Experimental data annotation guided by an ontology for decision support: @Web project

Patrice Buche, Juliette Dibie

ECOBIOCAP

Ecoefficient Biodegradable Composite Advanced Packaging

Experimental data annotation guided by an ontology for decision support: @Web project

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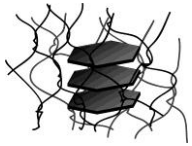
ECOBIOCAP
Ecoefficient Biodegradable Composite Advanced Packaging

Heterogeneous data reuse for decision support

(Destercke et al. 2011, Buche et al 2013, Destercke et al. 2013, Tamani et al. 2014, Guillard et al. 2015)

Food packaging multi-criteria design support

- Scientific advances
- Food quality
- Consumer safety
- Economical competitivity
- Environmental protection



I want a packaging which preserves my product, made of renewable resources, but without GMO, if possible transparent and with a « material » cost < 3 € / kg …

Multi-criteria querying

Fresh produce database

- Industrial constraints
- Consumer preferences
- Waste management policy
- etc

Virtual MAP simulation

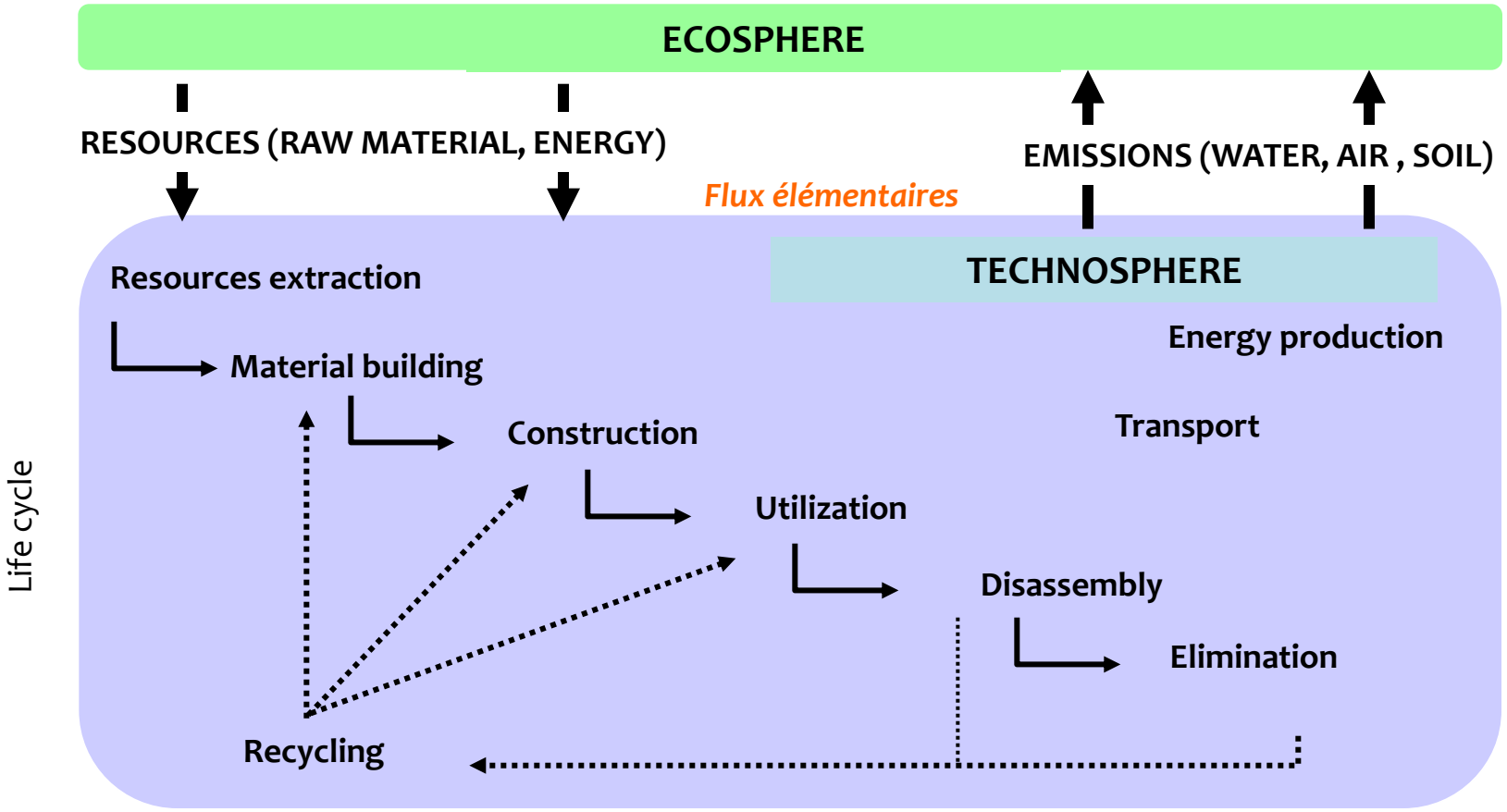
Stakeholder preferences and needs

Multi-criteria flexible querying

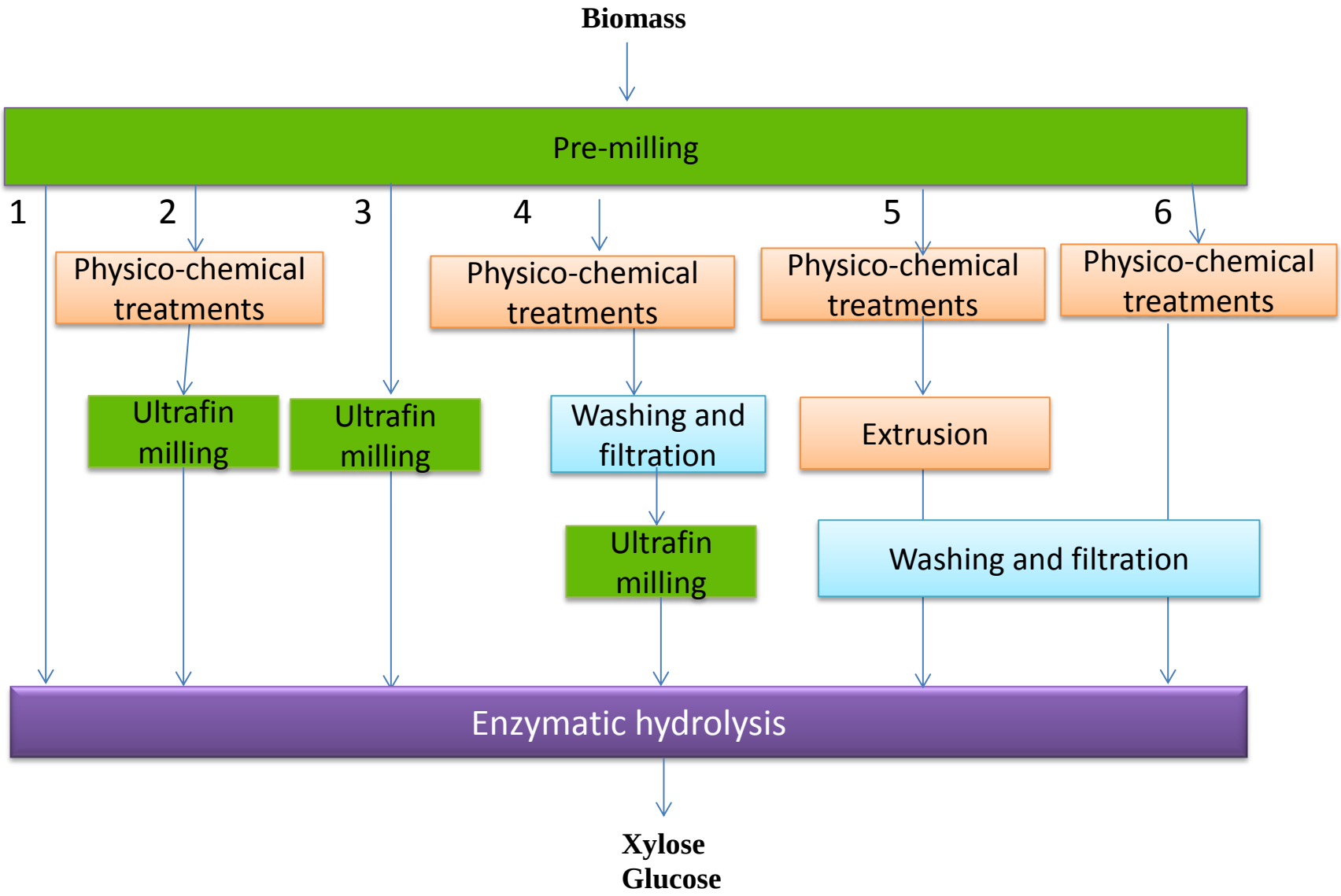
Packaging database

Ranked list of most relevant packagings

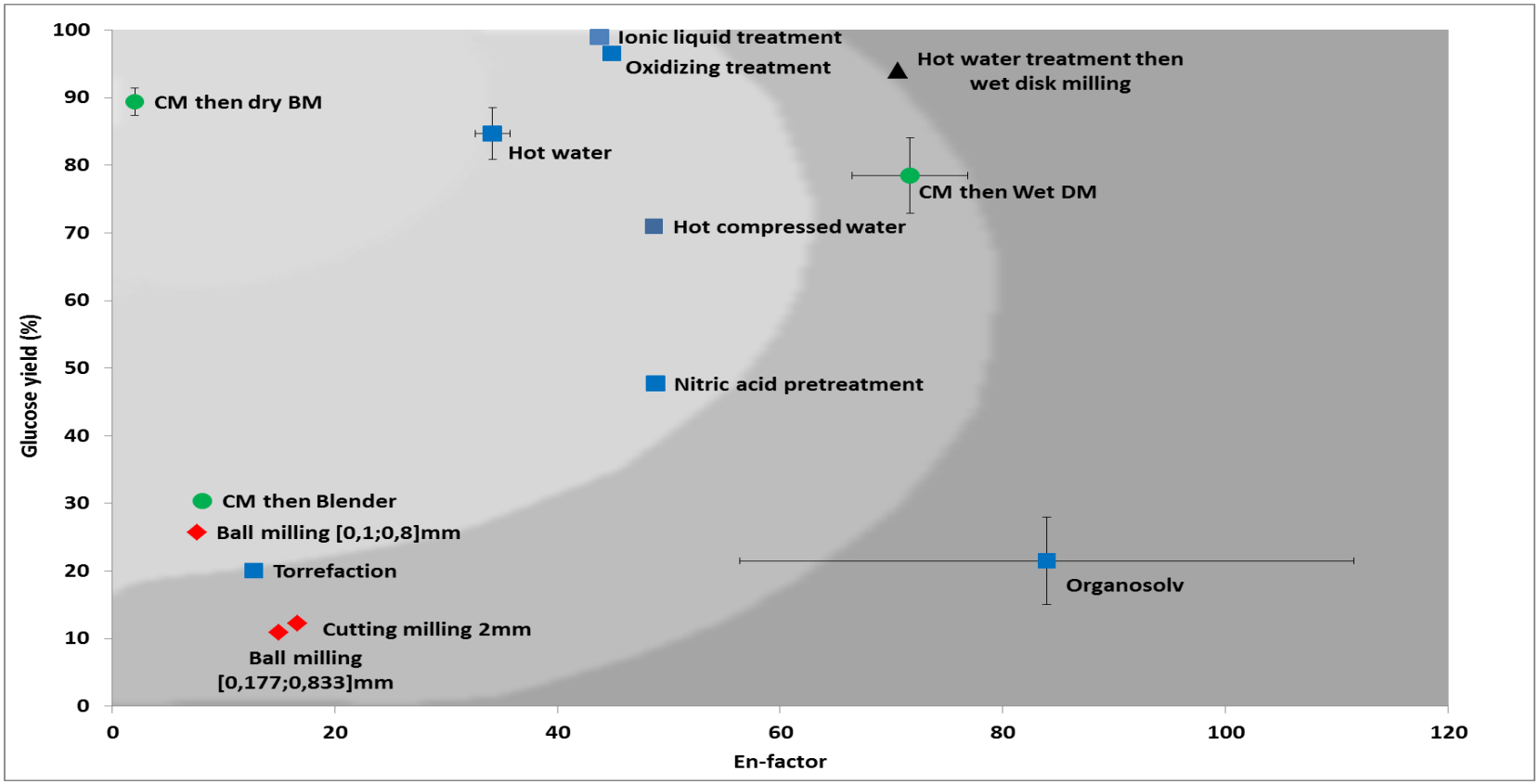
❖ **Life cycle analysis (LCA)** permits to **estimate environmental impacts** using a **complete inventory of matter flow, energy, and effluents** generated by the production process.



Pre-treatment eco-design



Pre-treatment comparison for rice straw



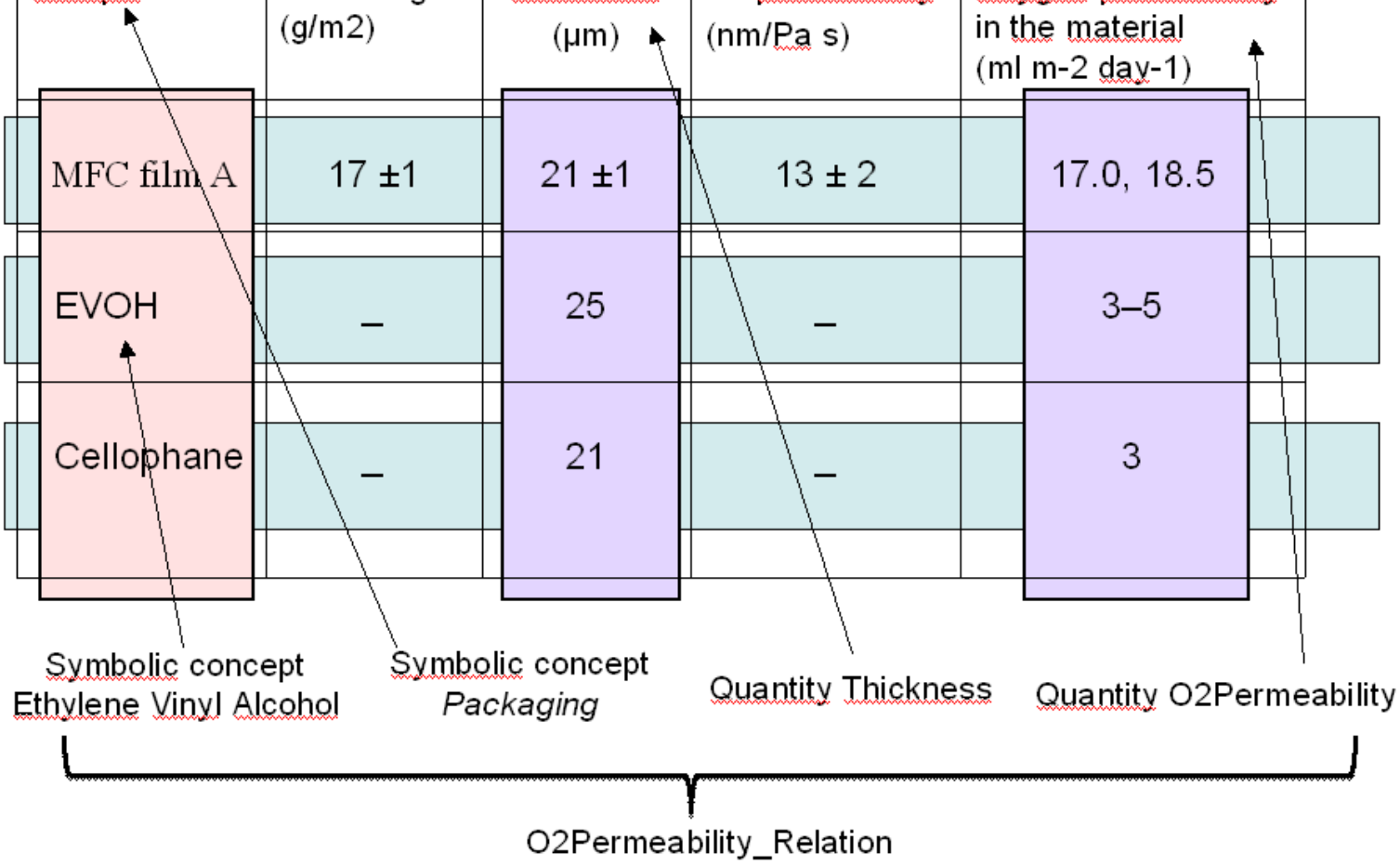
Heterogeneous data capitalisation guided by an ontology

(Touhami et al. 2011, Buche et al. 2011, Berrahou et al. 2013, Touhami et al. 2013, Buche et al. 2013a, Destercke et al. 2013, Buche et al. 2013b, Buche et al. 2014 submitted)

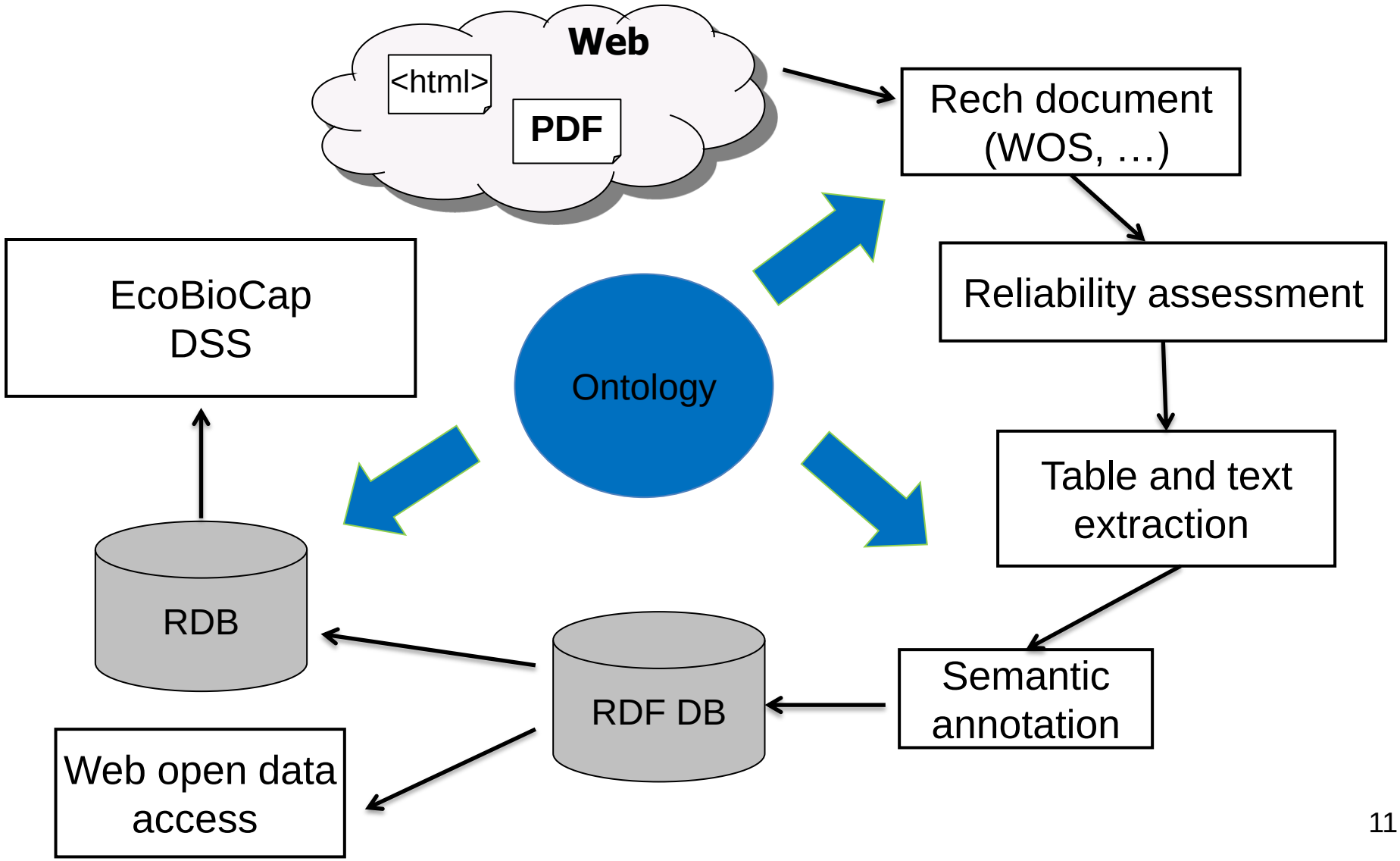
Example of data table

Table 1: Permeabilities of MFC films and literature values for films of synthetic polymers and cellophane

