

Elaboration and physical characterization of an agro-material based on sugar beet pulp and potato starch.

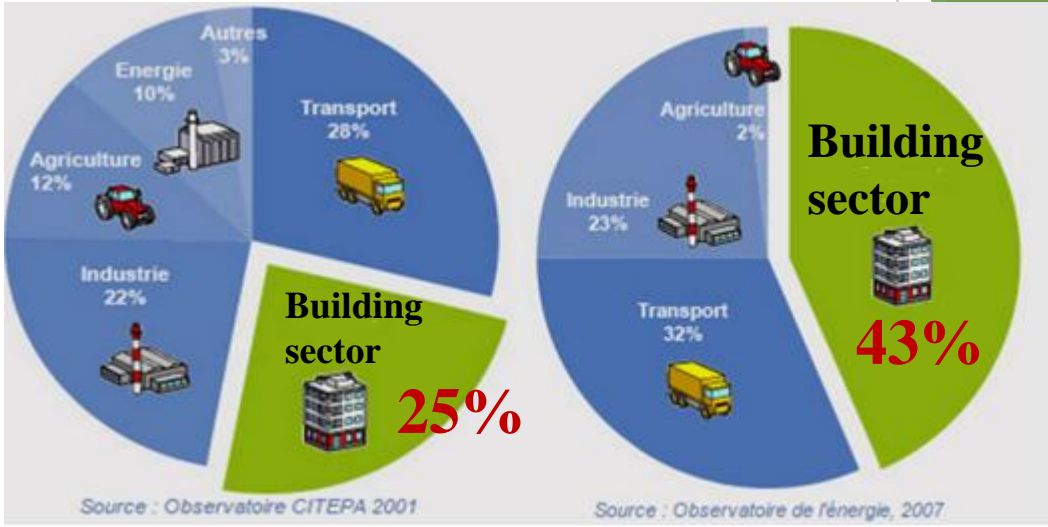
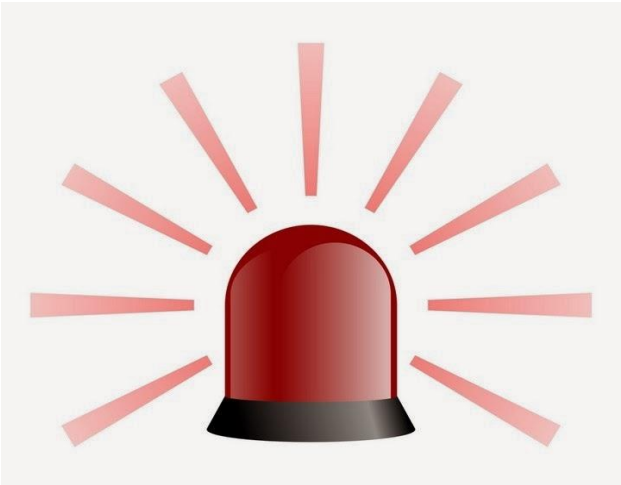
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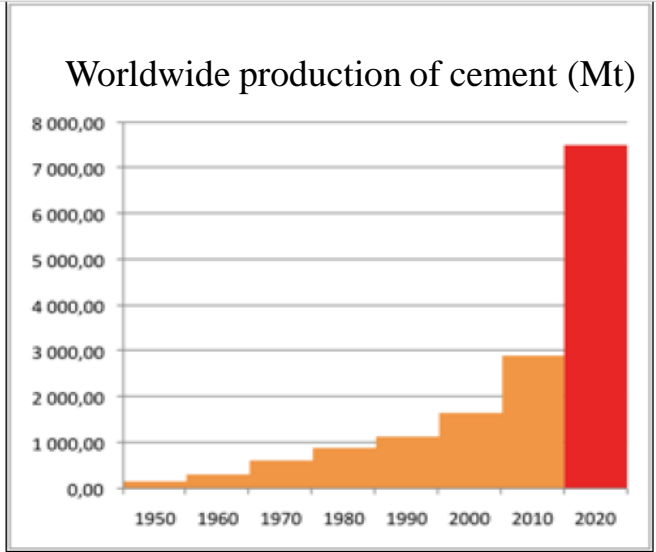
²Institute of Molecular Chemistry in Reims, *ICMR*.

15^{ème} Journée Scientifique du Groupe Français des Polymères (GFP), section Grand-Est, Strasbourg.

