

# Milling itineraries dataset for a collection of crop and wood by-products and granulometric properties of the resulting powders

Processes Stored in Data Warehouse Structured by an Ontology

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INRAE



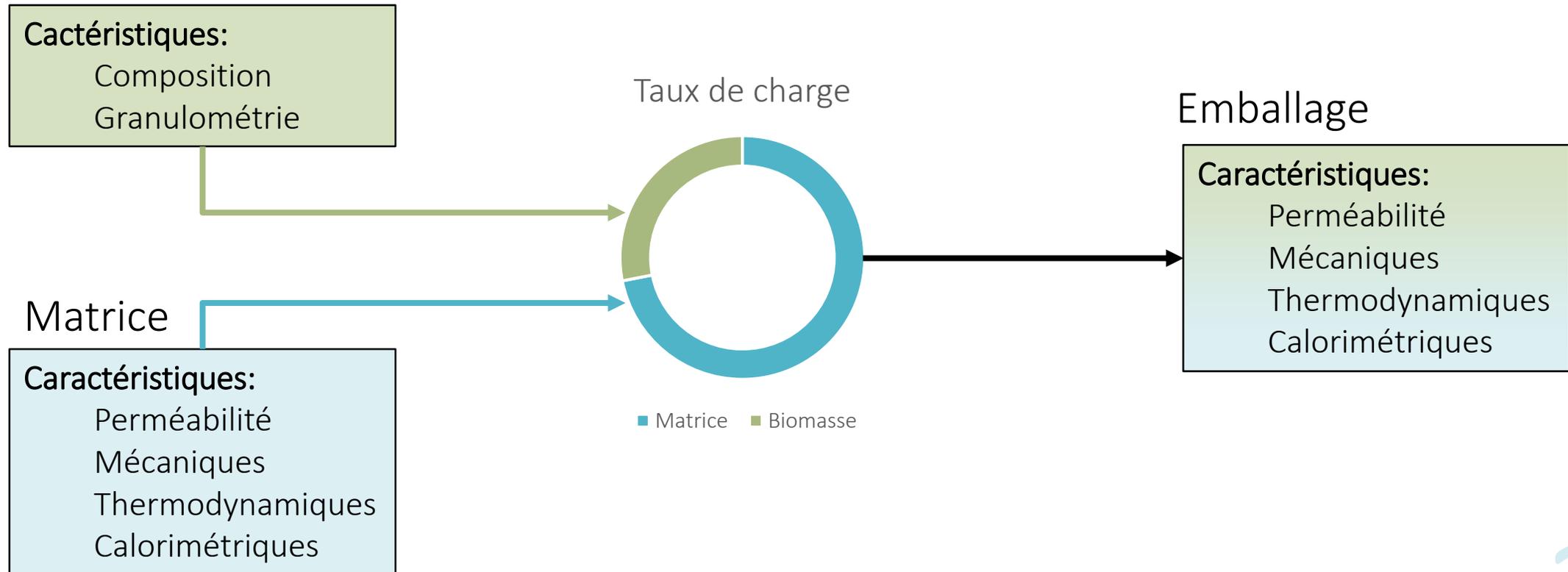
# Contexte – domaine d'application

- Lignocellulosic biomass represents a readily available reservoir of functional elements that can be an **alternative to fossil resources for energy, chemicals and materials production**
- **comminution of lignocellulosic biomass into fine particles is required to reveal its functionalities**, improve its reactivity and allow practical implementation in the downstream processing steps (carrying, dosage, mixing, formulation, shaping...)
- The sources of lignocellulosics are diverse, with two main families, being **agricultural and forest by-products**.
- Due to plant specificity and natural variability, the itineraries of particle size reduction by dry processing, the **behavior upon milling and therefore the characteristics of resulting powders can deeply vary according to various raw biomasses**.

# Contexte (2) potentiel de réutilisation

Biomasse *Déchets de parcs urbains,  
Sarments de vignes,*

...