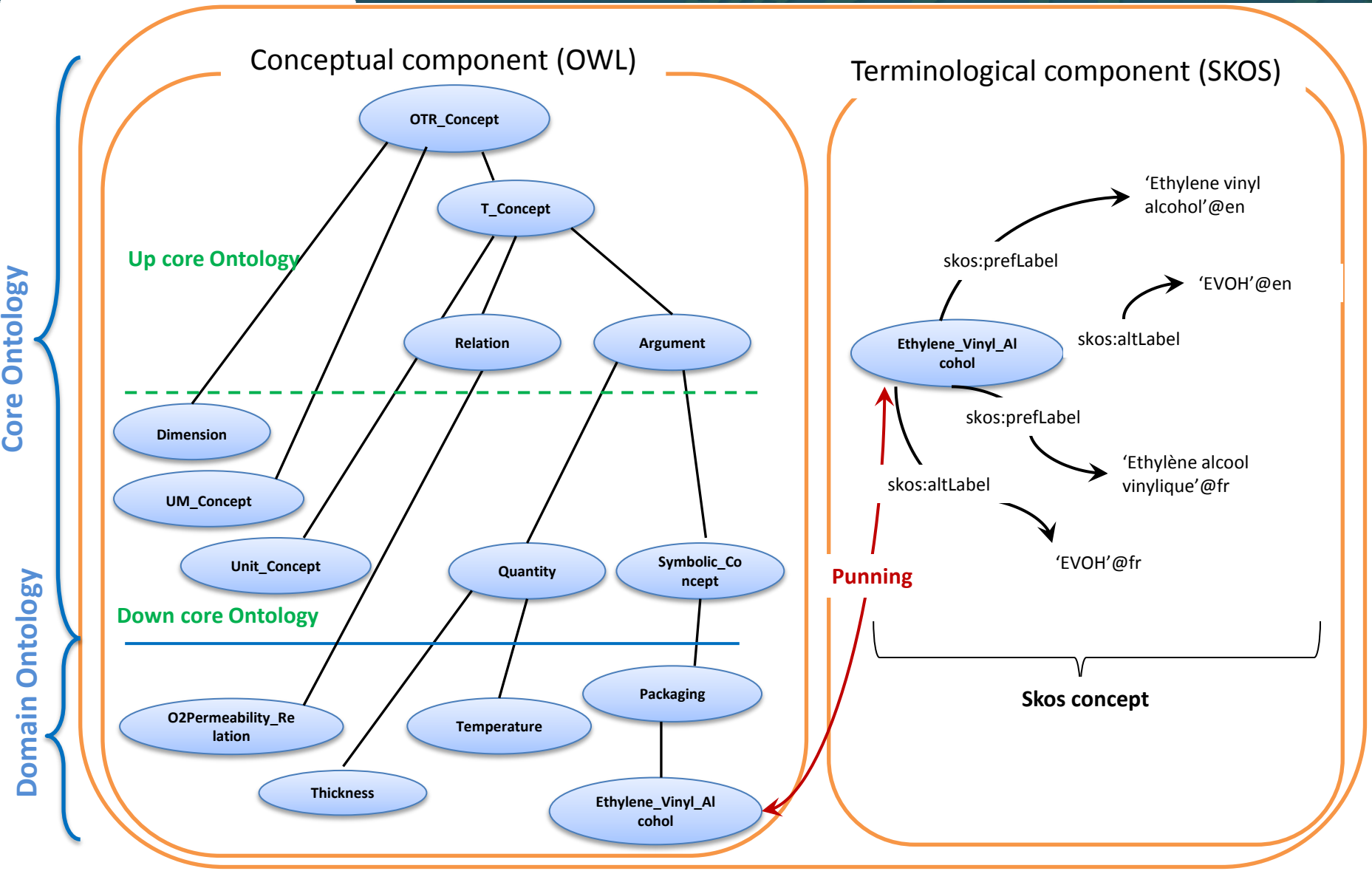
Sample	Grammage (g/m2)	Thickness (µm)	Air permeability (nm/Pa s)	Oxygen permeability in the material (ml m-2 day-1)
MFC film A	17 ±1	21 ±1	13 ± 2	17.0, 18.5
EVOH	–	25	–	3–5
Cellophane	–	21	–	3