Introduction & Objectives



2017 2018 2019 2020



Introduction & Objectives

**Why
not live
in a
sugar
beet ?**

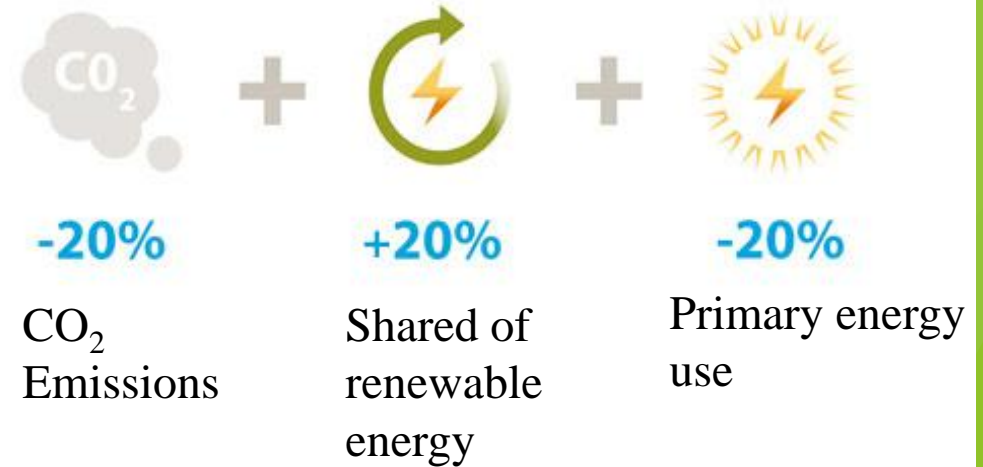


Introduction & Objectives

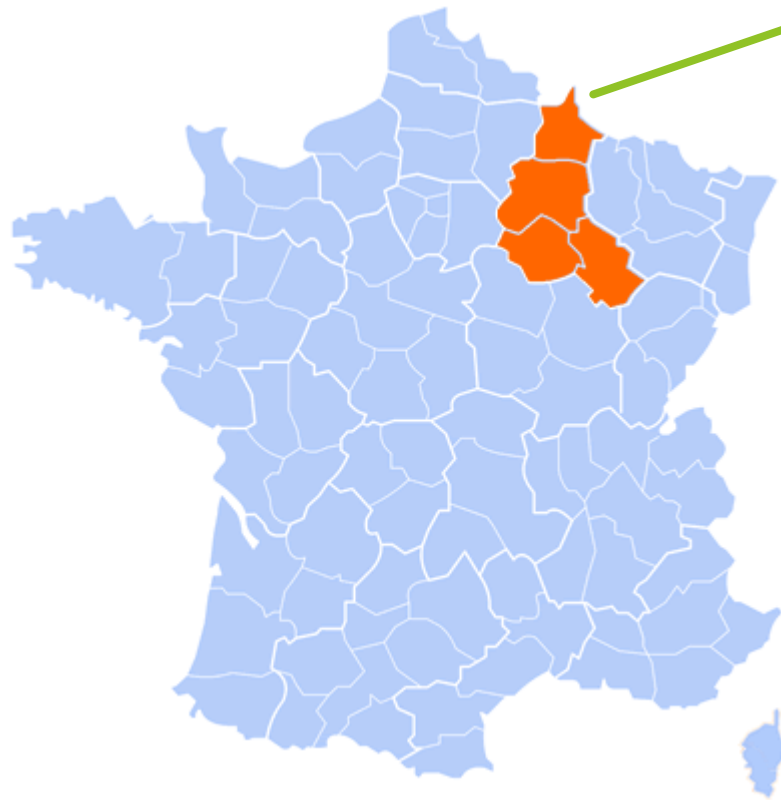
Good insulation of buildings envelop by using renewable green materials based on sugar beet pulp / potato starch

to reduce :

- Energy consumptions and CO₂ gas emissions in buildings.
- Fossil resources consumptions.
- Global warming & building environmental impact.



Introduction & Objectives



8 millions tons of
Sugar beet



Potato starch

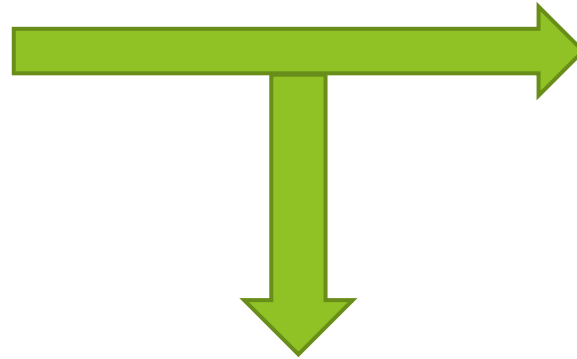


Calcium hydroxide

Sugar beet pulp characteristics



Sugar industry



White sugar

Wastes

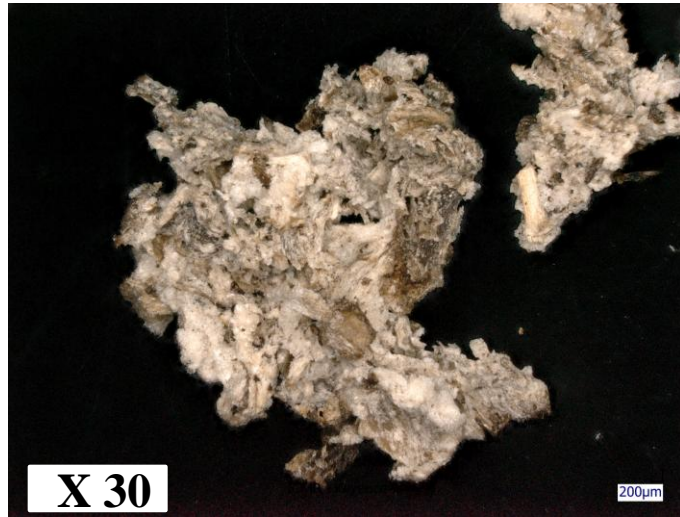


Granular pulp

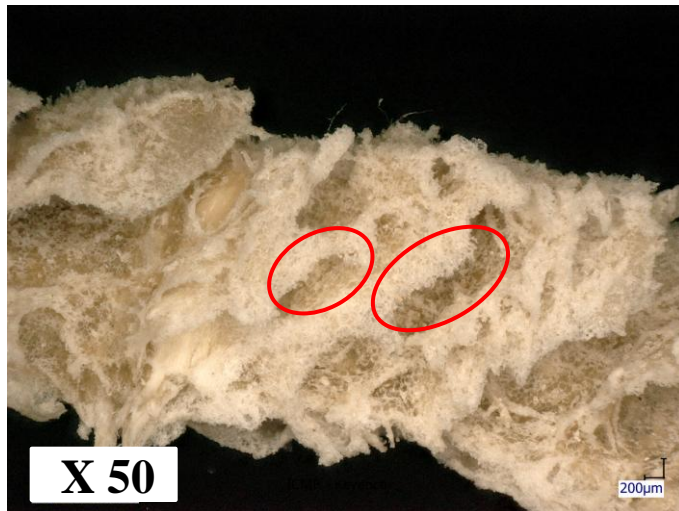
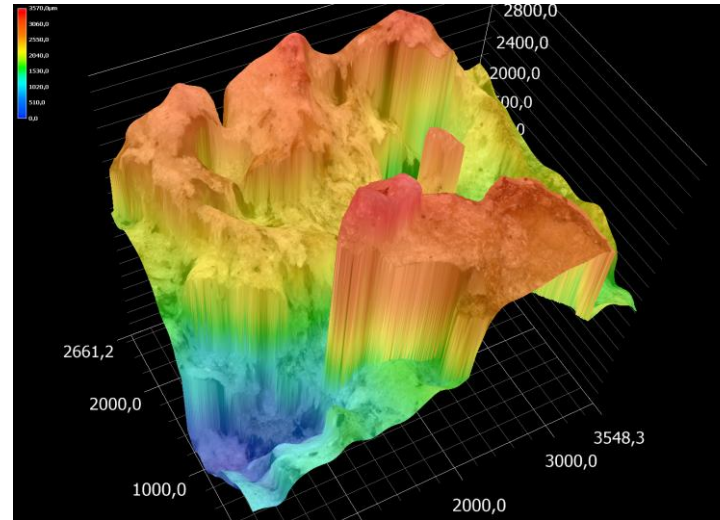


