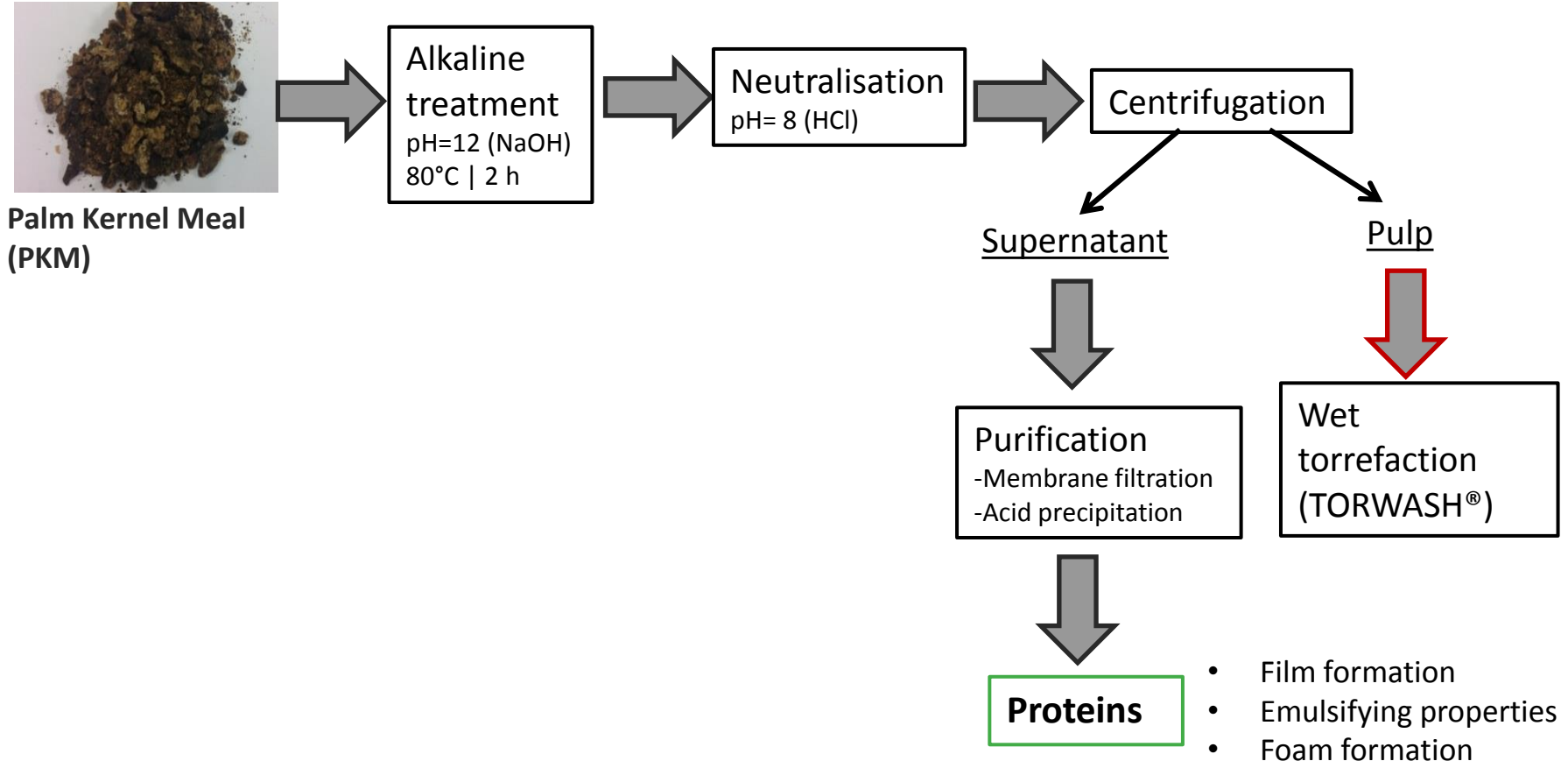
# Experimental approach

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# Protein extraction & characterisation