Data capitalisation guided by an ontology

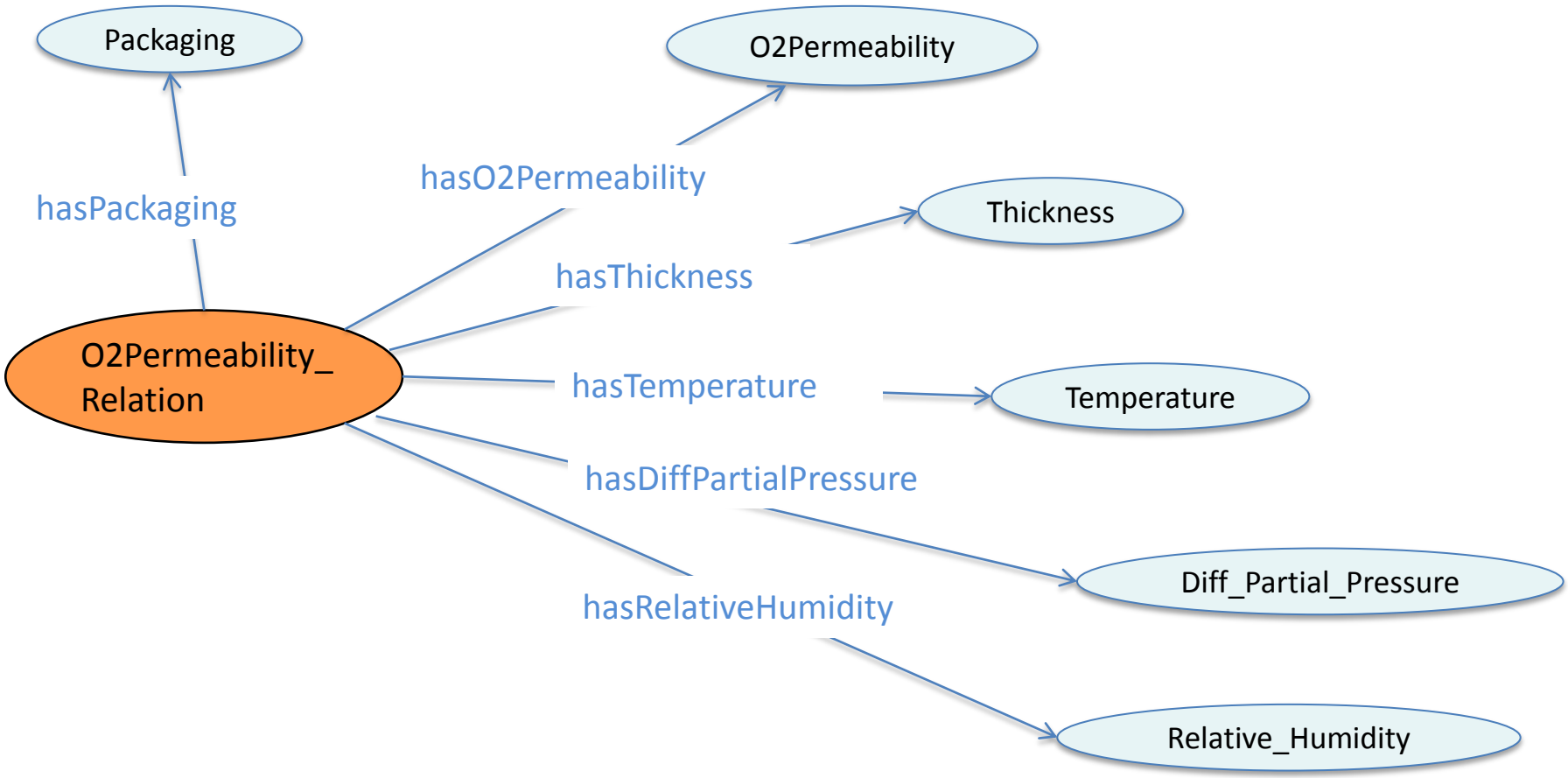


Termino-ontological resource

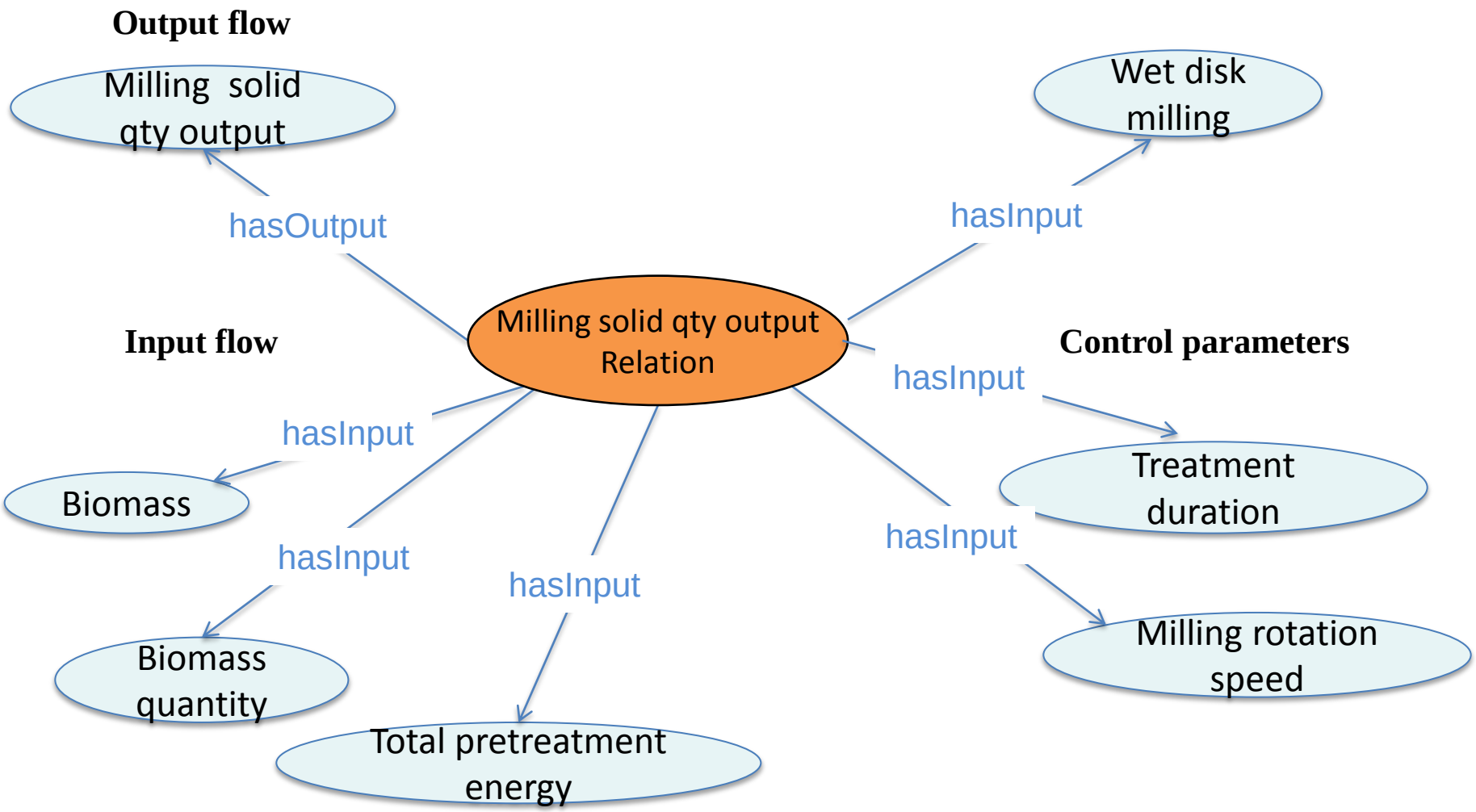


(Touhami et al. 2011, Buche et al. 2013c)

A relation concept guarantees the data reusability

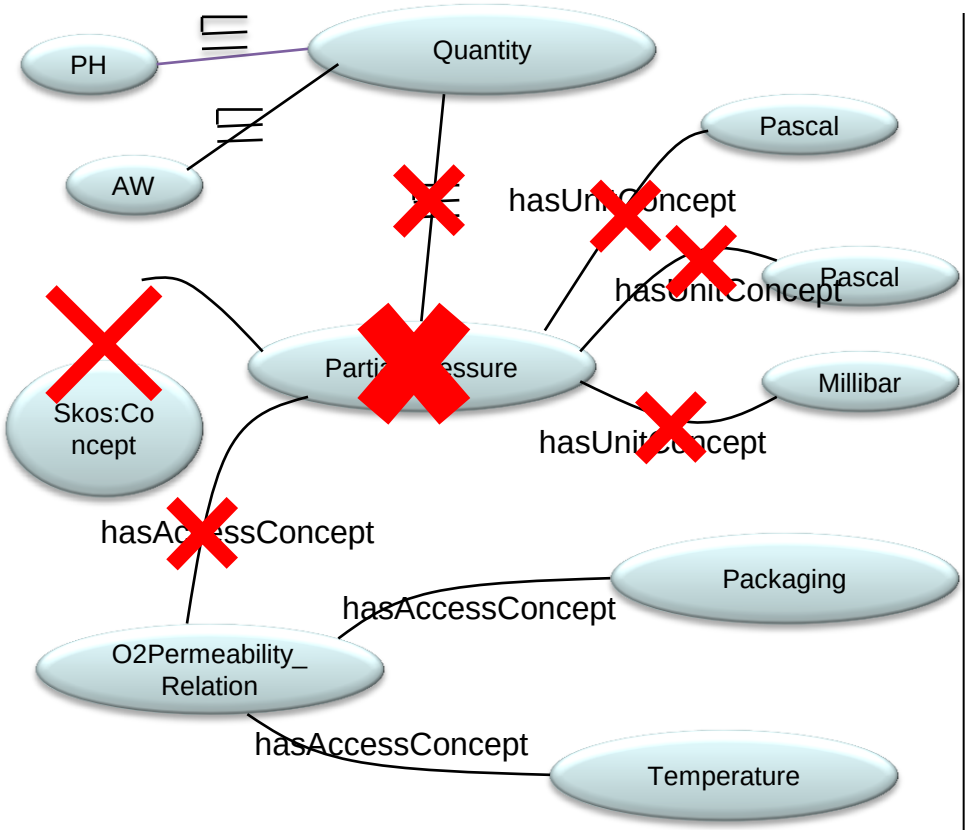


A relation concept models a unit operation



Verrou 1: Maintien de la cohérence de la RTO quand elle évolue

Exemple : Supprimer la quantité partial_pressure :



- Supprimer le lien d'hiérarchie entre le concept générique Quantity et le concept partial_pressure.

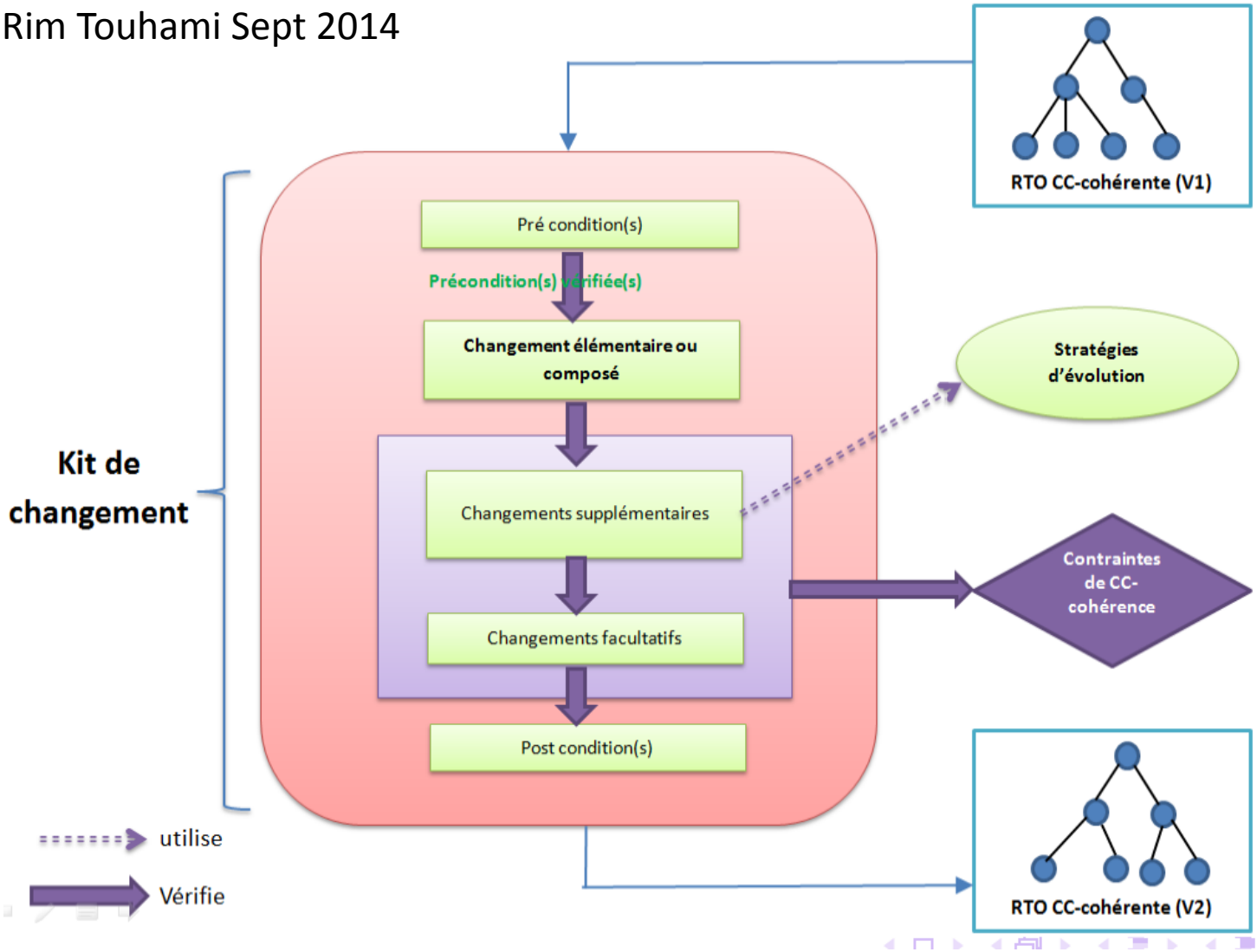
- Supprimer les liens avec les propriétés ayant partial_pressure comme domaine.