Fresh pulp

Morphology



**Granular
pulp**



**Fresh
pulp**

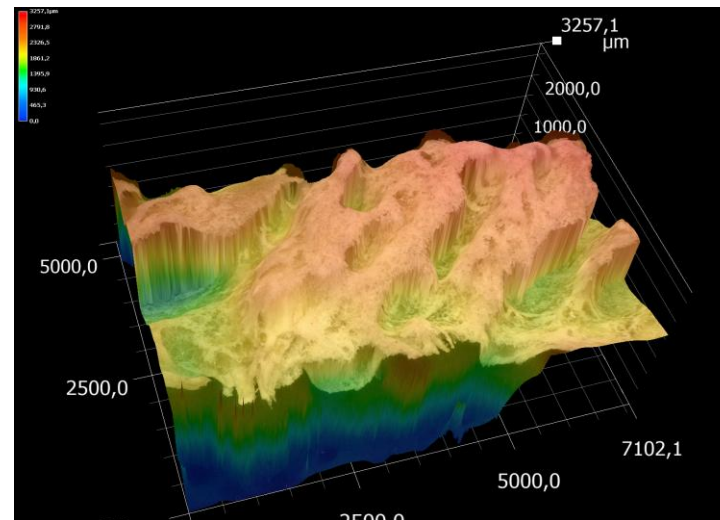
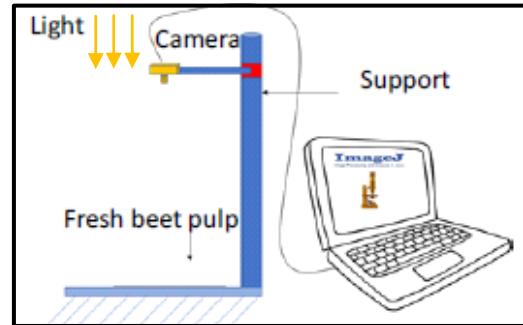
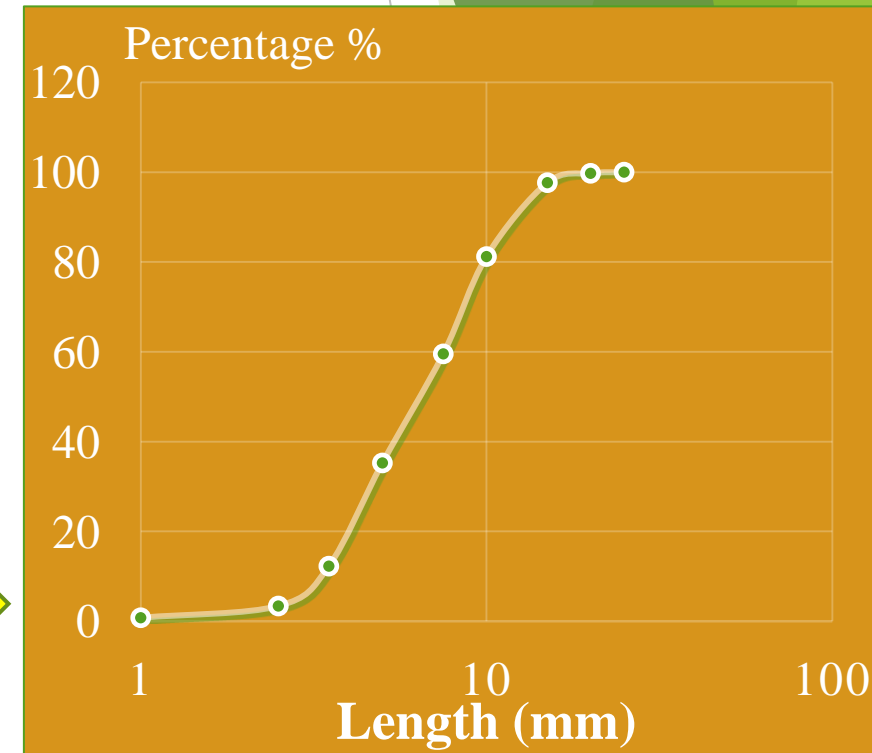
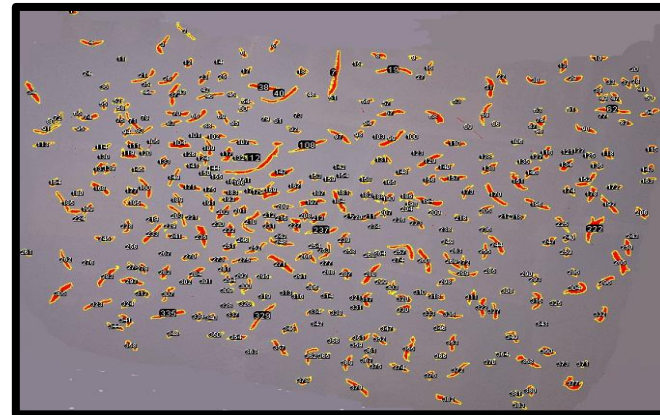