# Enjeux et défis

Nécessité de raisonnements par apprentissage pour relier les jeux de données

1. **Présence d'incertitudes:** données manquantes, mesurées, répétées...
2. **Complexité des itinéraires de production:** étapes multiples, raisonnement temporel...
3. **Questions de recherche** et connaissances expertes à intégrer
4. **Ouverture sur d'autres bases:** accès à des données complémentaires (ici production de biocomposites)

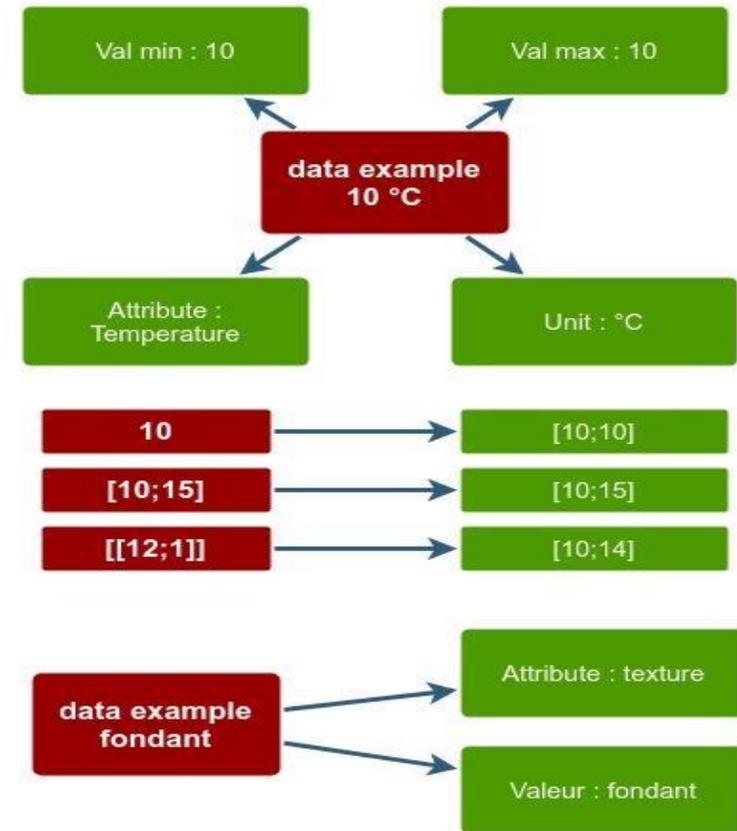
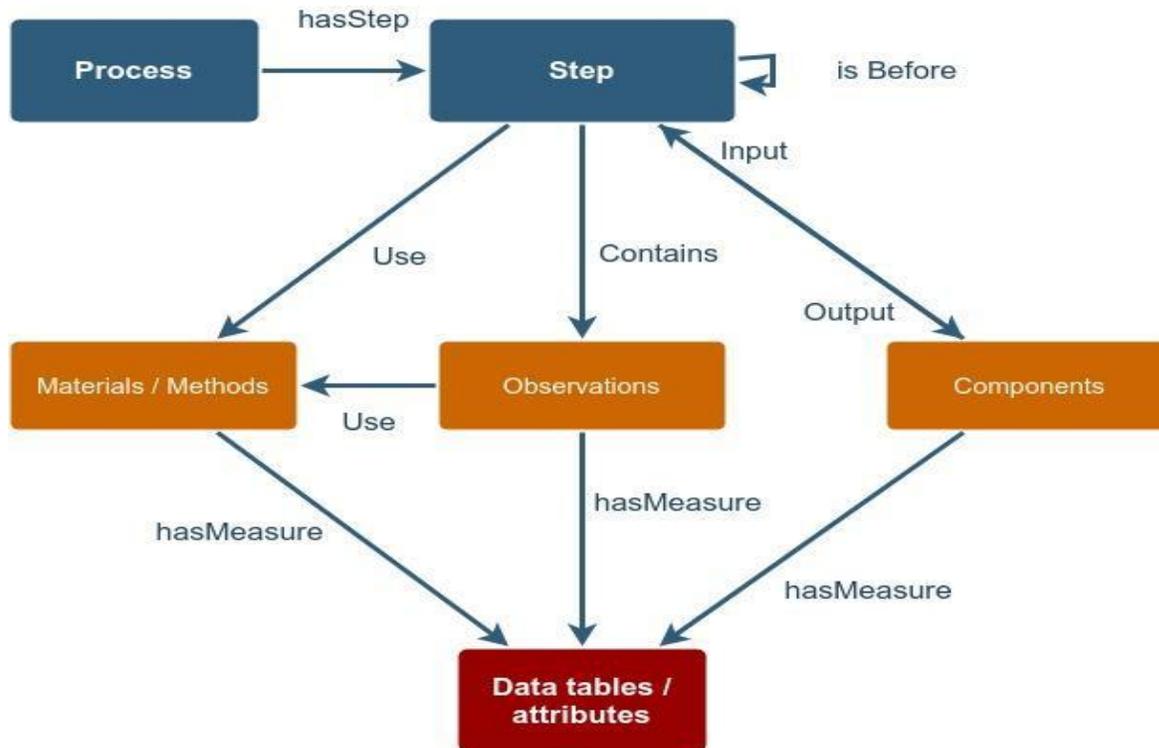
# Description générale du contenu du jeu de données