- Supprimer les liens avec les propriétés ayant partial_pressure comme co-domaine

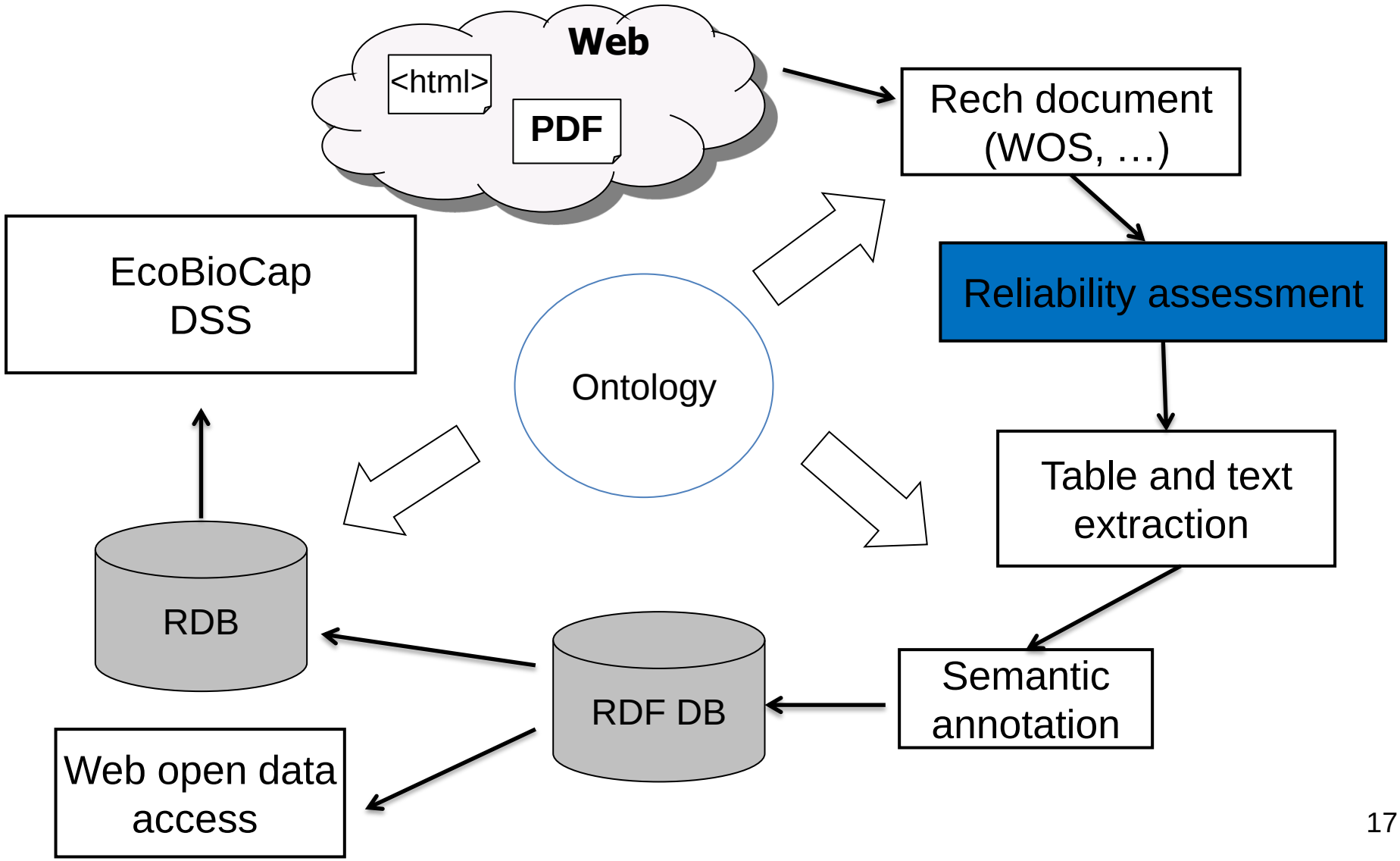
- Supprimer la terminologie associée à partial_pressure.

Proposition: Notion de kit de changement

Thèse Rim Touhami Sept 2014

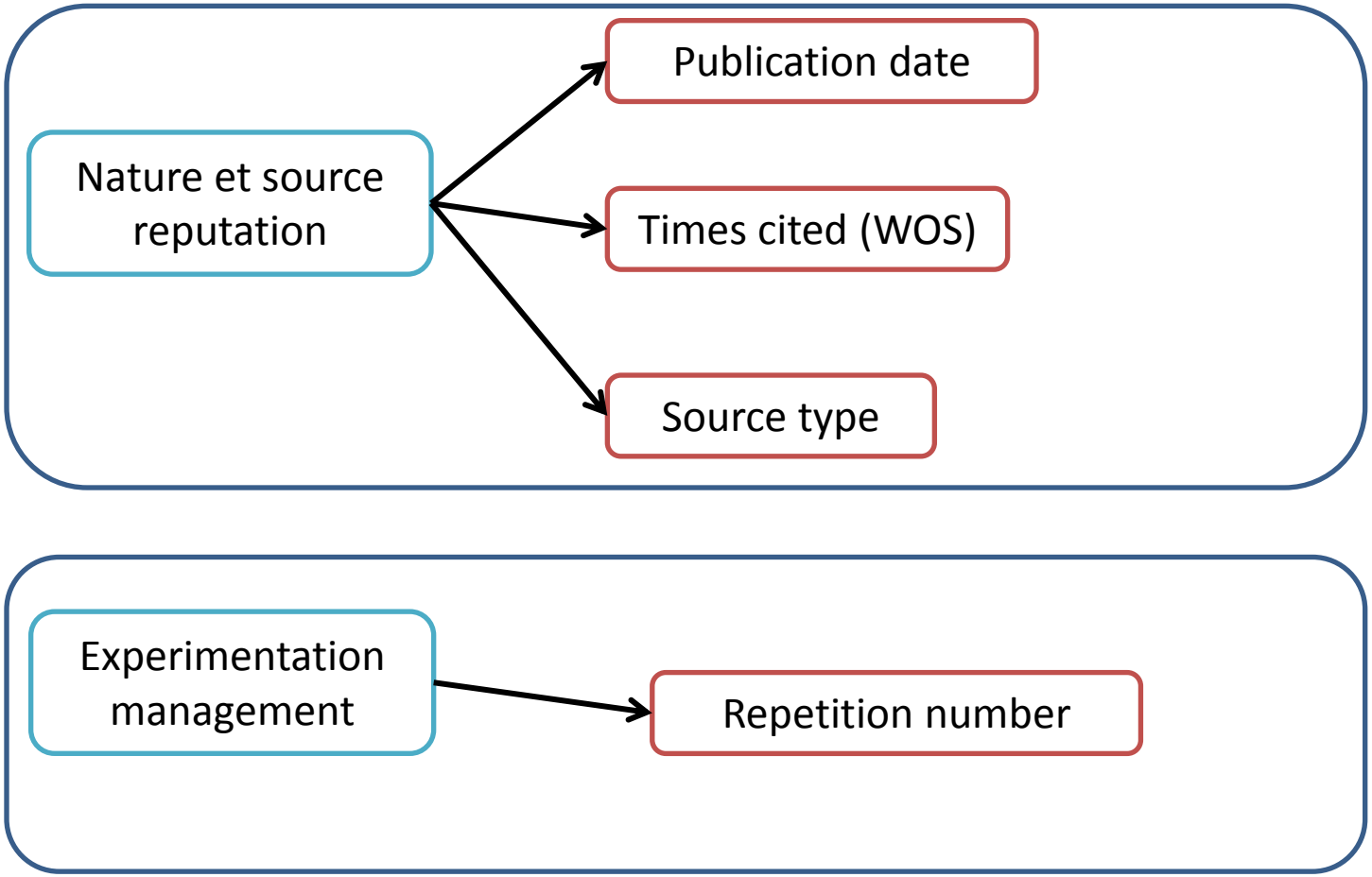


Data capitalisation guided by an ontology



Data sources reliability assessment

- 2 categories of meta data :



Reliability expert quotation

	unknown	not at all reliable	not at all or hardly	hardly reliable	hardly or average	average reliable	average or reliable	reliable	reliable or very	very reliable
repetition										
> No		--								
> Yes										++
number of repetitions										
> no repetition		--								
> once		--								
> twice						-+				
> 3 times								+		
> more than 3 times										++
age and citation number										
> between 3 and 8 years old & less than 10 citations			[--,-]							
> between 3 and 8 years old & between 10 and 20 citations					[-,-+]					
> between 3 and 8 years old & between 20 and 40 citations							[-+,+]			

2014 --- V 09-10-2014

@Web graphical user interface

Reliability computation

- MapOpt_demo
- PackPermeability
  - An Overview of Pol
  - Application of biopla
  - BRODART technica
  - Barrier and surface
  - Barrier properties o
  - Characterization of
  - Characterization of
  - Combined effects o
  - Danapak flexibles t
  - Effect of plasticizers
  - Evaluation of a Bio-
  - Fully Aliphatic Copo
  - Gas transfer proper
  - Layer-by-layer asse
  - Mechanical propert
  - Metabolix Mvera da
  - Morphology and Ba
  - Nanocomposites fo
  - Oxygen Permeabilit
  - Oxygen barrier of m

Citation Number : more than 40

Age : more than 8 years old

Criterion age and top citation

Age : more than 8 years old

Top Citation : top 0.10%

Criterion source type

Source Type : journal article

Reliability evaluation's document information

Reliability results

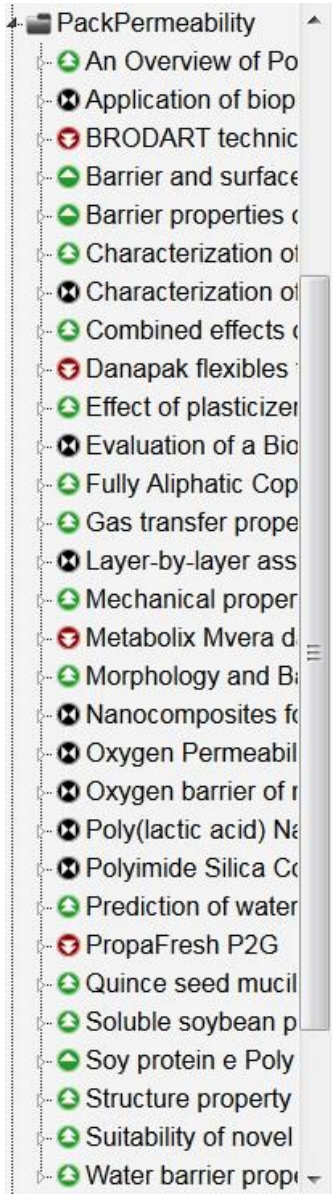
Low expectation : 4.94 ; High expectation : 5.0