Image analysis

1) Capture of fresh pulp picture



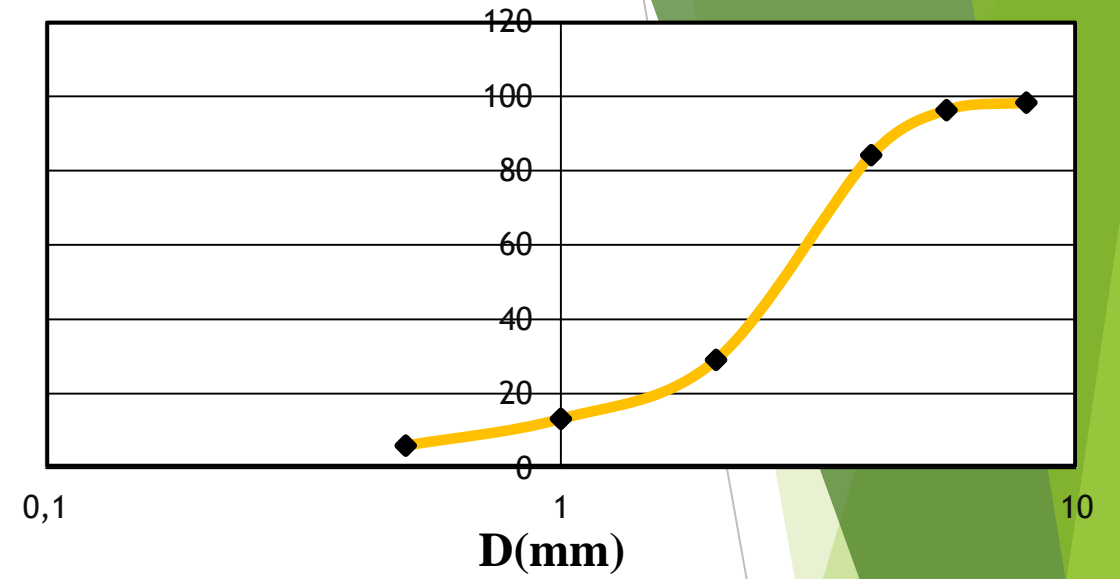
2) Application ImageJ



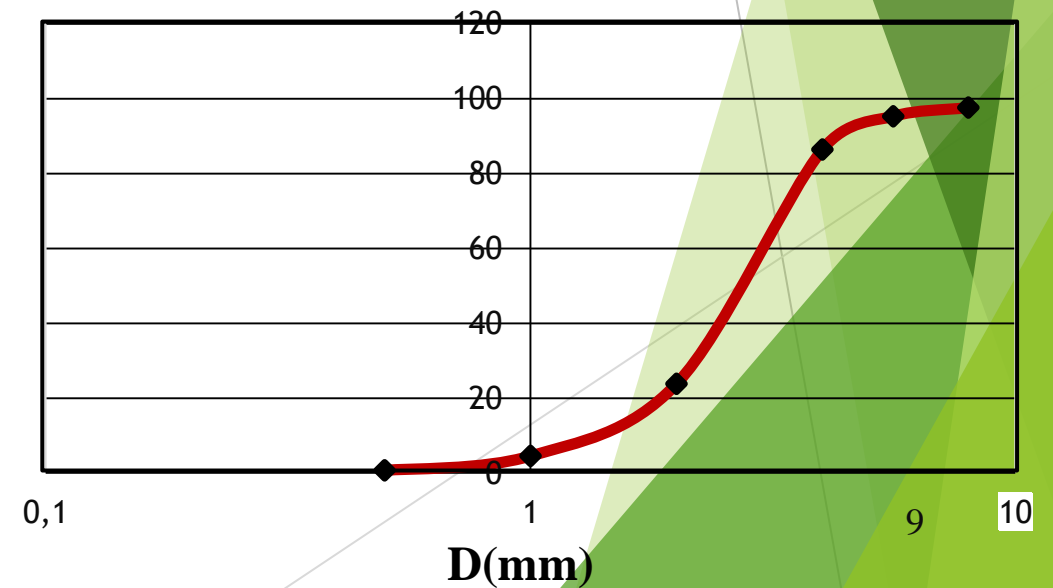
Particule size analysis by sieving



FRESH PULP

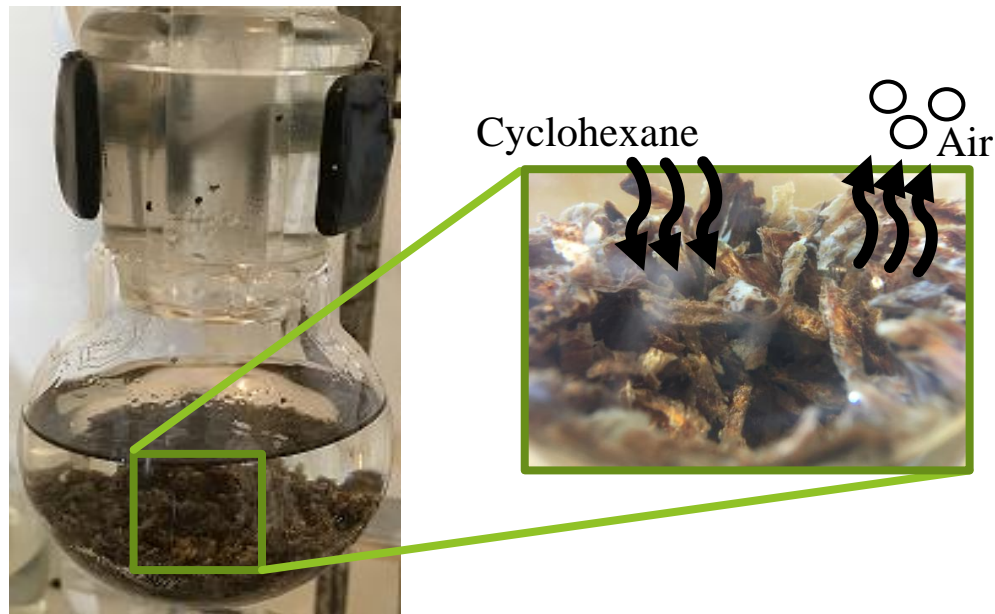


GRANULAR PULP



Absolute Bulk density (Christophe Method)

- 1) Put the dried pulp and cyclohexane in the pycnometer.
- 2) 6 cycles boiling and cooling of the system.