20 **itinéraires**: variations biomasse x procédé de broyage

Un **itinéraire**:

- Une biomasse en entrée (wheat straw, rice husk, ...)
- Une poudre de **biomasse en sortie** : décrite par ses caractéristiques, son process de fabrication...

# Méthodologie de construction: Process and Observation Ontology



# Un écosystème de données et d'outils basé sur le web sémantique

## PO2 Manager



PO2/TransformON  
Domain ontology

→ structuration  
← enrichment

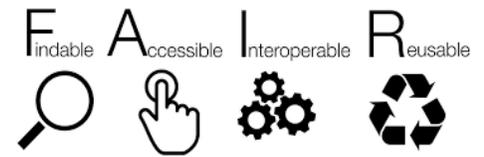
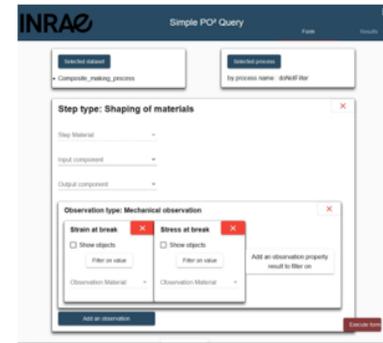


PO2/BaGaTel  
RDF graph DB



## SPO<sup>2</sup>Q

Simple PO2 Query



SPARQL queries

The **Dataverse**® Project

Structured datasets,  
conforming to FAIR  
principles

[BaGaTel Dataverse](#)

W3C Semantic Web

www

SPARQL endpoint

# PO<sup>2</sup> Manager : Edition du vocabulaire

PO<sup>2</sup> Manager - Biorefinery

File Tools Help

- ▶ PO2 / attribute
- ▼ PO2 / component
  - ▼ biomass
    - Brewing spent grain
    - ▼ Grasses and energetic plants
      - bagasse**
      - Corn stover
      - Oilseed rap straw
      - rice straw
      - Sugarcane leaf
      - Sugarcane straw
      - Switchgrass
      - wheat straw
    - Lignocellulosic filler
    - Olive pomace
    - Rapeseed oil cake
  - ▶ Urban park vegetal residue
  - ▶ Vine shoot
  - ▶ Wood
  - ▶ Gaz
  - ▶ polymers
  - ▶ Service product
- ▶ PO2 / material
- ▶ PO2 / method
- ▶ PO2 / observation

online Biorefinery Composite ...

