

# Study of the temperature and NaOH concentration for a cost-effective thermo-mechano-chemical pretreatment to obtain second generation bioethanol

Speaker: **Monica FONG**

Co-authors: M. Rigal, L. Rigal, G. Vilarem, V. Vandebossche

14th international conference on Renewable Resources and  
Biorefinery 2018- Gand, Belgium

# INTRODUCTION

- Energy transition

Petroleum based energy



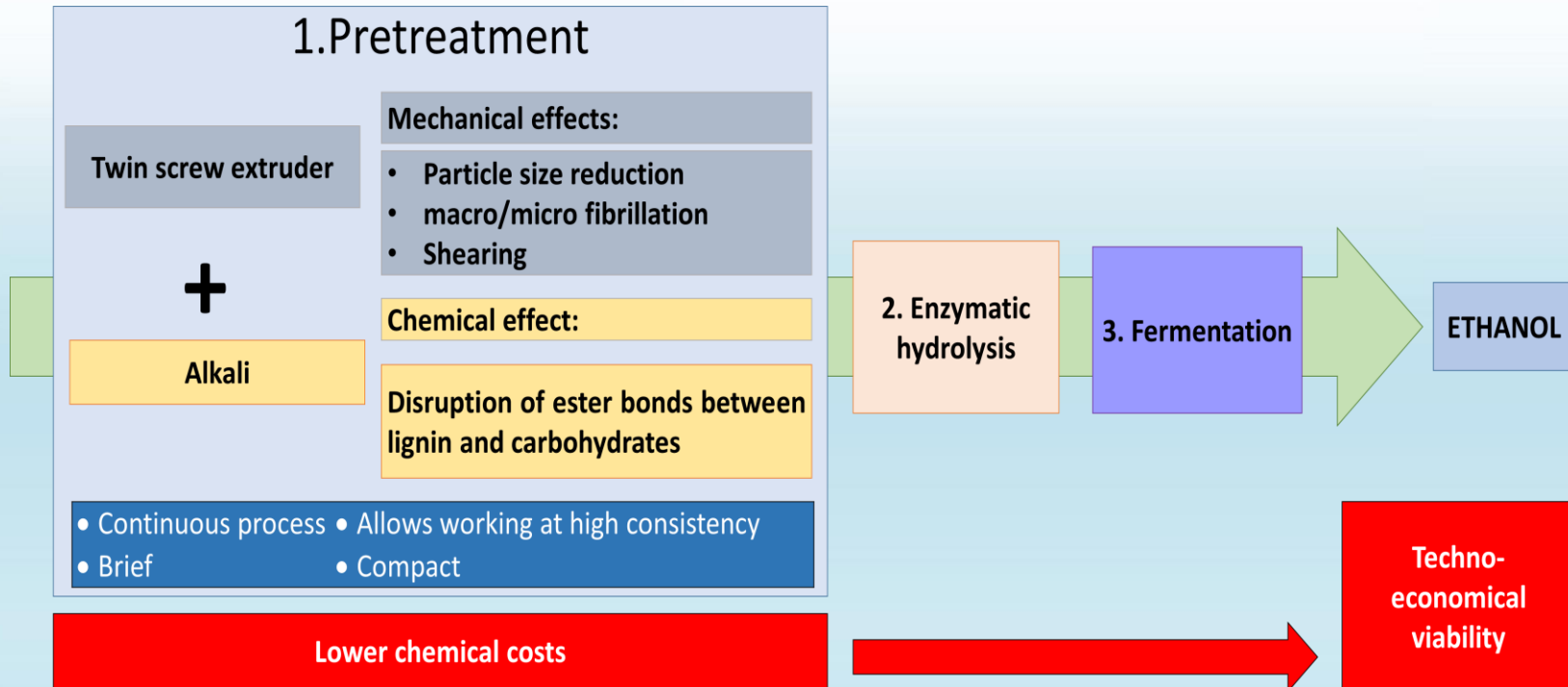
Renewable and sustainable energy



- BABET – REAL 5 project's objective: develop an alternative solution for the production of second generation bioethanol from lignocellulosic biomass at small-industrial-scale suitable for a variety of feedstocks