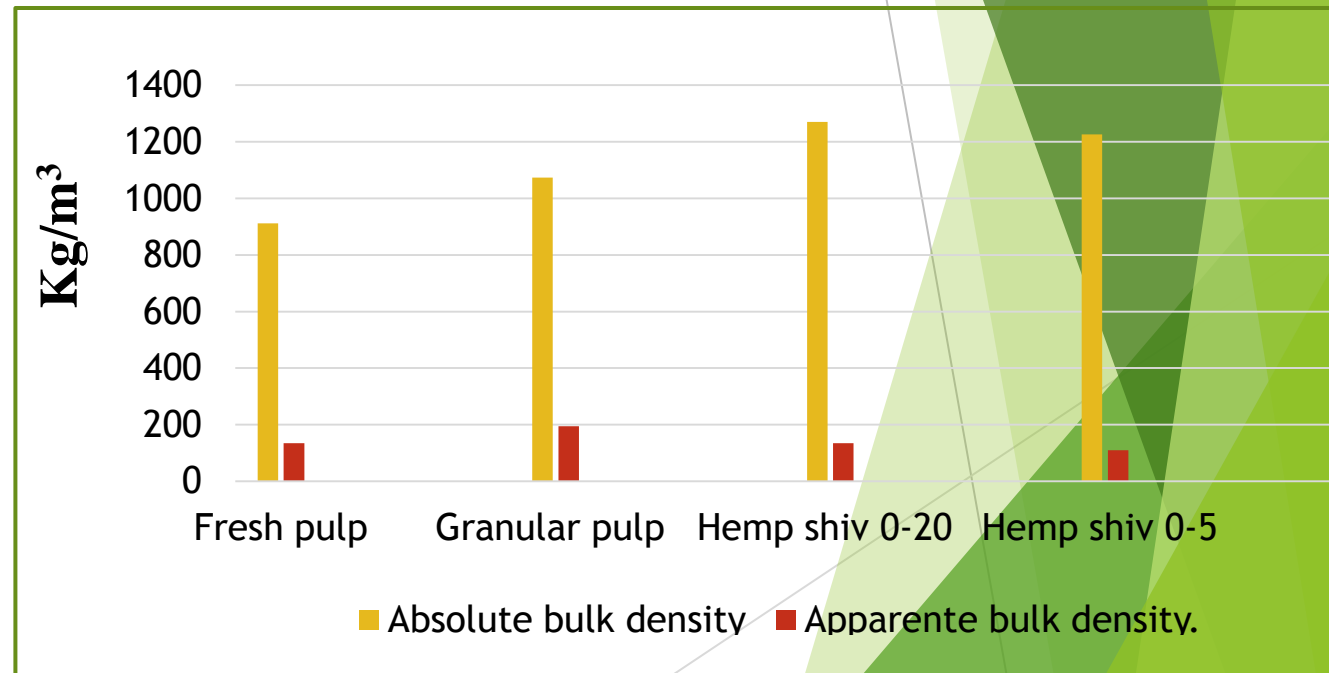
Pycnometer

$$3) \rho_{\text{absolute}} (\text{g/cm}^3) = (M_1 \times \rho_{\text{cyclohexane}}) / (M_1 - (M_2 - M_3))$$

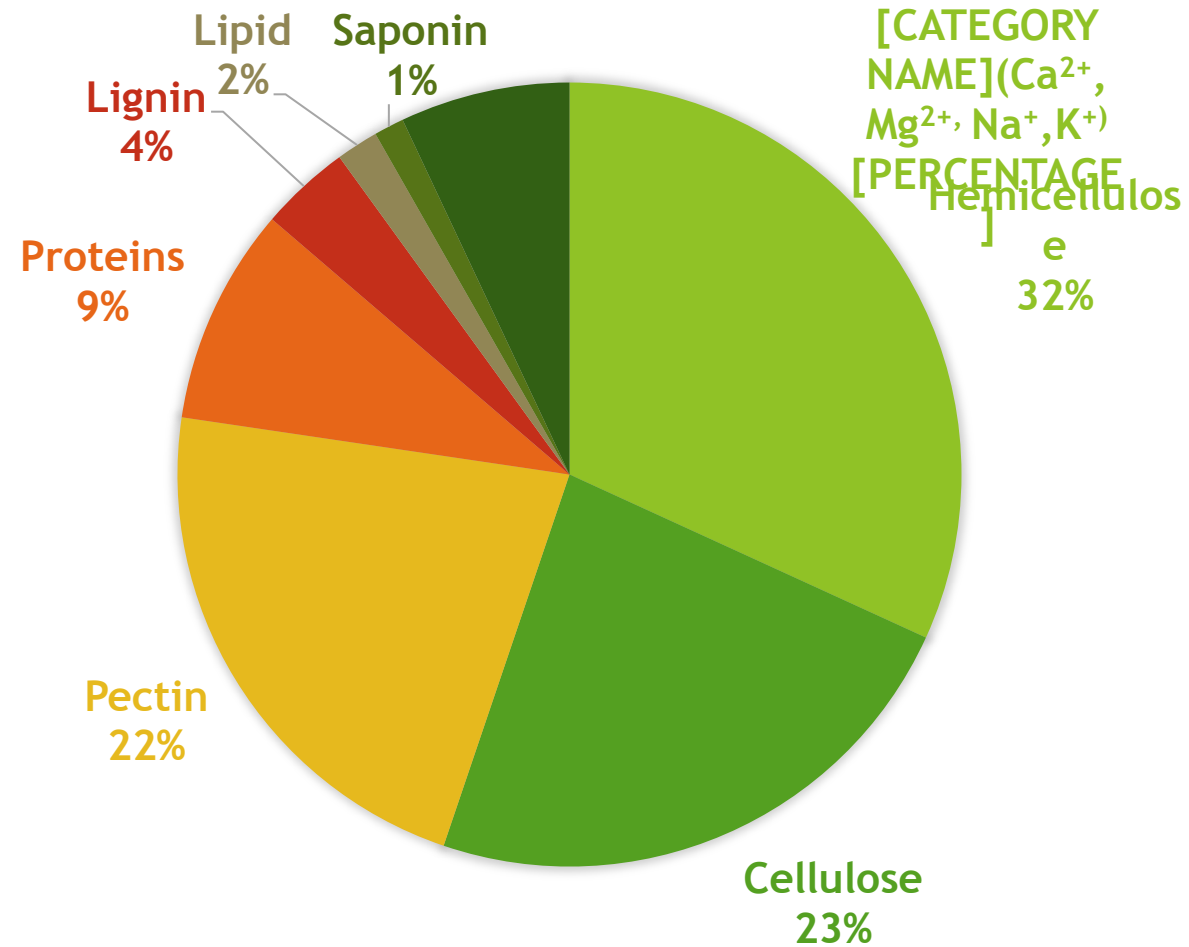
M_1 = Mass of dried pulp.

M_2 = Mass of pycnometer filled with cyclohexane and beet pulp.

M_3 = Mass of pycnometer filled with cyclohexane.



Chemical composition



Rashida BELHAMRI, Extraction des Macromolécules parietaux de betteraves sucrières, Thèse de Doctorat 2005, URCA.

Preparation of the composites

Step 1: Mixing the wet granular or fresh pulp with powder of potato starch and Calcium hydroxide .

Step 2: heating of mixture for 30 minutes in an autoclave.

Step 3: Put the mixture in a wood mold.

Step 4: freezing of the composites (granular pulp/starch at -80°C).