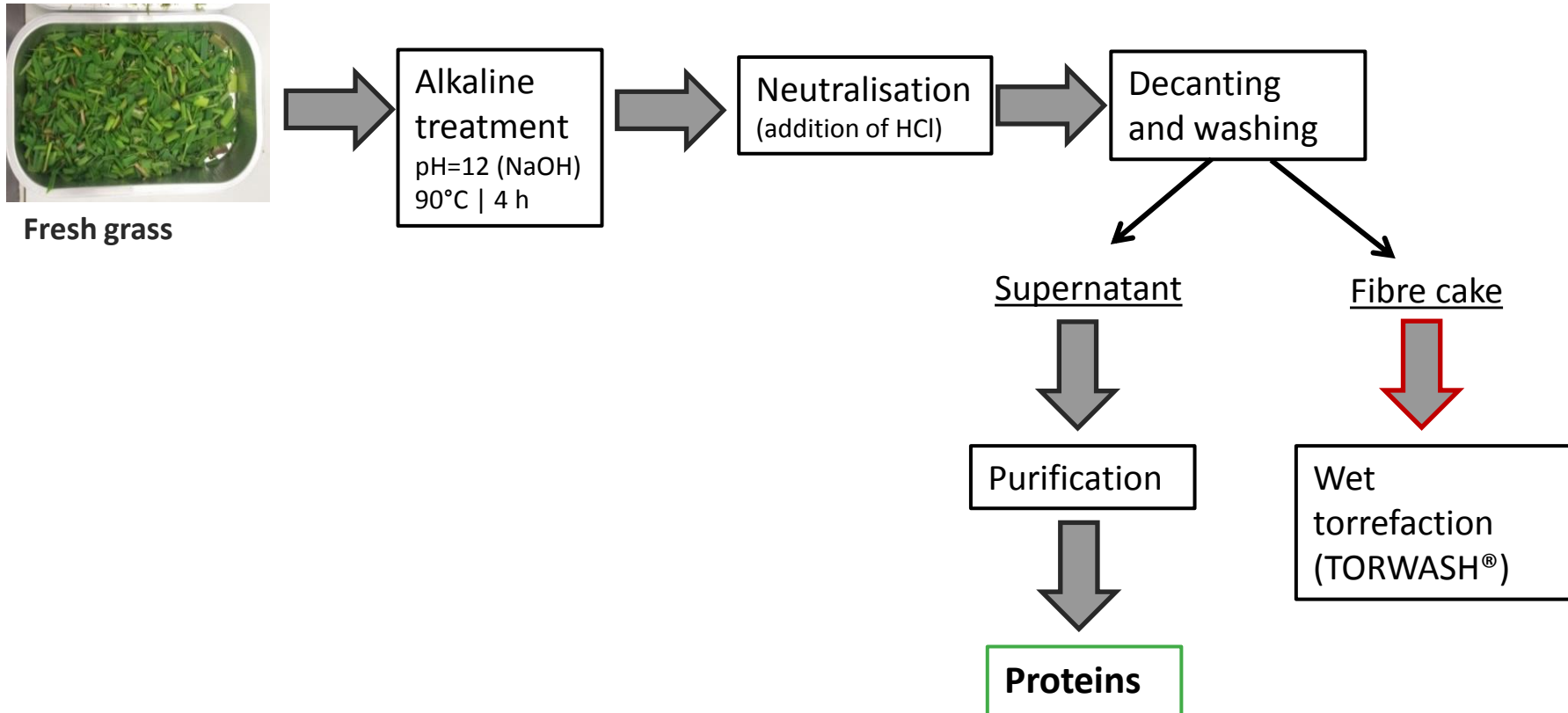
## PKM treatment



# Protein extraction & characterisation

## Fresh grass treatment