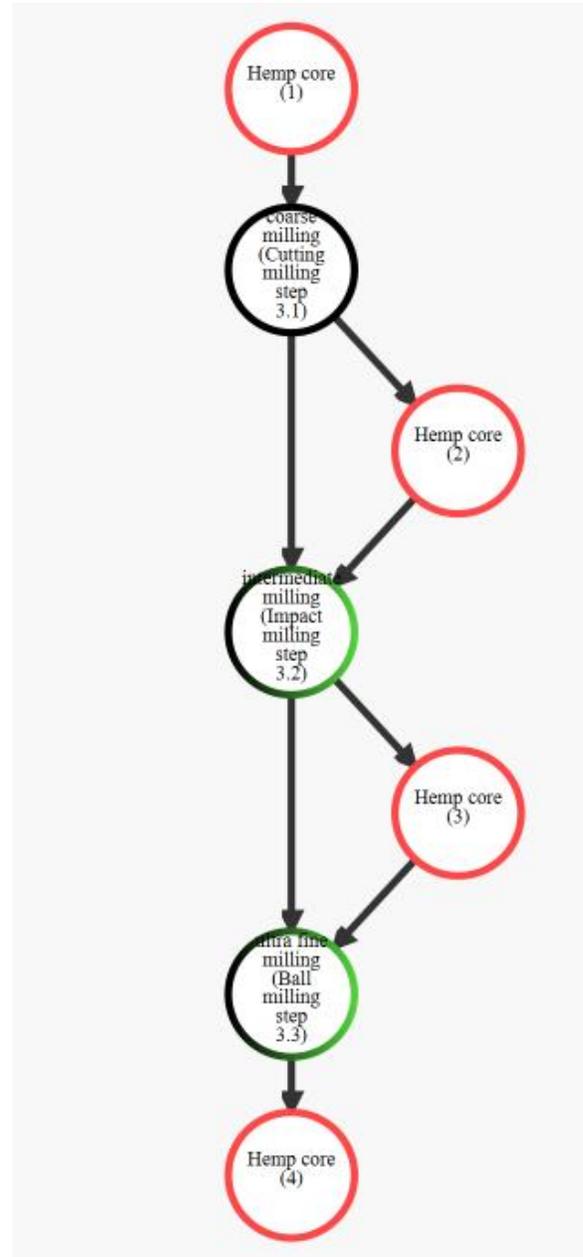
 **bagasse**

[http://opendata.inra.fr/PO2\\_biorefinery/component/Bagasse](http://opendata.inra.fr/PO2_biorefinery/component/Bagasse)  
 > component > biomass > Grasses and energetic plants

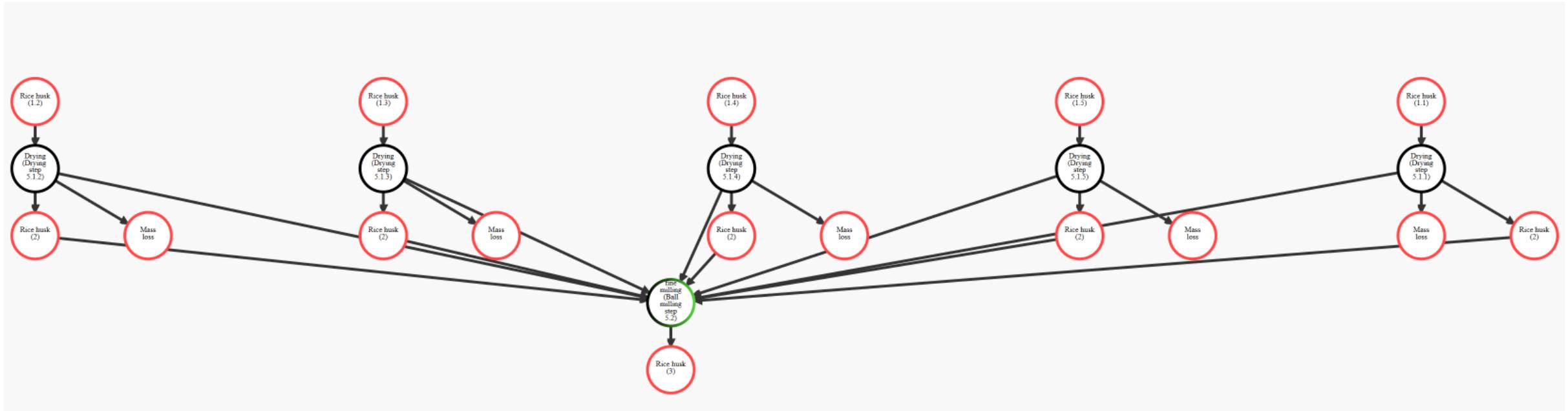
	Label	Synonyms	Description
	bagasse		
	Bagasse		
	Bagasse		
	bagazo		
	Bagassa		

Exact Match	Close Match
<a href="http://lod.nal.usda.gov/nalt/15515">http://lod.nal.usda.gov/nalt/15515</a>	No content in table
<a href="http://aims.fao.org/aos/agrovoc/c_776">http://aims.fao.org/aos/agrovoc/c_776</a>	
<a href="http://id.agrisemantics.org/gacs/C13405">http://id.agrisemantics.org/gacs/C13405</a>	
<a href="http://id.cabi.org/cabt/16848">http://id.cabi.org/cabt/16848</a>	

# PO<sup>2</sup> Manager : exemple d'itinéraire (Hemp core)



# PO<sup>2</sup> Manager : exemple d'itinéraire (Rice Husk)



# PO<sup>2</sup> Manager : Step description

▼ Step

Step type :  Step name :

Date (YYYY-MM-DD) :  Description :

Time (hh:mm:ss) :

Time duration (hh:mm:ss) :

▼ Materials & Methods

milling machine (UPZ)