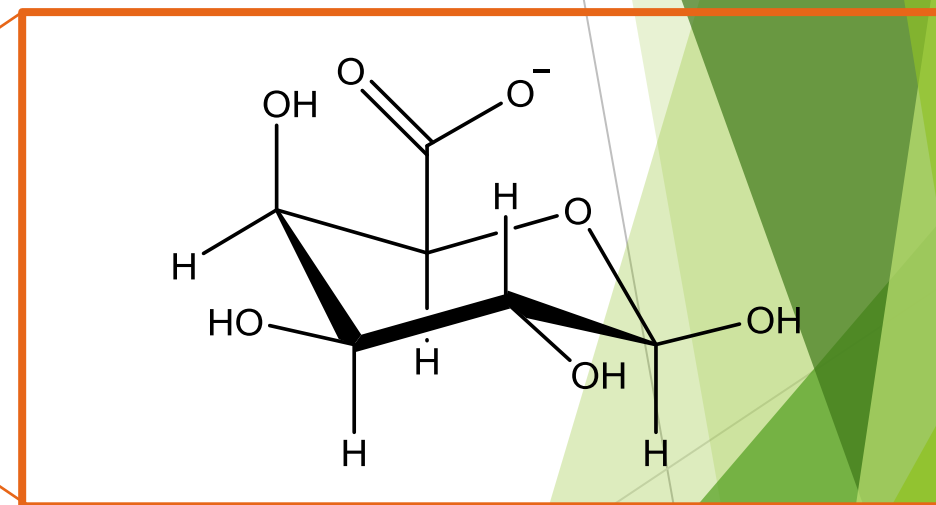
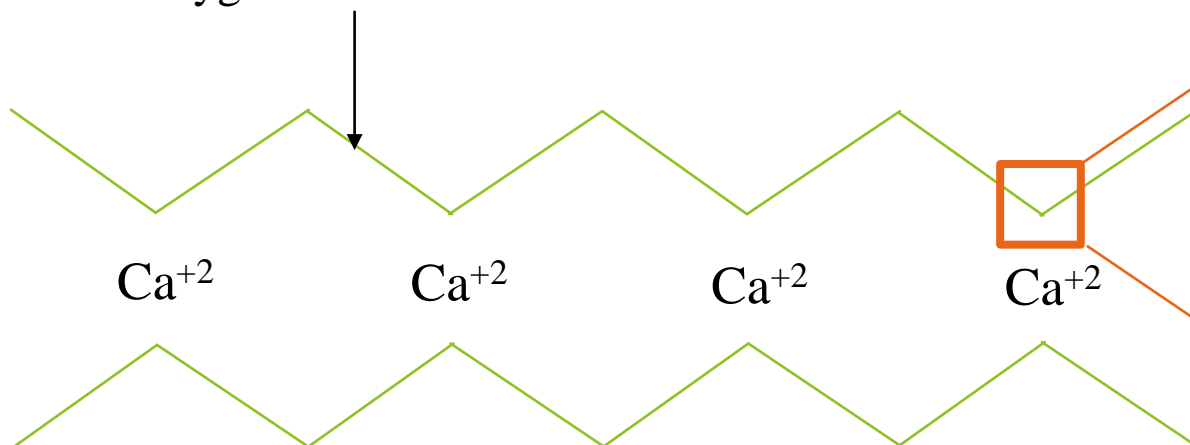
Step 5: Drying with ventilated oven at 50°C for fresh pulp (left side) or Freeze drying for granular pulp (right side).

After 8 days



Galacturonic acid (Beet Pectin)