Known criteria values rate : 80 %

Last evaluation date : 2014-09-29

@Web graphical user interface

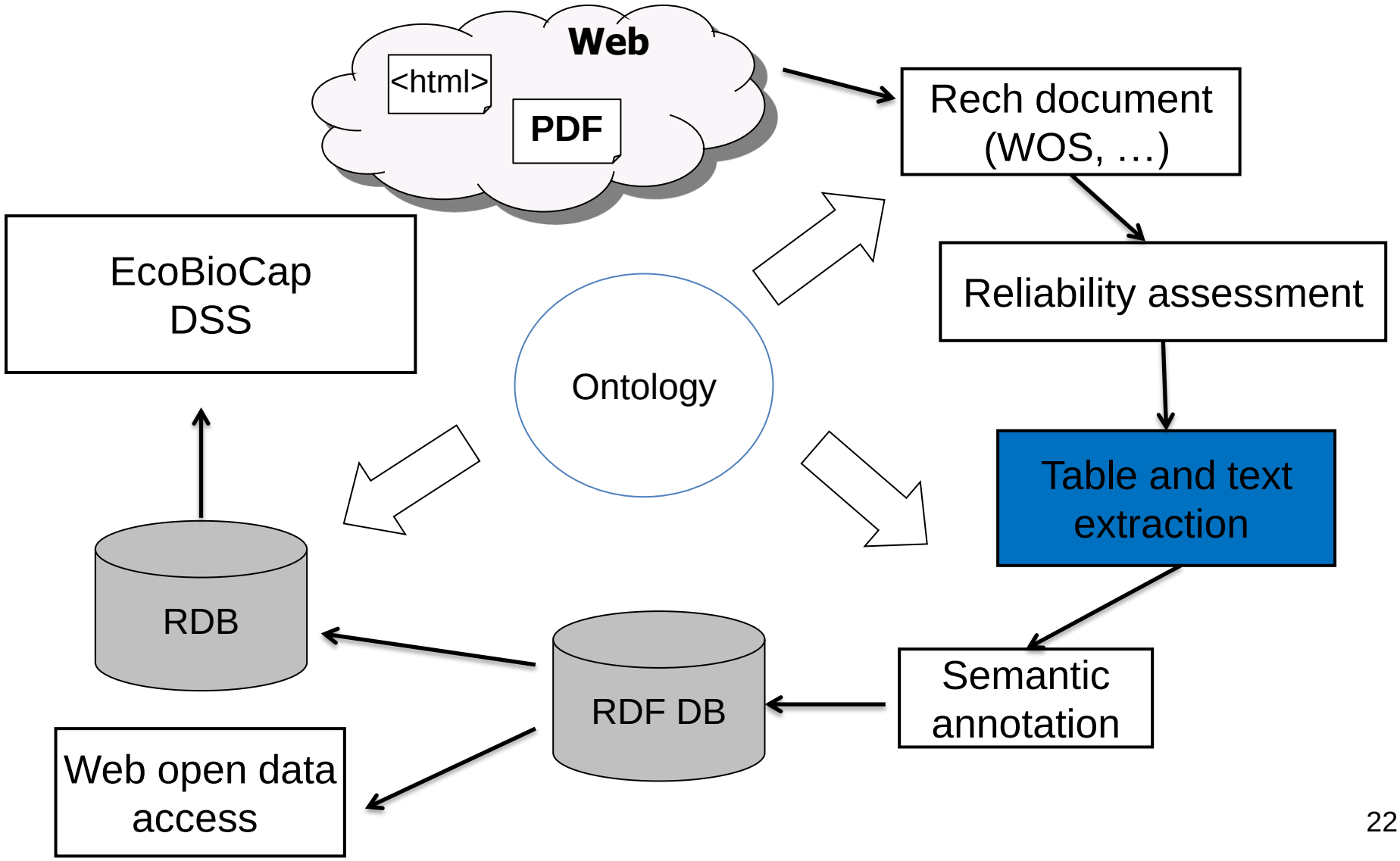
Reliability results



Classes	Number of publications	Reliability Interval
Very reliable	14	[4,97 ; 5]
Reliable	3	[3,2 ; 4,85]
In conflict	9	[1,01 ; 4,93]
Not at all reliable	4	[1,02 ; 1,33]

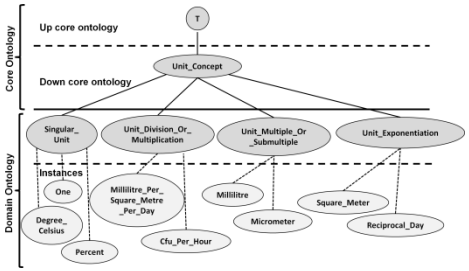
- Very reliable: peer-reviewed articles , with repetitions, high reputation
- Reliable: peer-reviewed articles, with repetitions, medium reputation
- In conflict: peer-reviewed articles but no repetition
- Not at all reliable: technical sheets without external review and no repetition

Data capitalisation guided by an ontology



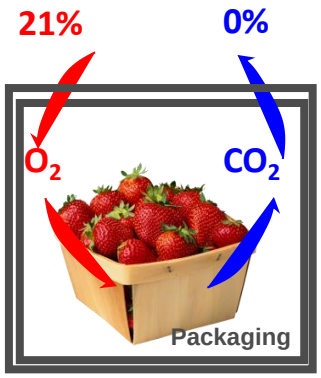
Verrou 2: Text-mining approach

Extracting **experimental data**

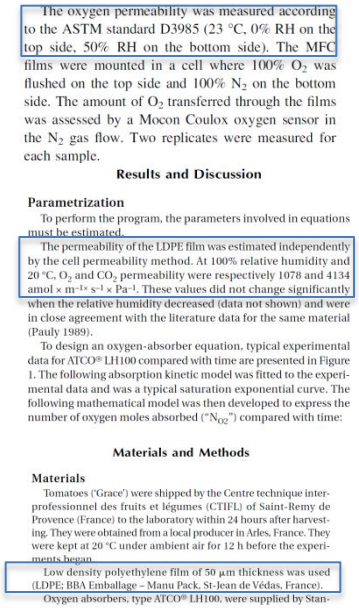


Enriching an Ontological and Terminological Resource (OTR)

Quantitative data



Experiments



The oxygen permeability was measured according to the ASTM standard D3985 (23 °C, 0% RH on the top side, 50% RH on the bottom side). The MFC films were mounted in a cell where 100% O_2 was flushed on the top side and 100% N_2 on the bottom side. The amount of O_2 transferred through the films was assessed by a Mocon Coulox oxygen sensor in the N_2 gas flow. Two replicates were measured for each sample.

Results and Discussion

Parametrization

To perform the program, the parameters involved in equations must be estimated.

The permeability of the LDPE film was estimated independently by the cell permeability method. At 100% relative humidity and 20 °C, O_2 and CO_2 permeability were respectively 1078 and 4134 amol × m^{-1}× s^{-1} × Pa^{-1}. These values did not change significantly when the relative humidity decreased (data not shown) and were in close agreement with the literature data for the same material (Pauly 1989).

To design an oxygen-absorber equation, typical experimental data for ATCO® LH100 compared with time are presented in Figure 1. The following absorption kinetic model was fitted to the experimental data and was a typical saturation exponential curve. The following mathematical model was then developed to express the number of oxygen moles absorbed ("N_{O2}") compared with time:

Materials and Methods

Materials

Tomatoes ('Grace') were shipped by the Centre technique interprofessionnel des fruits et légumes (CTIFL) of Saint-Remy de Provence (France) to the laboratory within 24 hours after harvesting. They were obtained from a local producer in Arles, France. They were kept at 20 °C under ambient air for 12 h before the experiments began.

Low density polyethylene film of 50 µm thickness was used (LDPE; BBA Emballage – Manu Pack, St-Jean de Védas, France).

Oxygen absorbers, type ATCO® LH100, were supplied by Stan-

Published experimental data in scientific documents

{(LDPE, Packaging: (Low Density Polyethylene)),

(50 µm, Thickness: (value: 50, unit concept: Micrometer)),

(1078 amol x m-1 x s-1 x Pa-1, O2Permeability : (value: 1078, unit concept: Attomole per meter per second per pascal))}

Localisation of relevant information (packaging characteristics)

Text-mining approach outputs

Reduction of the search space in the text and enrichment of the termino-ontological resource by adding units of measure

Motivation

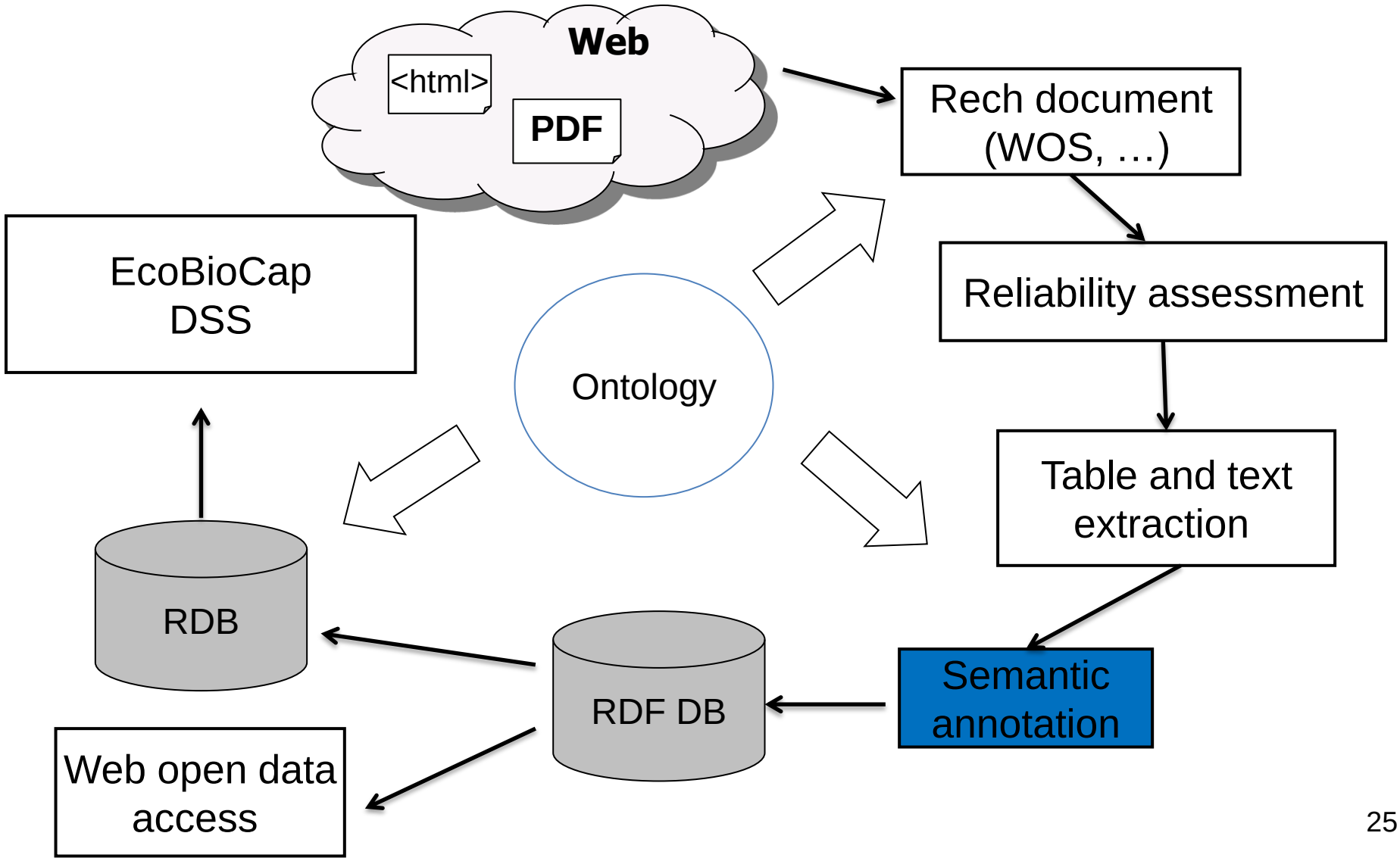
Automatic extraction from the text of quantitative data

