Environmental impact assessment of bio-based binders: from production to industrial applications

Saïcha Gerbinet [(1)], Sandra Belboom [(1)], Vincent Briard [(2)], Carl Hampson[(3)] and Angélique Léonard [(1)]

(1) Department of Chemical Engineering – PEPs (Products, Environment and Processes) - University of Liège, Building B6 – Sart-Tilman, 4000 Liège, Belgium. Saicha.Gerbinet@ulg.ac.be

(2) Knauf Insulation Sprl, Head of Sustainability, Products and Buildings, Axis Parc, Rue E. Francqui, 1435 Mont-St-Guibert, Belgium

(3) Knauf insulation Sprl., ECOSE development manager, St-Helens, United Kingdom

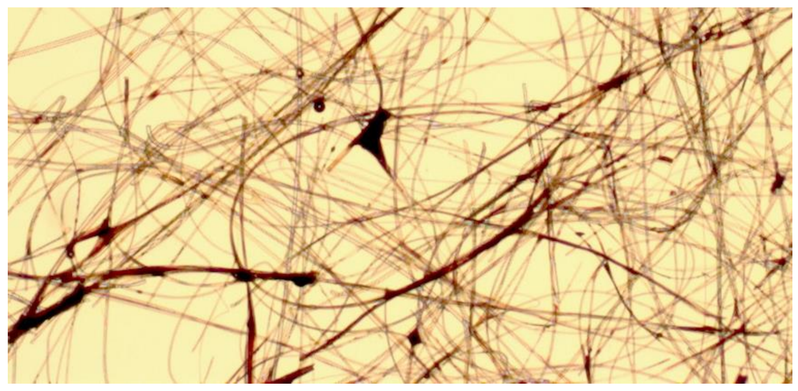
A binder?

Use: e.g. holds together fibers for mineral wool insulation products

Traditionally: based on Phenol Formaldehyde Urea (PFU).

Knauf Insulation

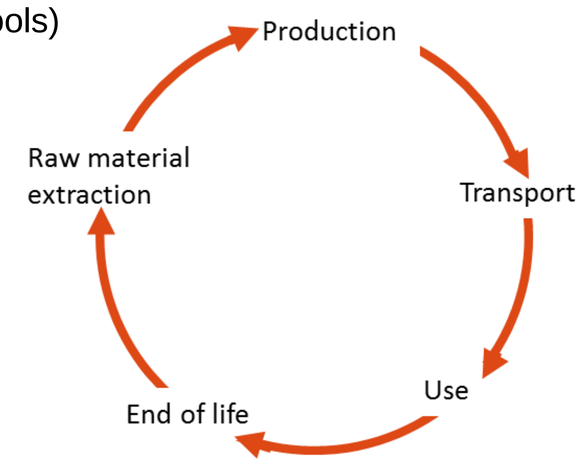
- Developed a new binder: **ECOSE Technology**
- No added formaldehyde
- Bio-based materials
- First developed for mineral wool products (glass and stone wools)
- Others applications possible: wood composite panels, etc.

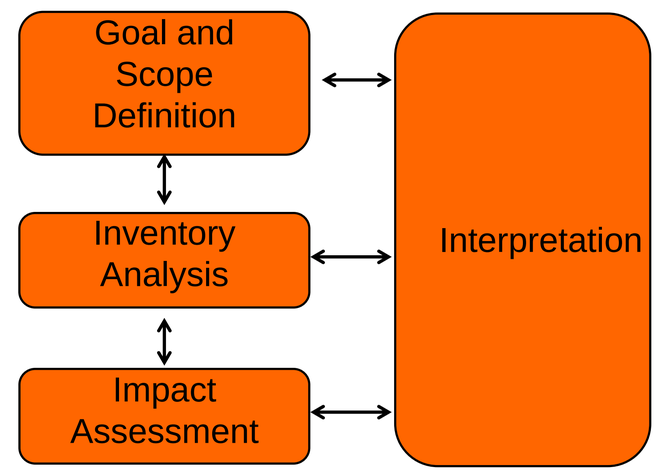


➔ **Environmental impact?**

Life Cycle Assessment (LCA)