Polygalacturonic acid



Box of eggs

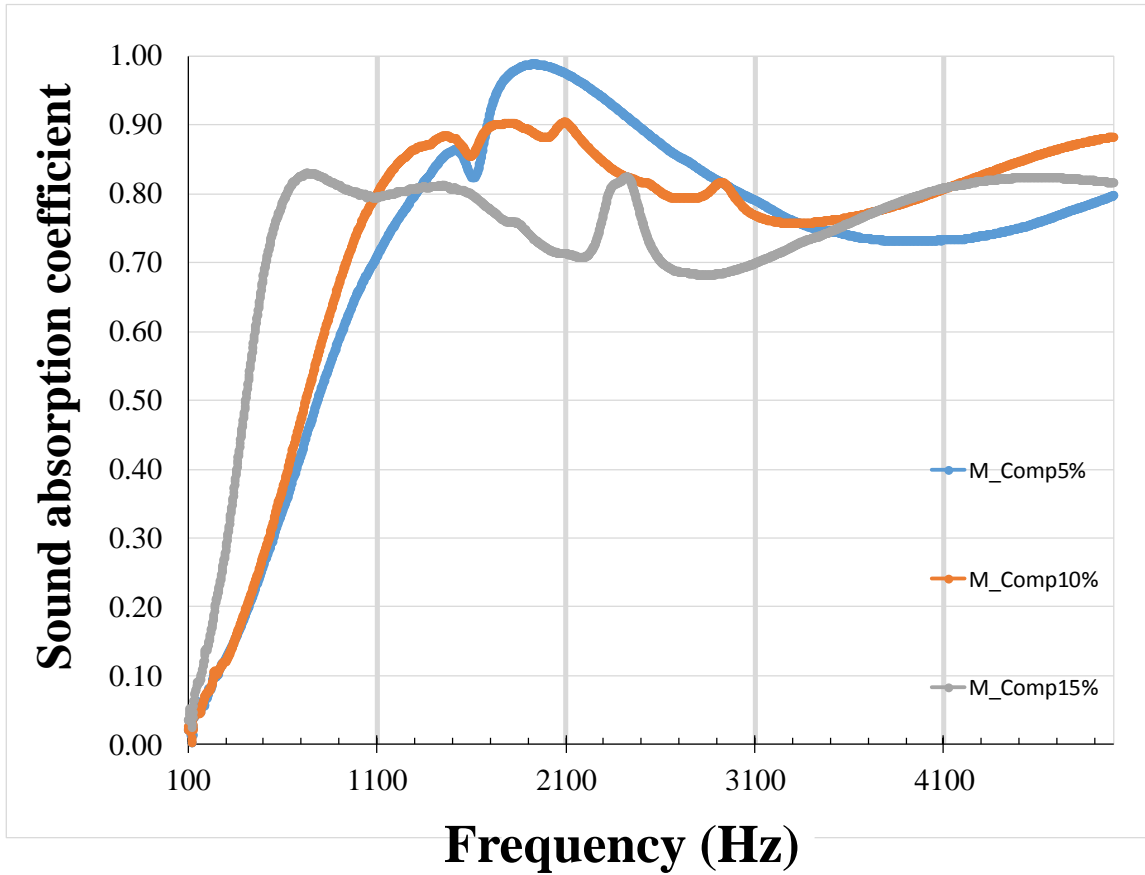


Characteristics of the composites

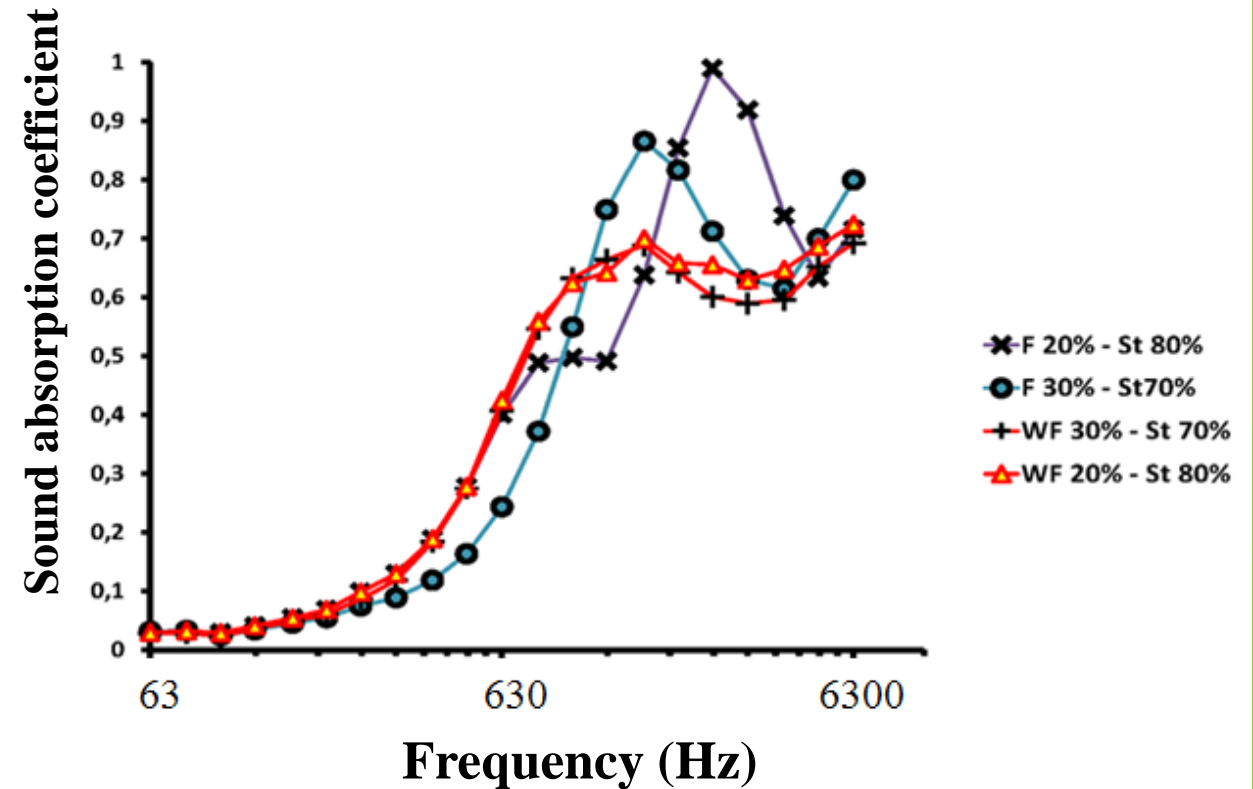
To characterize the composites :

- ❖ Sound Absorption Coefficient (α).
- ❖ Moisture Buffering Value (MBV).