- Water Vapor Permeability (WVP) of 1.81 × 10^-^9 g m^-^1 s^-^1 Pa^-^1
- O[2] permeability increasing from 7.12 to 7.68 × 10^−15 g·(Pa s m)^−1

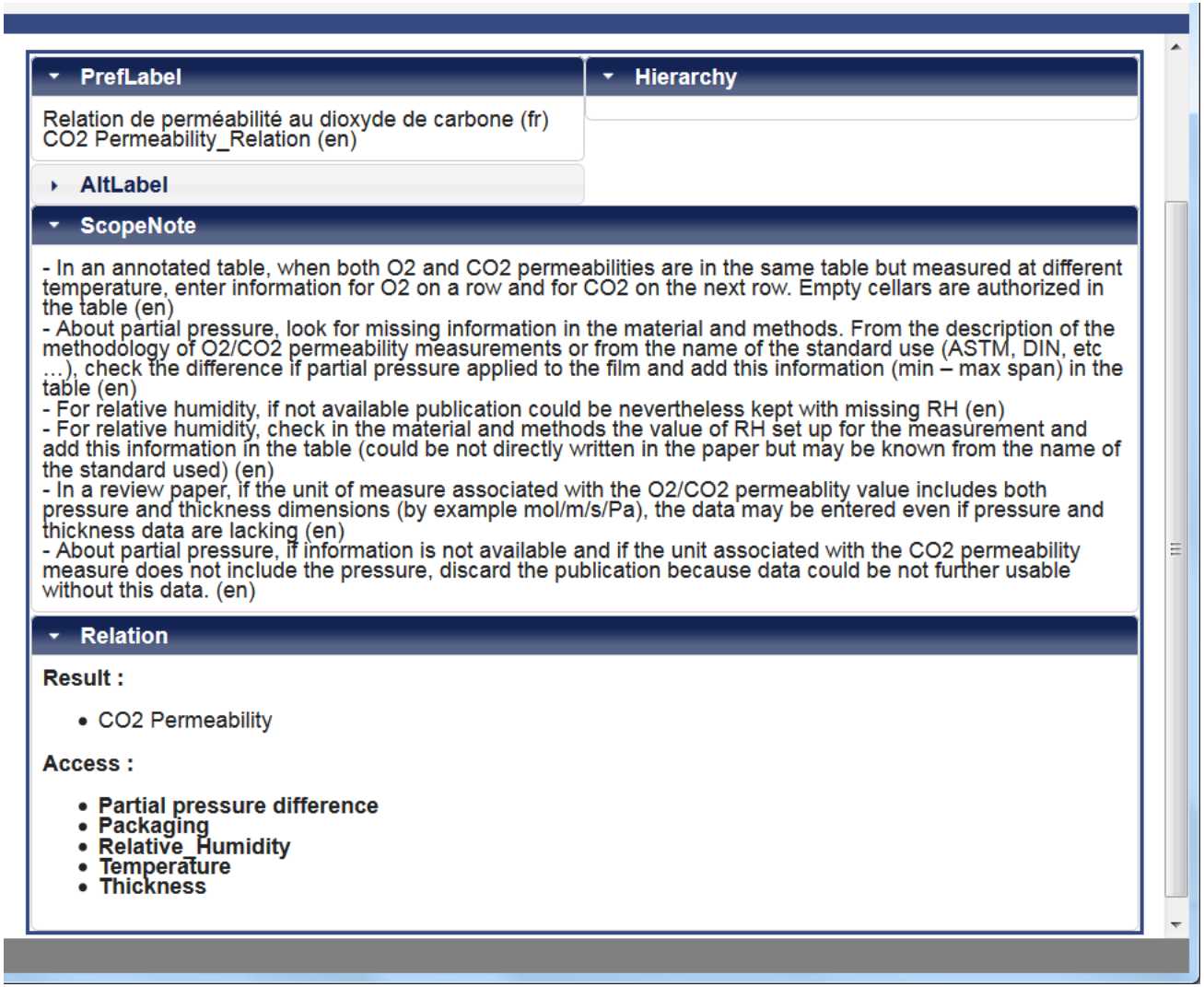
Scientific locks

- Locate relevant information in the text
- Identify and extract units of measure taking into account their specific syntactical rules

Data capitalisation guided by an ontology



Concept description and associated guidelines



@Web graphical user interface

Data table annotation (pack example)

@Web

Ontology | Documents | Query

Patrice

Logout / Profil

Management

- Bioref-PM
- Bioref-PM-PT-E…
- Bioref-PM-PT-PS
- Bioref-PM-PT-UFM
- Bioref-PM-PT-U…
- Bioref-PM-UFM
- Biorefinery
- MapOptTopic
- PackPermeability
- Application of …
  - /
  - Current appli…
  - Main charact…
- Characterizatio…
  - O2 permeability
- Combined effec…
  - Oxygen trans…
  - water vapour …
- DonnÃ©es Car…
  - andconditions
  - values
- Morphology an…
  - Oxygen Perm…
- Nanocomposite…
- New polylactid…
- Poly(lactic acid…
- PolyimideâSilic…
- PropaFresh P2G
- Structureâprope…
- Topics
- Topics2
- garbage

Manual Annotation of Oxygen Permeability of the Various Samples at 0% RH and at 80% RH and Estimated Diffusion and Solubility...

Original table

TableIII. Oxygen Permeability of the Various Samples at 0% RH and at 80% RH and Estimated Diffusion and Solubility Coefficients at 80% RH for the Blends

Sample	PO_2 (m^3 m/m^2 s Pa) 24°C, 0% RH	PO_2 (m^3 m/m^2 s Pa) 80% RH	DO_2 (m^2 /s) 80% RH	SO_2 (m^3 /m^3 Pa) 80% RH
PHB-Blend	[a] $4.2 \pm 0.0005 e^{-19}$	[a] $5.2 \pm 0.004 e^{-19}$	[a] $1.1 \pm 0.01 e^{-12}$	[a] $4.7 \pm 0.05 e^{-7}$
($14.6 e^{-19}$)				
($4.0 e^{-19}$)				
1%NanoterPHB-Blend	[b] $3.8 \pm 0.3 e^{-19}$	[b] $3.9 \pm 0.1 e^{-19}$	[b] $1.0 \pm 0.02 e^{-12}$	[b] $3.9 \pm 0.2 e^{-7}$

Annotated table

n°	Thickness Unit : mm	Temperature Unit : °C	Relative_Humidity Unit : %	Packaging	Partial pressure difference Unit : Pa	O2 Permeability Unit : m3.m/(m2.s.Pa)
1	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	Polyhydroxybutyrate/Polycaprolactones	[0.000e0 ; 1.013e5]	[4.199e-19 ; 4.200e-19]
2	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	(1%Nanoter) Polyhydroxybutyrate/Polycaprolactones	[0.000e0 ; 1.013e5]	[3.500e-19 ; 4.100e-19]
3	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	(4%Nanoter) Polyhydroxybutyrate/Polycaprolactones	[0.000e0 ; 1.013e5]	[2.100e-19 ; 2.700e-19]
4	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	Polyhydroxybutyrate	[0.000e0 ; 1.013e5]	[2.298e-19 ; 2.302e-19]
5	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	(4%Nanoter) Polyhydroxybutyrate	[0.000e0 ; 1.013e5]	[1.500e-19 ; 2.100e-19]
6	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	Polycaprolactones	[0.000e0 ; 1.013e5]	5.800e-18
7	[1.000e-1 ; 9.000e-1]	2.400e1	0.000e0	Polyethylen Terephthalate	[0.000e0 ; 1.013e5]	3.300e-19
8	[1.000e-1 ; 9.000e-1]	2.400e1	8.000e1	Polyhydroxybutyrate/Polycaprolactones	[0.000e0 ; 1.013e5]	[5.196e-19 ; 5.204e-19]

@Web graphical user interface

Data table annotation (bioraf example)

Patrice

Ontology | Documents | Query

Logout / Manage

Manual Annotation of Comparison of sugar yields, crystallinity, and energy consumption between three pretreatments in various...

