

Growing the Future: Comparative LCA of Locally-Grown Hemp & Flax Insulation vs. Imported Alternatives

The aim is to identify the most climate-friendly insulation option per m² insulation material for a Dutch house.

The bigger picture

The building sector accounts for 39% of global CO₂ emissions; one third comes from production construction materials. Switching to biobased insulation tackles both operational and embodied carbon: crop such as hemp and flax lock up CO₂ while growing and need far less process energy than petrol-based foams [1].



Fig. 1: Biobased insulation



Fig. 2: Hemp plant

Methods

First finding the most suitable hemp species to grow locally in the Netherlands, then the best way to process it on small scale.

To understand the environmental impact of the process, a life cycle assessment (LCA) is performed.

To compare different insulation materials on more aspects a multi-criteria analysis (MCA) is performed.

LCA (with Sphera): cradle-to-grave, functional unit = 1m² insulation material achieving R = 2.6 m²K/W.

MCA adds fire safety, economic feasibility and legislation.

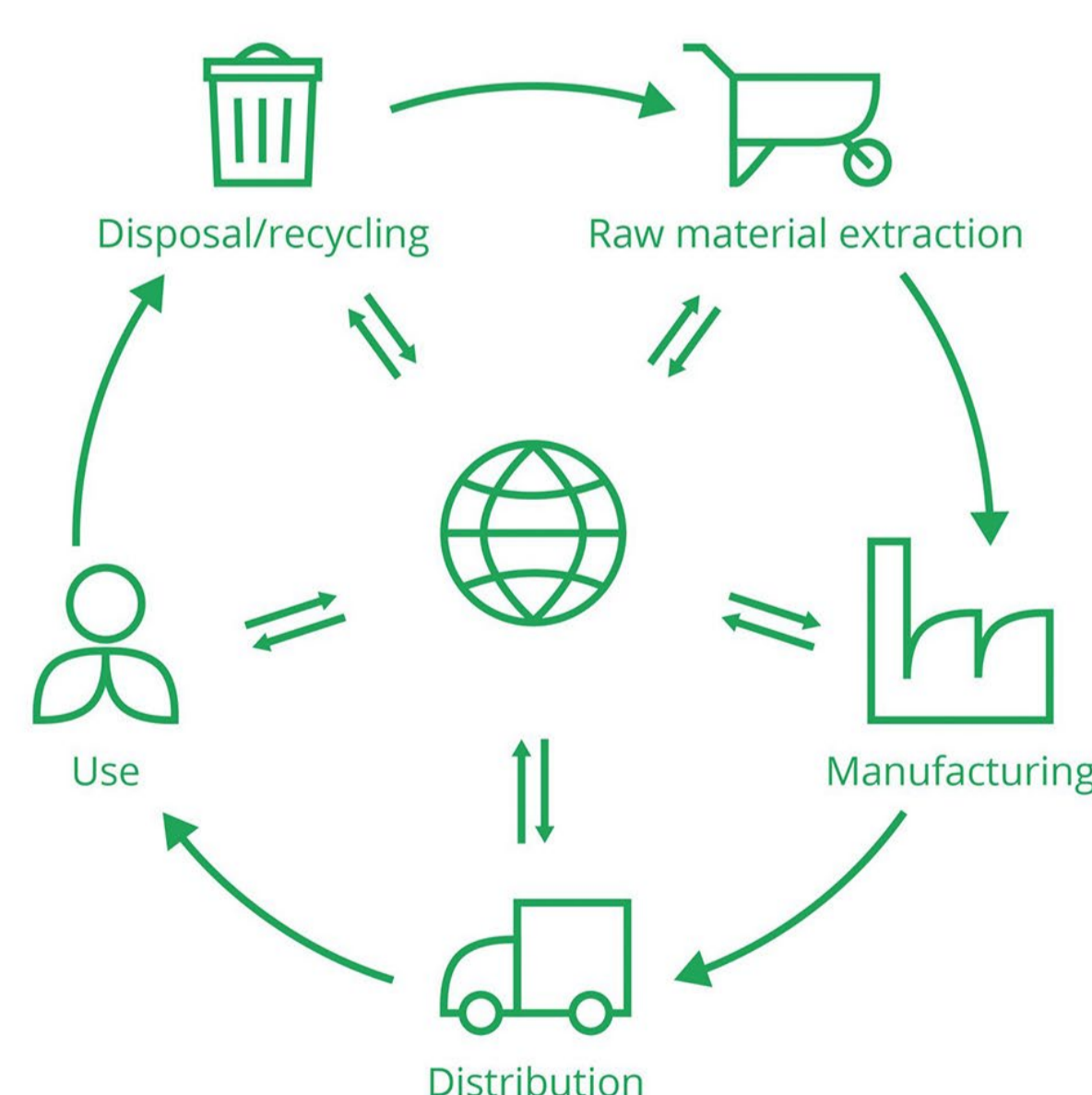


Fig. 3: Life Cycle Analysis

Current findings

Futura 75 species is suitable with a high yield and high fiber percentage. One hectare of Futura 75 lead up to 5.600 kg of hemp fiber [2].