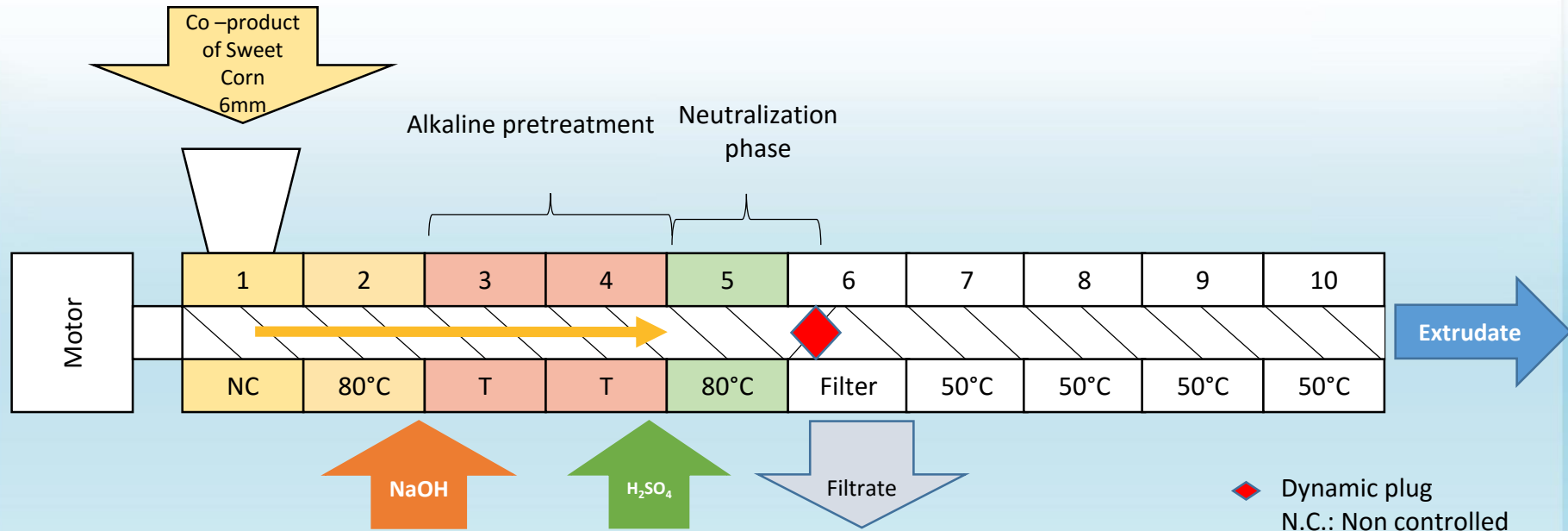
# INTRODUCTION



**Objective of the study: Lower chemical cost by decreasing the chemical use**

**→ Study of the temperature effect to compensate the decrease of alkaline concentration**

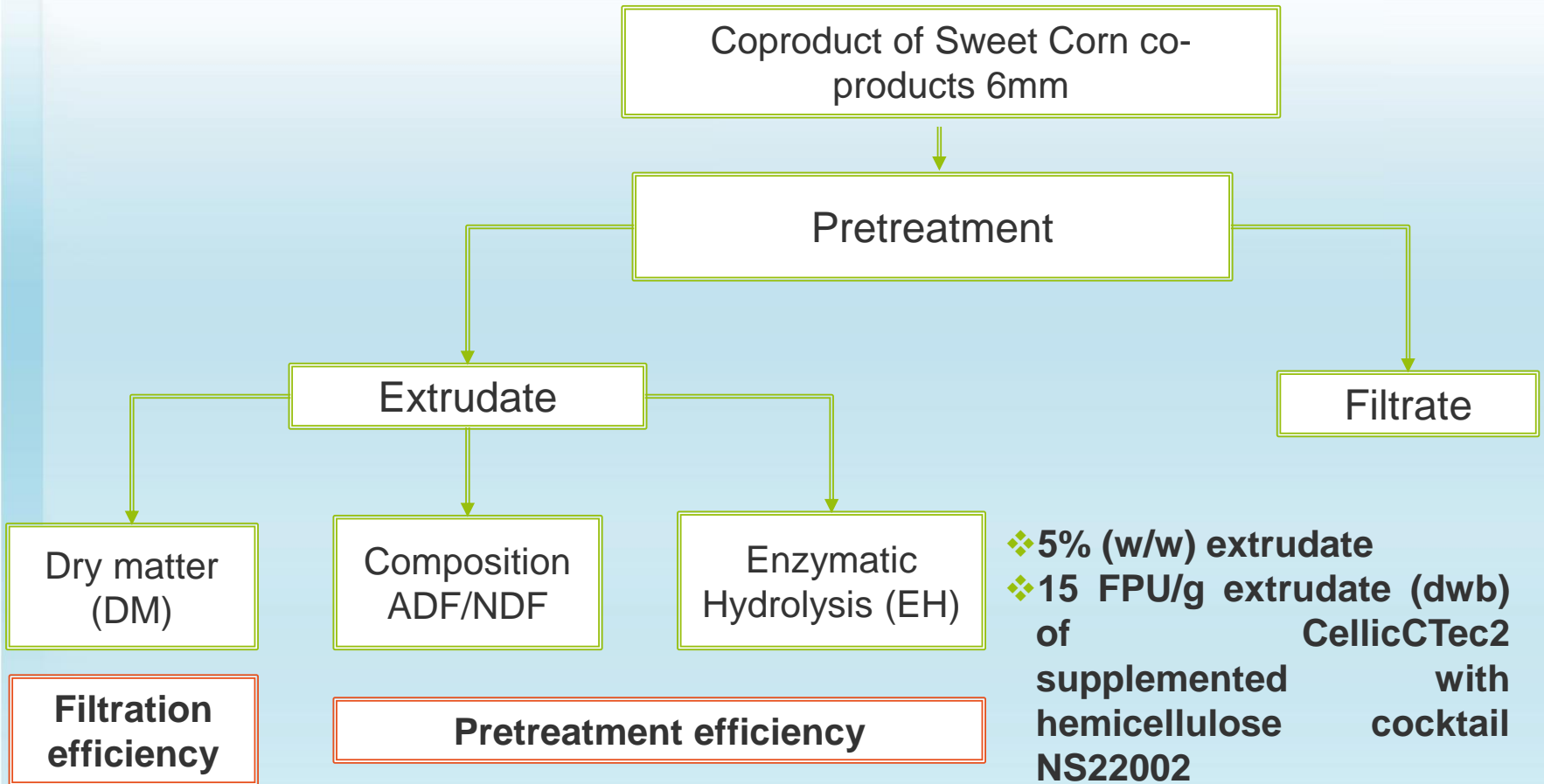