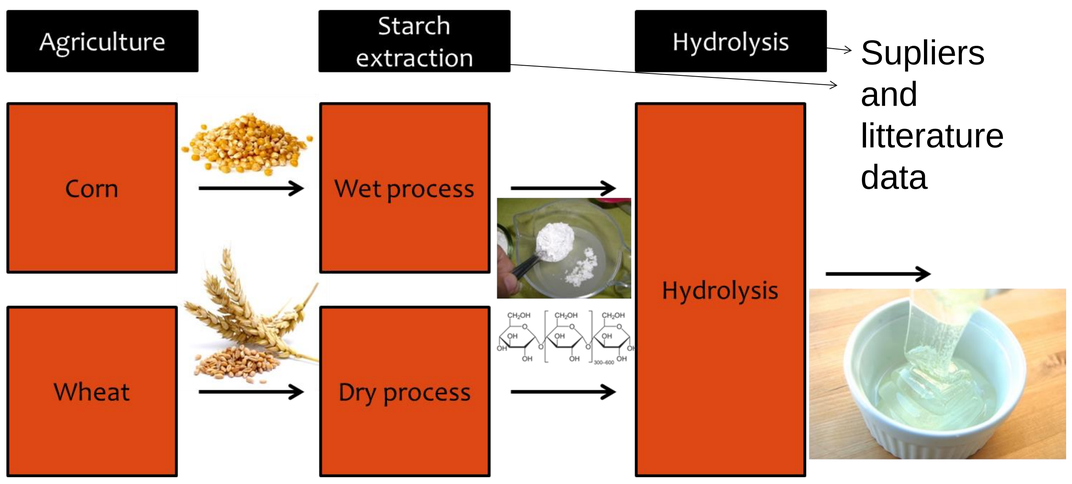
- All life cycle steps
- Energy and material fluxes for the entire life-cycle analysed
- 4 interdependent steps
- ISO 14040 and 14044 norms [1]



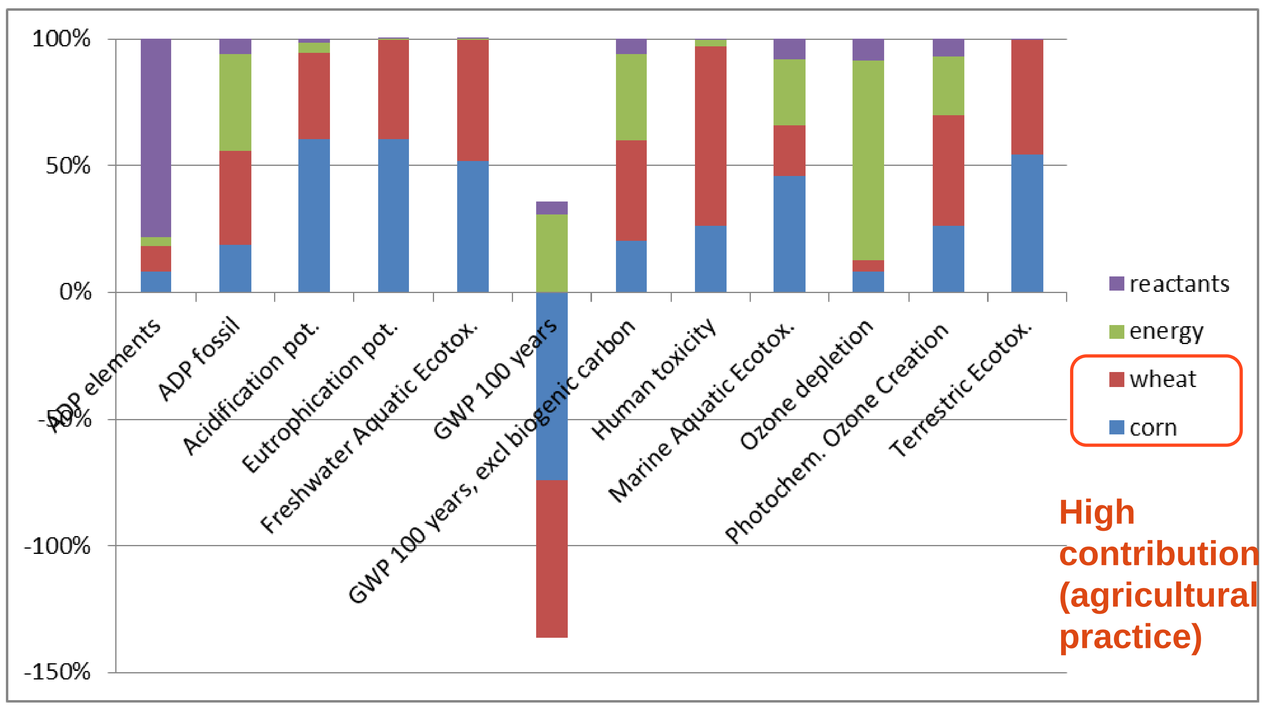


ECOSE LCA:

1. **LCA of ECOSE mains component**: Carbohydrate



↘ Belgian practice + adapted to others countries (yields) [2]

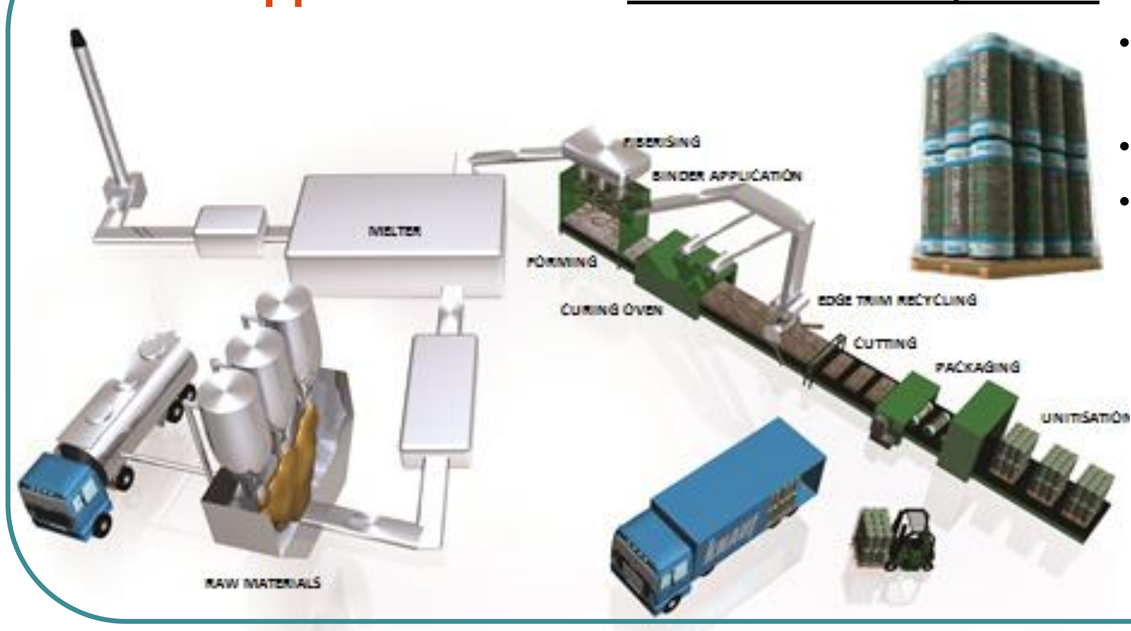


High contribution (agricultural practice)

2. Inclusion of others components

- High contribution of carbohydrate (agricultural practice)
- Comparison with other binders: results depend on the environmental impacts categories. ECOSE better if related to resources depletion, GWP

ECOSE application LCA: Glass mineral wool products



- A lot of products/production sites but production process always similar
- Developed a generic model: Able to model all products from all Knauf Insulation plants in GaBi software [3]
- Included ECOSE LCA
- Modified version to study products with PF (old plant data)

thinkstep GaBi Product Sustainability Performance

Results:

- Environmental Products Declarations
- Ecodesign
- Comparison ECOSE vs PF (results depend of the impact categories)
- Comparison with products using other binders

Conclusions and perspectives

Carbohydrate LCA: High contribution of agricultural pratices

ECOSE LCA: High contribution of Carbohydrate (agriculture)

Comparison with non biobased binders: results depend of the environmental impact

GMW LCA: Generic model: Ecodesign and EPD

Comparison with PF binders: results depend on the environmental impact

Perspectives: Other sources for carbohydate

Other ECOSE applications: Stone wool, wood composite panels, etc.

Bibliography:

1. ISO 14040 and 14044 , Environmental management - Life cycle assessment - Requirements and guidelines. 2006.
2. Walloon Agricultural Research Centre (CRA-W), ALT4CER project. 2014.
3. LBP, University of Stuttgart, and PE INTERNATIONAL, GaBi 6, 2012. p. GaBi 6: Documentation of GaBi6-Datasets for life cycle engineering.