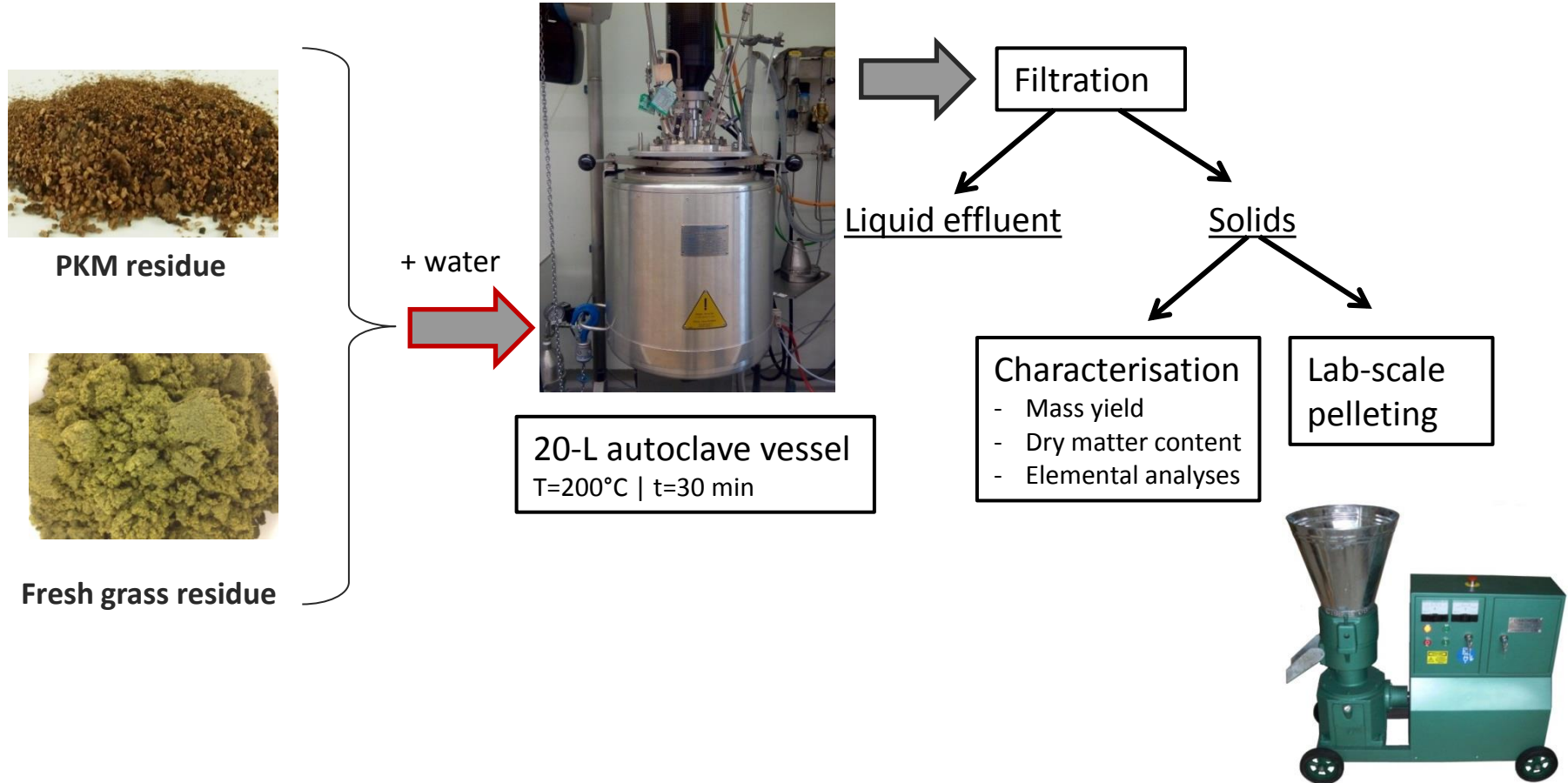
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# Wet torrefaction (TORWASH®)