# PRETREATMENT PROCESS



2 parameters were modified for alkaline pretreatment :

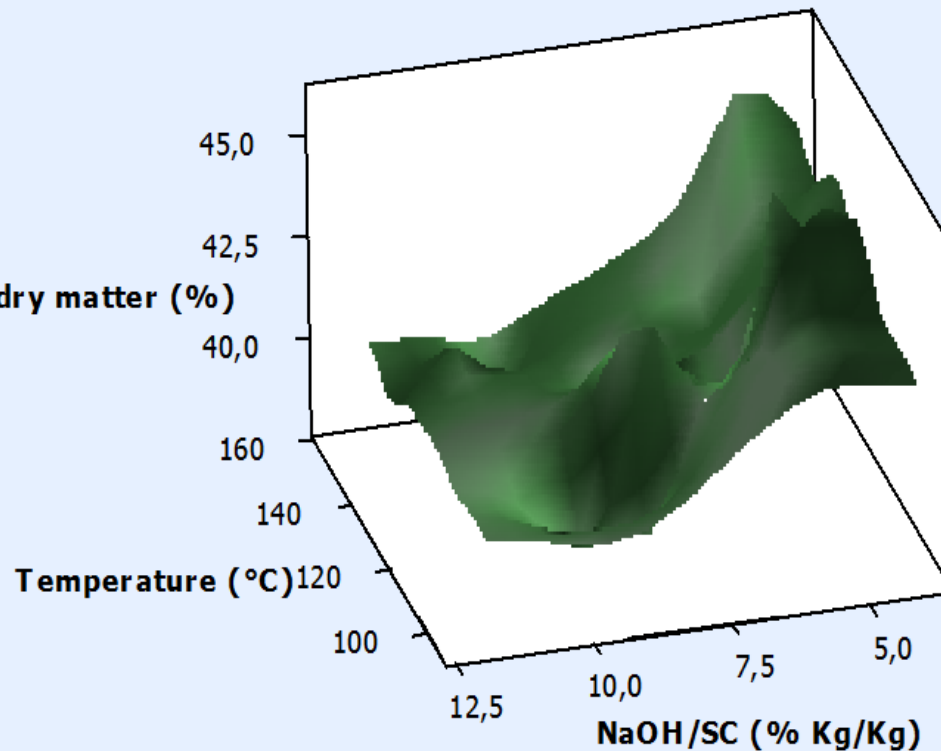
- Temperature in modules 3-4 : 90-170°C
- NaOH/dry sweet corn ratio: 4-11%

# METHODOLOGY



- ❖ 5% (w/w) extrudate
- ❖ 15 FPU/g extrudate (dwb) of supplemented hemicellulose NS22002
- ❖ 50 °C
- ❖ 48h