Mycelium is found to be a sustainable binder of the hemp fibers, and feasible to use in small scale operations [3].



Fig 4: Mycelium composite

For locally grown hemp [4][5] :

1. Hemp sowing
2. Growing period
3. Harvest (cut & bale)
4. Field retting – controlled rotting & turning
5. Drying (sun / barn)
6. Decortication – fibre & shive separation
7. Hydration – bring substrate to 65% moisture
8. Steam pasteurization – 65 C x 2 h
9. Inoculation &. moulding with grain spawn
- 10.Colonisation wait – 6-10 days
- 11.Heat-dry / inactivate (70 C) – Insulation ready

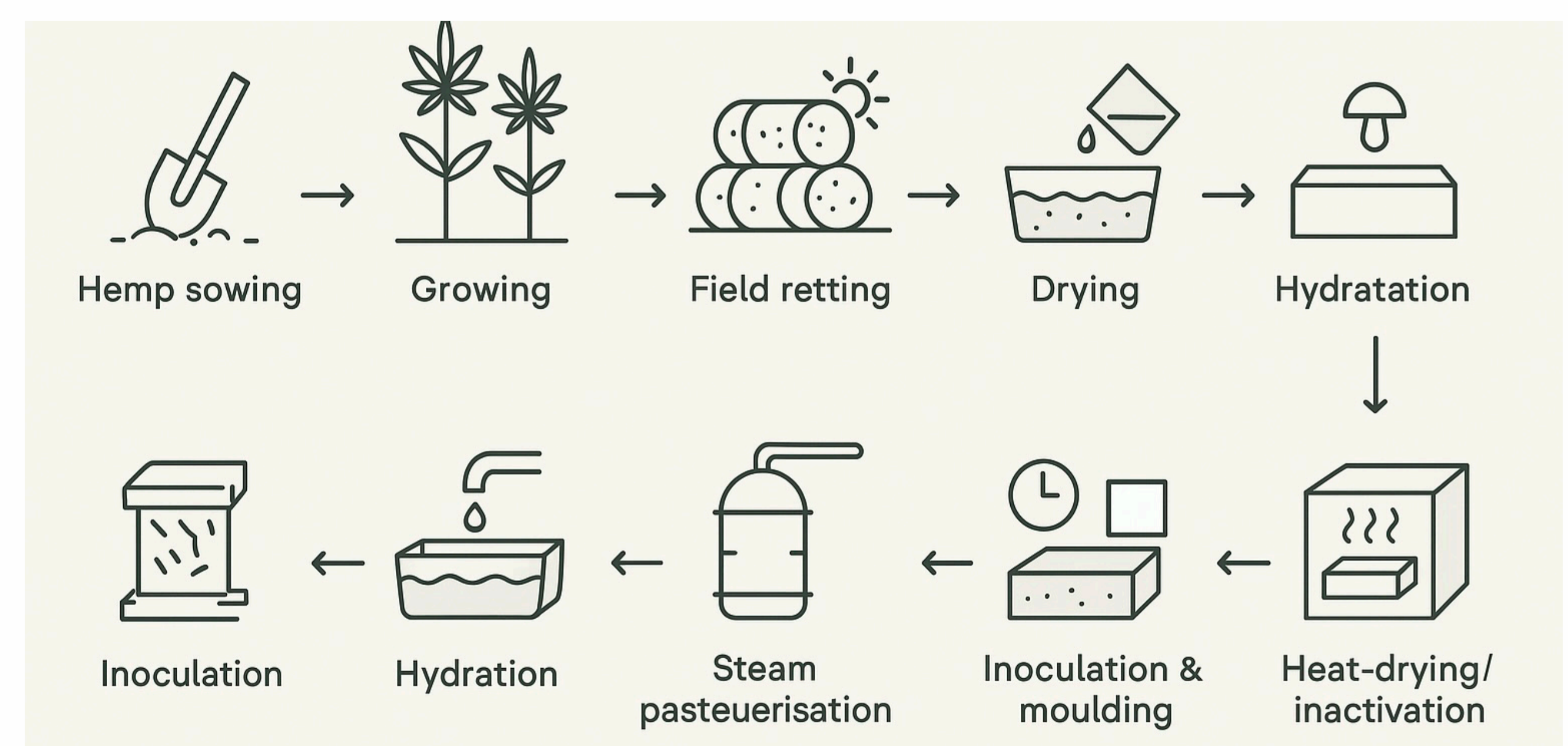


Fig. 5: Locally grown hemp process

References

1. United Nations Environment Program: Global Status Report for Buildings and Construction. 2022
2. University of Vermont: 2021 Industrial Hemp Fiber Variety Trial. 2021
3. Palanisamy, S.: Use of hemp waste for the development of mycelium-grown matrix biocomposites: A concise bibliographic review. 2023
4. Wageningen Universiteit: Handboek vezelhennepteelt, -verwerking en -toepassingen. 2023
5. MNEXT: Protocol, How to grow mycelium-biocomposite materials. 2025

Van Dongen, Stan.

Project/Research Group: Biobased Building

Contact information: s.vandongen4@student.avans.nl

Date: 12 June 2025