Sound absorption coefficient

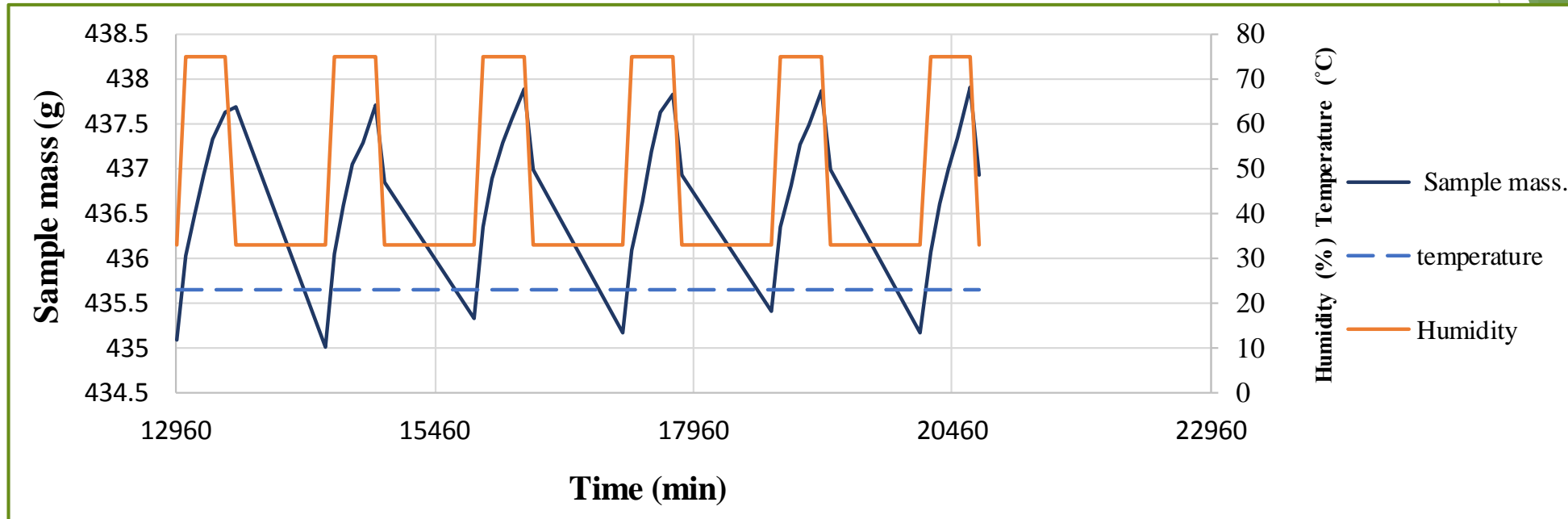


Sugar beet pulp / Starch



Date palm fibers / Starch

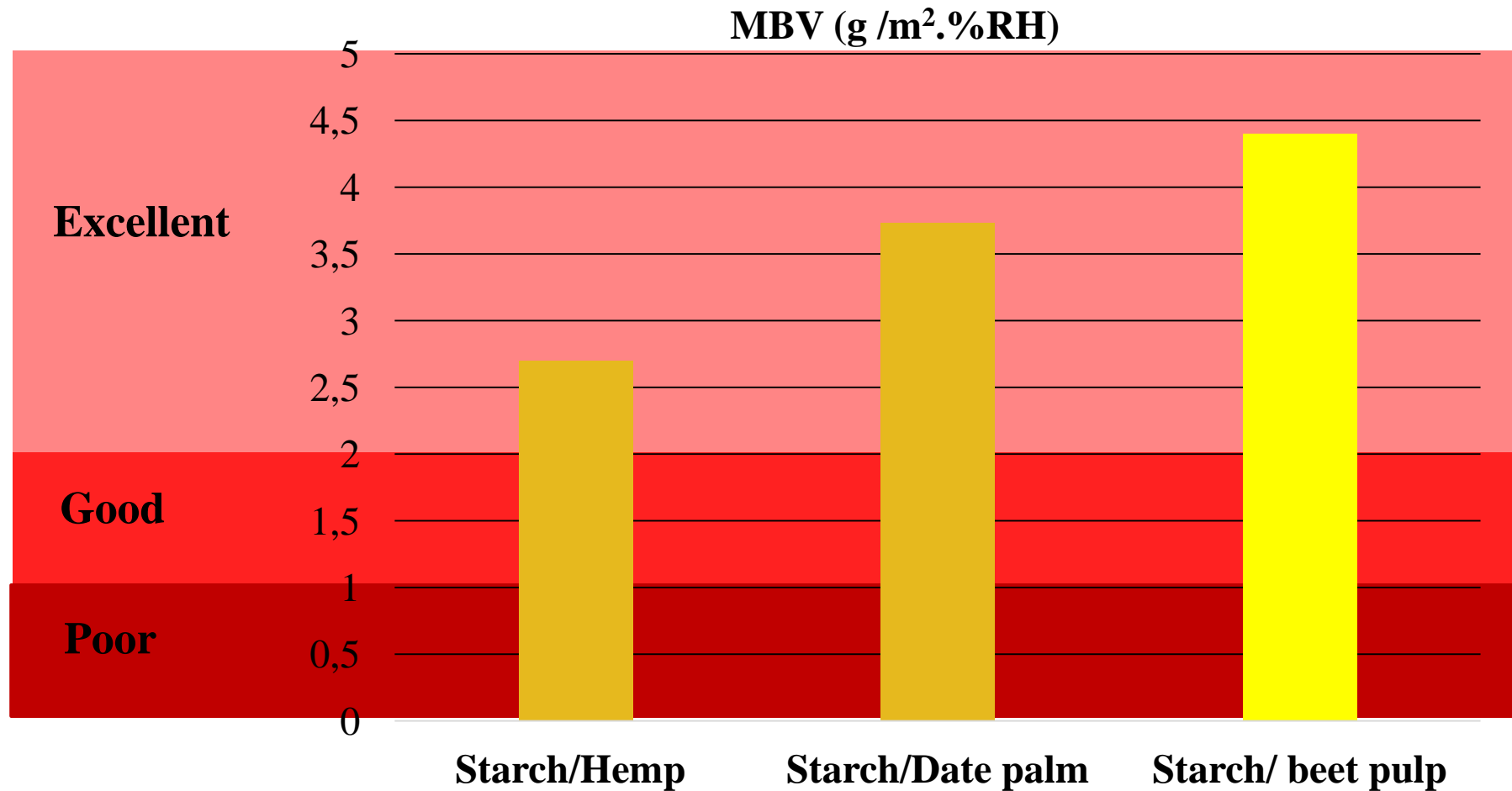
Moisture Buffering Value (Code NORD TEST)



The capacity of the composite to regulate the relative humidity of the medium.



MBV = $\Delta m / (A \times \Delta RH)$.
 Δm : mass variation in g.
A : Area exposed to humidity variation.
 ΔRH : $RH_{high} - RH_{low}$



Conclusions

- Porosity of sugar fresh beet pulp.
Roughness surface of granular beet pulp.
Strong bond between the cations Ca^{2+} and beet pectin. } ✓ Good adhesion of mixture.
- Low bulk density } ✓ Porous and lighter composite
- The morphology of sugar beet pulp }
- Beet pulp/potato starch , Smart wall:
 - 1) Good acoustic insulator for frequency higher than 300 Hz.
 - 2) $\text{MBV} = 4.4 > 2$ → Excellent hygric regulator.

Perspectives

-Thermal characteristics (λ).

-Hygric characteristics.

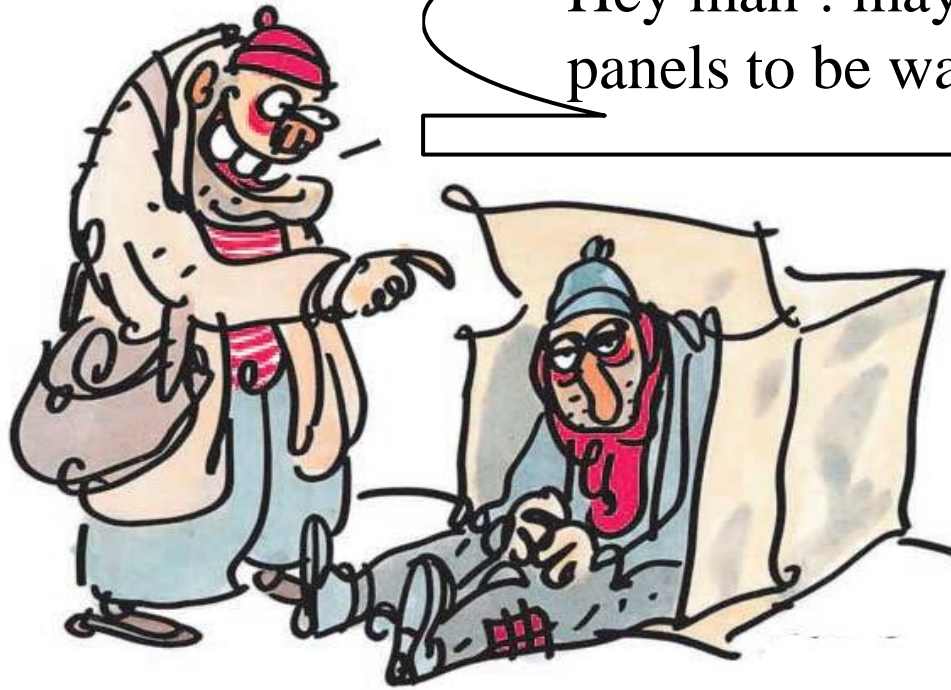
-Mechanical properties.

-The effect of composite humidity on its characteristics.

-Chemicals treatments will be applied to make the sugar beet pulp, hydrophobic and safe against the molds growth.



Hey man ! may be you need some beet panels to be warmer in your room !!



THANK YOU
THANK YOU