## RESULTS- FILTRATION LIMITS

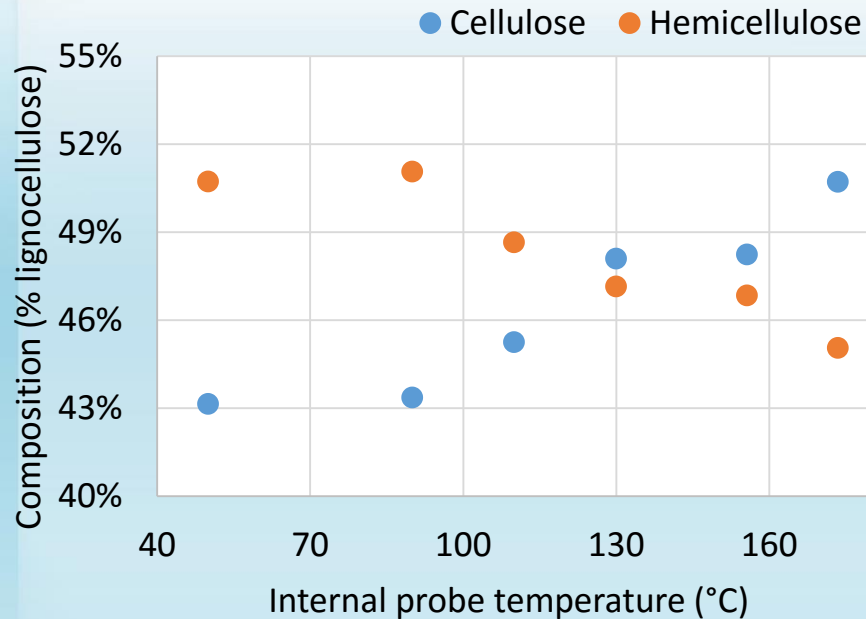


- During the study, filtration was evaluated by the dry matter of the extrudate
- The DM is lower at high alkali concentration → dynamic plug was less stable because the biomass is more destructured
- Filtration is a limiting factor, unstable at high temperature and high concentration

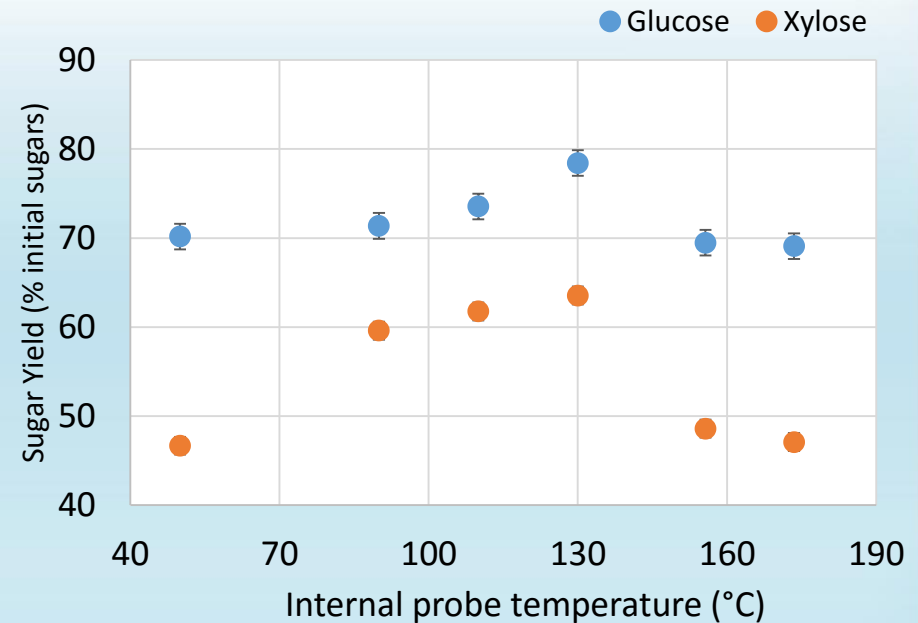
# RESULTS- PRETREATMENT EFFICIENCY

NaOH/SC = 6,0%

Extrudate composition



Sugar yield at 48h



- The increase of temperature favors the hemicellulose extraction and the enrichment of the cellulose fraction in the extrudate
- At 130°C cellulose fraction is high and the glucose (around 80% of the initial glucose) and xylose (around 65%) yields are the highest

## CONCLUSIONS / PERSPECTIVES

- Filtration limits the process at a concentration lower than 8% and 140°C
- The best results in terms of pretreatment are at **6% NaOH/SC** and **130°C** for internal temperature:
  - **High cellulose fraction in extrudate by a good solubilization of hemicelluloses**
  - **High conversion of glucose and xylose → better enzyme accessibility**
- Perspectives:
  - physico-chemical characterization of extrudates to understand the effect of temperature
  - Statistical analysis





## Acknowledgement:

This work has been co-funded by the European Commission (Horizon 2020 Program under Grant agreement reference n°654365 (BABET-REAL 5 PROJECT)).

# Thank you for your attention

[monica.fong@ensiacet.fr](mailto:monica.fong@ensiacet.fr)