Parameters							
#	attribute	object	value	unit	comment		+
0	Rotation speed	<input type="text"/>	<input type="text" value="18000"/>	<input type="text" value="1/min"/>	<input type="text"/>	<input type="button" value="+"/>	<input type="button" value="x"/>
1	Treatment durator	<input type="text"/>	<input type="text" value="2"/>	<input type="text" value="h"/>	<input type="text"/>	<input type="button" value="+"/>	<input type="button" value="x"/>
2	Sieving size	<input type="text"/>	<input type="text" value="0.3"/>	<input type="text" value="mm"/>	<input type="text"/>	<input type="button" value="+"/>	<input type="button" value="x"/>

► Composition --- ⓘ Type :  Composition type :  Composition name :

► Composition --- ⓘ Type :  Composition type :  Composition name :

# PO<sup>2</sup> Manager : Observation caractéristiques granulométriques

▼ Observation

Observation type :  Observation name :

Date (YYYY-MM-DD) :  Scale :

Time (hh:mm:ss) :  Repetition :

Time duration (hh:mm:ss) :

Objects observed :

- Step - ultra fine milling (Ball milling step 3.3)
- Output composition - Hemp core (Hemp cor
- Input composition - hemp core (Hemp core

▼ Materials & Methods

- Mastersizer 2000 (Malvern 2000)
- granulometry (standard operating condition - SOP1)

+ add    × del

▼ Table 1 raw data

#	attribute	object	value	unit	comment	
0	Volume D50		[8.382;8.491]	µm		+ ×
1	Volume D10		[1.762;1.783]	µm		+ ×
2	Volume D90		[30.254;30.343]	µm		+ ×

▼ Table 2 raw data

#	Sampl...	Volu...	Volu...	Volu...	Span (1)	Specif...	
0	0	[143.768;163.504]	[27.199;30.276]	[412.022;456.268]	[2.605;2.677]	[0.094;0.105]	+ ×
1	30	[119.499;121.815]	[17.6;17.675]	[395.711;409.903]	[3.164;3.22]	[0.162;0.164]	+ ×
2	60	[56.149;61.372]	[8.885;9.358]	[257.734;334.691]	[4.432;5.301]	[0.302;0.319]	+ ×

# PO<sup>2</sup> Manager : Observation caractéristiques biochimiques

▼ Observation

Observation type :  Observation name :

Date (YYYY-MM-DD) :  Scale :

Time (hh:mm:ss) :  Repetition :

Time duration (hh:mm:ss) :

Objects observed :

- Step - coarse milling (impact milling 5.3)
- Output composition - hemp core powder (hemp core-p)
- Input composition - hemp core powder (hemp core-p)

▼ Materials & Methods

-  spectrophotometer (spectrophotometer)
-  biological or biochemical characterization (Lignin measurement)

▼ Table 1

#	attribute	object	value	unit	comment	
0	<input type="text" value="rate"/>	<input type="text" value="lignine"/>	<input type="text" value="22.16"/>	<input type="text" value="%"/>	<input type="text"/>	<input type="button" value="+"/> <input type="button" value="x"/>

# PO<sup>2</sup> Manager : Observation caractéristiques biochimiques (suite)

▼ Observation

Observation type :  Observation name :

Date (YYYY-MM-DD) :  Scale :

Time (hh:mm:ss) :  Repetition :

Time duration (hh:mm:ss) :

Objects observed :

- Step - coarse milling (impact milling 5.3)
- Output composition - hemp core powder (hemp core)
- Input composition - hemp core powder (hemp core-p)

▼ Materials & Methods

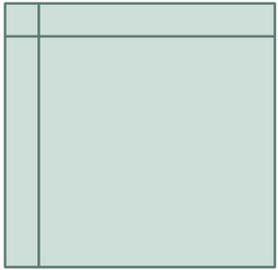
- chromatography instrument (TRACE Ultra Gas Chromatograph)
- biological or biochemical characterization (Monosaccharides measurement)

+ add      × del

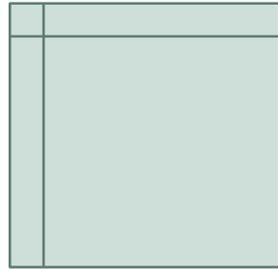
▼ Table 1

#	attribute	object	value	unit	comment	
0	<input type="text" value="rate"/>	<input type="text" value="glucose"/>	<input type="text" value="37.0"/>	<input type="text" value="%"/>	<input type="text"/>	<input type="button" value="+"/> <input type="button" value="×"/>
1	<input type="text" value="rate"/>	<input type="text" value="hemicellulose"/>	<input type="text" value="20.28"/>	<input type="text" value="%"/>	<input type="text"/>	<input type="button" value="+"/> <input type="button" value="×"/>

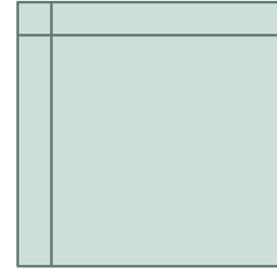
# Présentation des deux datasets déposés

A light green rectangular icon representing a table with a header row and a vertical column on the left.