## Upgrading of PKM and fresh grass residues



# PKM results

## Protein product

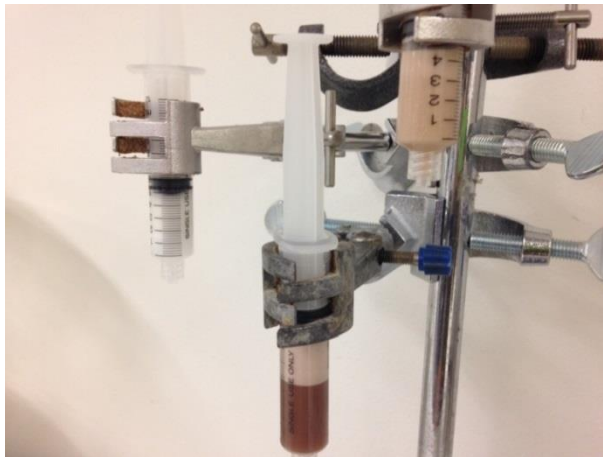
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PKM

After membrane  
filtration

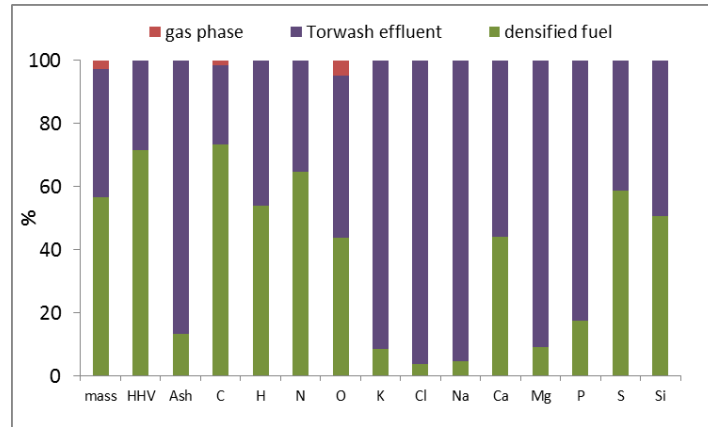
After precipitation



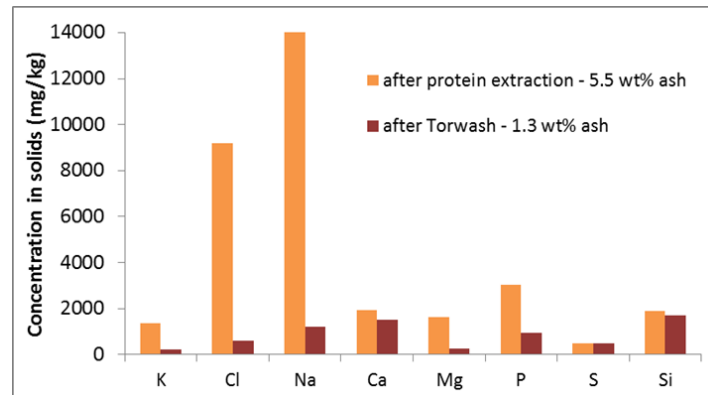
- 80 % of proteins could be extracted using the alkaline treatment method
- Purification methods – Protein purity
  - 42 % after membrane filtration
  - 37 % after precipitation
- Protein properties
  - Purified protein products show film formation (brittle & flexible film)
  - Good emulsifying properties after precipitation
  - No foam formation

# PKM results

## Fuel pellets



- TORWASH® treatment converts 56.5 wt% of the dry PKM residues into solid fuel pellets
- The thermal treatment can remove: 91% K, 96% Cl and 95% Na
- Alternatives to NaOH and HCl could be used in the protein extraction step in view of fuel quality



