

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

Presented by Patrice Buche, INRAE IATE Montpellier

Lignocellulosic biomass represents a readily available reservoir of functional elements that can be an alternative to fossil resources for energy, chemicals and materials production. However, 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.

This data set contains milling itineraries and granulometric properties of the resulting powders obtained from a collection of by-products from crops (flax fibers, hemp core, rice husk, wheat straw) and woods (pine wood pellets, pine bark, pine sawdust, Douglas shavings, chestnut tree sawdust) representative of currently used lignocellulosic biomass. Samples provided in the form of large pieces (hemp core, pine bark, Douglas shavings) were successively milled using different mills to progressively reduce the matter into coarse, intermediate and finally fine powders. The other samples, supplied as sufficiently small format, were directly processed in the fine powder mill. The machine characteristics and their operating parameters were recorded. The granulometric properties of the powders were analyzed with a laser granulometer and the main indicators related to the particle size distribution (PSD) are presented: (i) d10, d50 (or median diameter) and d90 which are the 10th, 50th and 90th percentiles of the cumulative volume distribution; (ii) the span, which evaluates the width of the particle size distribution; (iii) the calculated specific surface area of the powders which represents the sum of total surface exhibited by the particles per unit of gram and for some powders.

Data are stored as a knowledge graph structured by the @Web BIOREFINERY ontology, which is dedicated to represent n-ary relations (i.e., relations to link multiple concepts together) in the field of biorefinery [1]. The knowledge graph can be accessed manually through the @Web interface (<https://www6.inrae.fr/cati-icat-atweb/>); it can also be directly queried using the SPARQL language in the accessible SPARQL endpoint (<https://ico.iate.inra.fr/fuseki/annotation/query>).

Data are also stored as a knowledge graph structured by PO² (Process and Observation Ontology) [2], an ontology dedicated at its core to the representation of transformation processes through the definition of steps, relations between those and their associated observations. In our case, specific domain vocabulary has been elicited and used to define precisely the different technologies used for the biomass treatment and the biocomposites production. This vocabulary is currently considered for integration in the PO2/TransformON domain ontology [3].

[1] C Lousteau-Cazalet, et al., A decision support system for eco-efficient biorefinery process comparison using a semantic approach, *Comput. Electron. Agricul.* 127 (2016) 351–367
<https://doi.org/10.1016/j.compag.2016.06.020>.

[2] Mélanie Munch, Patrice Buche, Stéphane Dervaux, Juliette Dibie, Liliana L. Ibanescu, et al.. Combining ontology and probabilistic models for the design of bio-based product transformation processes. *Expert Systems with Applications*, 2022, 203, pp.117406.

[3] Magalie Weber, Patrice Buche, Liliana Ibanescu, Stéphane Dervaux, Hervé Guillemain, Julien Cufi, Michel Visalli, Elisabeth Guichard, Caroline Pénicaut. PO2/TransformON: an ontology on food, feed and biowastes engineering for data integration in a circular bioeconomy and nexus-oriented approach. *Nature Science of Food*, in press.

Associated data paper : 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)