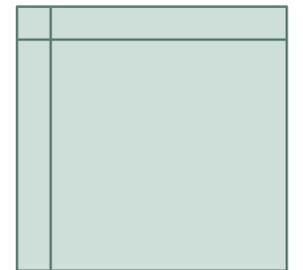
**Table 1.** Étapes de production des poudres

A light green rectangular icon representing a table with a header row and a vertical column on the left.

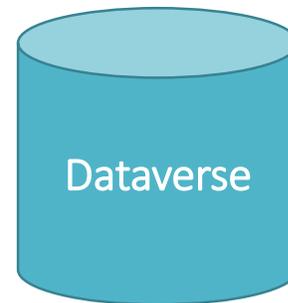
**Table 2.** Caractéristiques granulométriques des poudres

A light green rectangular icon representing a table with a header row and a vertical column on the left.

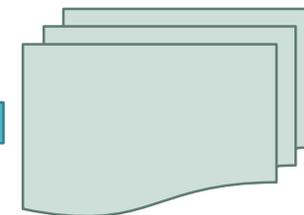
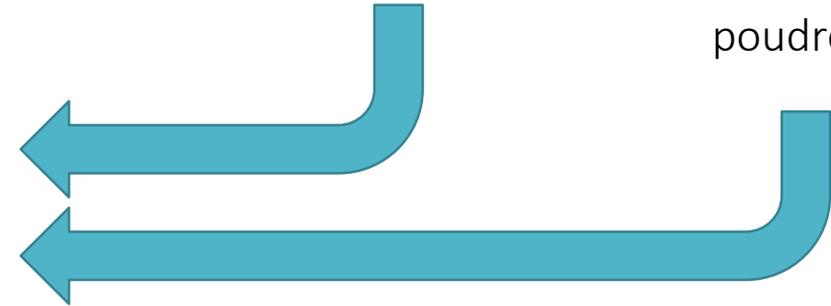
**Table 3.** Cinétique des réductions de taille des particules

A light green rectangular icon representing a table with a header row and a vertical column on the left.

**Table 4.** Caractéristiques biochimiques des poudres



Dataverse



Vocabulaire spécifique  
PO2/TransformON

# Accessibilité

Sous forme de SPARQL endpoint

[http://quantum.agroparistech.fr/graphdb/repositories/Planet-Milling itineraries for a collection of crop byproducts](http://quantum.agroparistech.fr/graphdb/repositories/Planet-Milling_itineraries_for_a_collection_of_crop_byproducts)

A travers un web-service

<https://quantum.mia-ps.inrae.fr/spoq/form>

Sous forme de CSV présents ds les datasets déposés sur Dataverse

Crop by-products: <https://doi.org/10.15454/YZJXET>

Wood by-products: <https://doi.org/10.15454/S660LH>

# Conclusion

- Jeu de données expérimentales pour la production et la caractérisation de poudres végétales intégrant des données provenant de deux unités Transform (IATE et BIA)
- Travail d'homogénéisation réalisée à partir de l'ontologie PO<sup>2</sup>/TransformON
- Plusieurs façons d'accéder aux données (dataset, sparql endpoint, SPO<sup>2</sup>Q)
- Réutilisation du jeu de données pour le croiser de manière indirecte avec le jeu de données: *Biocomposites from poly(3-hydroxybutyrate-co-3-hydroxyvalerate) and lignocellulosic fillers: Processes stored in data warehouse structured by an ontology*

Charlène Fabre, Patrice Buche, Xavier Rouau, Claire Mayer-Laigle. Milling itineraries dataset for a collection of crop and wood by-products and granulometric properties of the resulting powders. *Data in Brief*, 2020, 33, pp.106430. [10.1016/j.dib.2020.106430](https://doi.org/10.1016/j.dib.2020.106430). [hal-03004903](https://hal.archives-ouvertes.fr/hal-03004903)