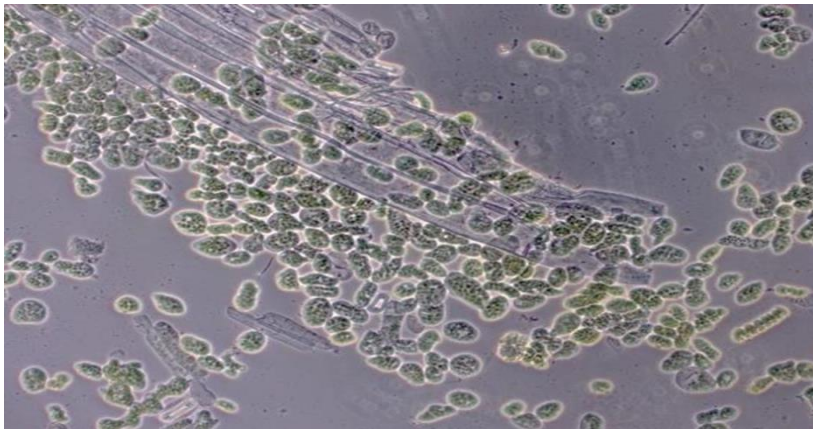
Palm Kernel Meal PKM extracted - pellets  
Torwashed 200/30 - 15072901, dried at 105°C

# Fresh grass results

## Protein product

Alkaline column extraction from fresh grass

- Protein product purity 60 wt%
- Extraction of whole cells
- Extraction of whole chloroplasts
- Pressure drop high

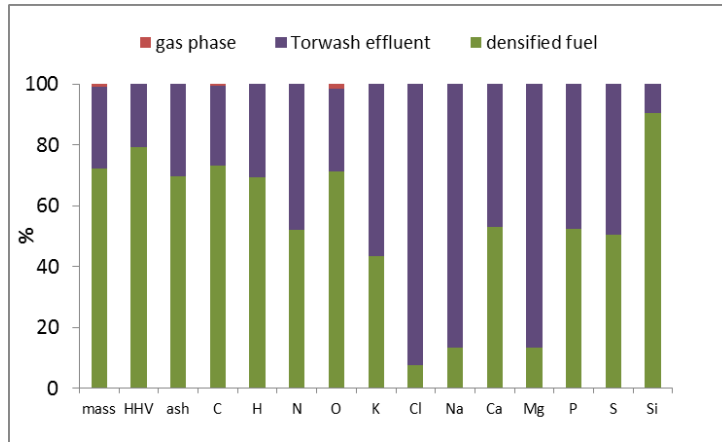


Standard protein extraction from fresh grass

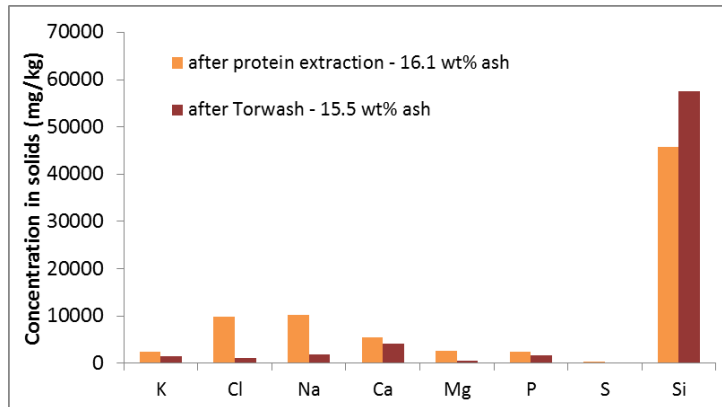
- Pressing + coagulation
- Protein product purity <50 wt%
- Protein yield about 25 wt%

# Fresh grass results

## Fuel pellets



- TORWASH® treatment converts 72 wt% of the dry fresh grass residues into solid fuel pellets
- The thermal treatment can remove 56.5% K, 92% Cl and 87% Na
- Si remains in the solids, most possibly in the form of  $\text{SiO}_2$



# Conclusions

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- Combined concepts for protein extraction and wet torrefaction (TORWASH®) for production of high-quality solid energy carriers were demonstrated for grass and palm kernel meal (PKM) at bench-scale
- Protein extraction on pilot scale from fresh grass had a low protein product yield, due to long transportation and processing times. Column extraction of grass increases protein purity.
- Protein from PKM might be interesting for food and feed applications
- The fuel pellets produced have a K+Na content of 1400-2500 mg/kg and can be used as co-firing pellets



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## Partner:



## Financial support:



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**See you at our booth: B11**



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