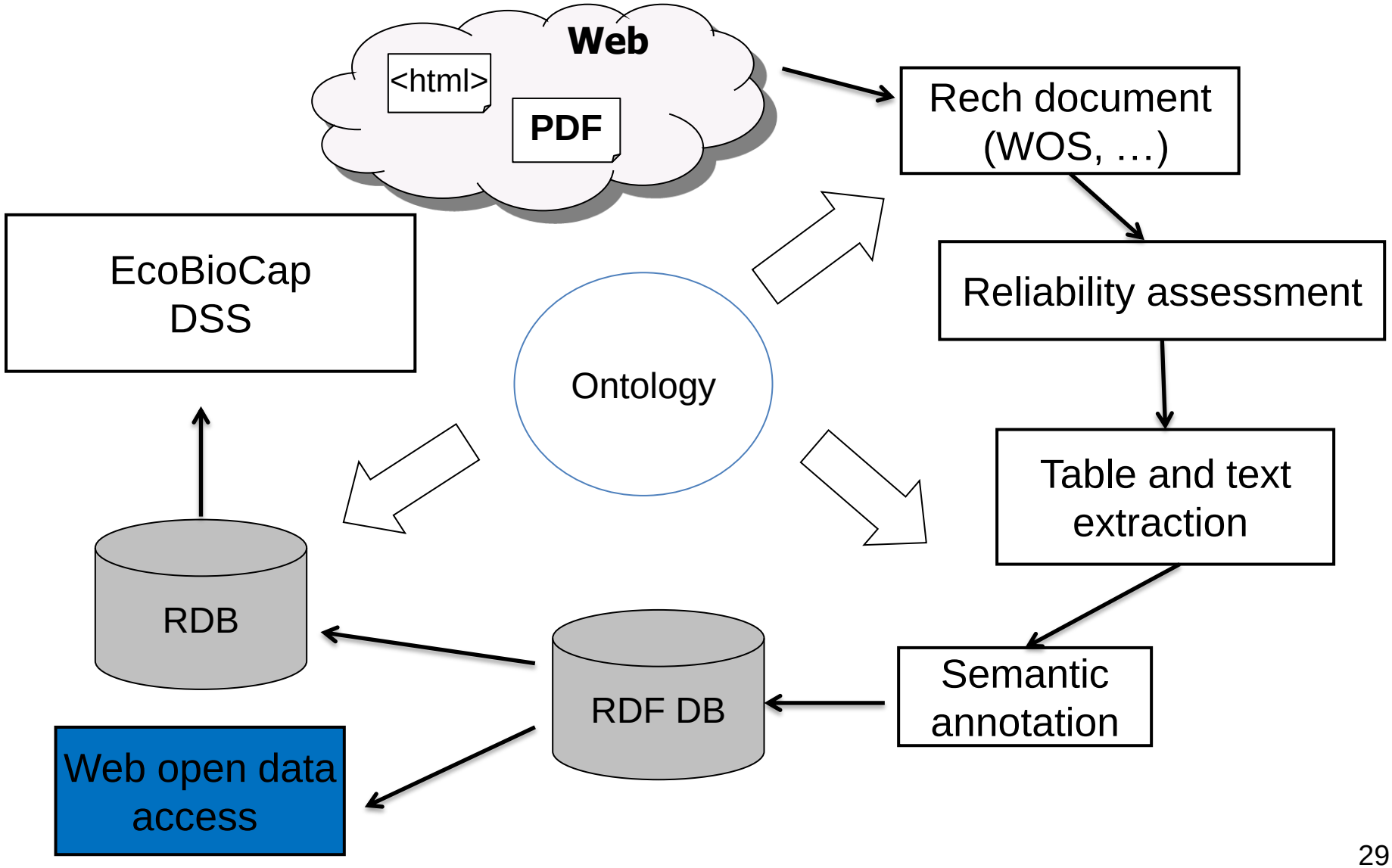
Original table

Sample	Sugar yields (%)	CrI (%)	Energy consumption (MJ/kg rice straw)			
Glu	Xyl	Ara	Total			
CM	23.4±2.3	18.7±2.7	29.7±1.4	22.5±1.3	51.9	–
DBM 5 min	52.2±3.5	16.5±0.4	28.4±1.0	41.8±2.3	46.7	9.0
DBM 15 min	66.0±0.5	28.0±0.3	34.3±0.4	54.5±0.4	35.0	27
DBM 30 min	75.9±0.5	38.3±0.2	40.5±0.4	64.4±0.4	25.2	54
DBM 60 min	89.4±2.0	54.3±1.3	48.9±1.0	78.2±1.7	13.3	108
HCWT 160	70.3±3.3	88.6±4.4	54.7±3.4	74.1±3.6	56.5	5.7

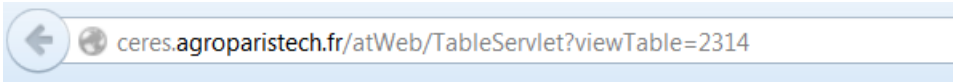
Annotated table

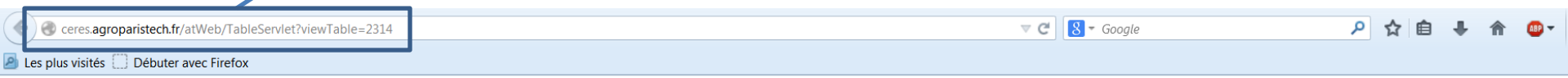
n°	Output solid constituant size Unit : mm	Treatment	Experience number Unit : 1	Process step number Unit : 1	Biomass	Biomass quantity Unit : g	Total pretreatment energy Unit : MJ/kg	Water quantity Unit : ml	Milling rotation speed Unit : min-1	Treatment duration Unit : min	Output solid constituant quantity Unit : g	Temperature Unit : °C	Outpu liquor quant Unit :
1	2.000e+0	Cutting milling	1.000e+0	1.000e+0	Rice straw	3.000e+1	[-inf ; inf]	0.000e+0	[-inf ; inf]	[-inf ; inf]			
2		Drying	1.000e+0	2.000e+0	Rice straw	3.000e+1	[-inf ; inf]			[-inf ; inf]	3.000e+1	6.000e+1	
3		Hot water treatment	1.000e+0	3.000e+0	Rice straw	3.000e+1	5.700e+0	3.000e+2		3.000e+1	3.000e+1	1.600e+2	3.000
4		Enzymatic hydrolysis treatment	1.000e+0	4.000e+0	Rice straw	[4.000e-2 ; 6.000e-2]				4.320e+3	[3.020e-2 ; 4.670e-2]	4.500e+1	
5	2.000e+0	Cutting milling	2.000e+0	1.000e+0	Rice straw	3.000e+1	[-inf ; inf]	0.000e+0	[-inf ; inf]	[-inf ; inf]			

Data capitalisation guided by an ontology



Annotated data table access using permalink





CO2 permeability
(export)

n°	CO2 Permeability Unit : kg.m.m-2.s-1.pa-1	Partial pressure difference Unit : atm	Packaging	Relative_Humidity Unit : %	Temperature Unit : °C	Thickness Unit : µm
1	[2.720e+17 ; 2.820e+17]	[-inf ; inf]	poly(98% l-lactide)/Polylactic Acid	0.000e+0	2.500e+1	[0.000e+0 ; inf]
2	[1.930e+17 ; 2.050e+17]	[-inf ; inf]	poly(94% l-lactide)/Polylactic Acid	0.000e+0	2.500e+1	[0.000e+0 ; inf]
3	[3.070e+17 ; 3.170e+17]	[-inf ; inf]	poly(98% l-lactide)/Polylactic Acid	0.000e+0	3.000e+1	[0.000e+0 ; inf]
4	[2.230e+17 ; 2.350e+17]	[-inf ; inf]	poly(94% l-lactide)/Polylactic Acid	0.000e+0	3.000e+1	[0.000e+0 ; inf]
5	[3.360e+17 ; 3.480e+17]	[-inf ; inf]	poly(98% l-lactide)/Polylactic Acid	0.000e+0	3.500e+1	[0.000e+0 ; inf]
6	[2.460e+17 ; 2.580e+17]	[-inf ; inf]	poly(94% l-lactide)/Polylactic Acid	0.000e+0	3.500e+1	[0.000e+0 ; inf]
7	[3.720e+17 ; 3.840e+17]	[-inf ; inf]	poly(98% l-lactide)/Polylactic Acid	0.000e+0	4.000e+1	[0.000e+0 ; inf]
8	[2.830e+17 ; 2.910e+17]	[-inf ; inf]	poly(94% l-lactide)/Polylactic Acid	0.000e+0	4.000e+1	[0.000e+0 ; inf]
9	[4.030e+17 ; 4.330e+17]	[-inf ; inf]	poly(98% l-lactide)/Polylactic Acid	0.000e+0	4.500e+1	[0.000e+0 ; inf]
10	[3.290e+17 ; 3.410e+17]	[-inf ; inf]	poly(94% l-lactide)/Polylactic Acid	0.000e+0	4.500e+1	[0.000e+0 ; inf]

SPARQL querying of the RDF base

Query Summary

Query scope

Ontology	IC2ACV
Topics	"Bioref-PM-PC-UFM", "Bioref-PM-PC-UFM-PS", "Bioref-PM-UFM", "Bioref-PM-PC-EX-PS", "Bioref-PM-PC-PS", "Bioref-PM"
Relation	Biomass glucose composition relation

Value domains wanted for attributes

Mandatory
(1) Biomass : [Grasses and energetic plants : 1]

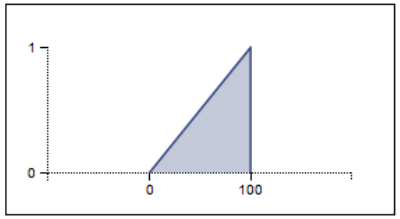
Desirable
(1) Glucose rate : [0 ; 100 ; 100 ; 100] - unit : Percent

Parameters

(default parameters)

Run query

Define numeric value domain



best values

min	max		
0	100	100	100
min			max

acceptable values

@Web graphical user interface

Query Results

Query Results (216)

Ontology: IC2ACV - Topics: Bioref-PM-PC-UFM-PS , Bioref-PM-PC-EX-PS , Bioref-PM , Bioref-PM-UFM , Bioref-PM-PC-PS , Bioref-PM-PC-UFM
Relation: Biomass glucose composition relation

■Mandatory □Desirable

rank	reliability score	Biomass [Grasses and energetic plants]	Glucose rate [[0.000e+00;1.000e+02;1.000e+02;1.000e+02],%]	Biomass state	Experience number
row 2_2317					
1		Rice straw	[5.333e+01;5.600e+01],%	Untreated biomass	[2.000e+00],1
row 2_2523					
2		Bagasse	[4.666e+01],%	Untreated biomass	[3.000e+00],1
row 1_2489					
3		Rice straw	[4.633e+01],%	Untreated biomass	[1.000e+00],1
row 0_2489					
3		Rice straw	[4.633e+01],%	Untreated biomass	[0.000e+00],1
row 5_2500					
4		Rice straw	[4.522e+01],%	Untreated biomass	[5.000e+00],1
row 0_2546					

@Web graphical user interface

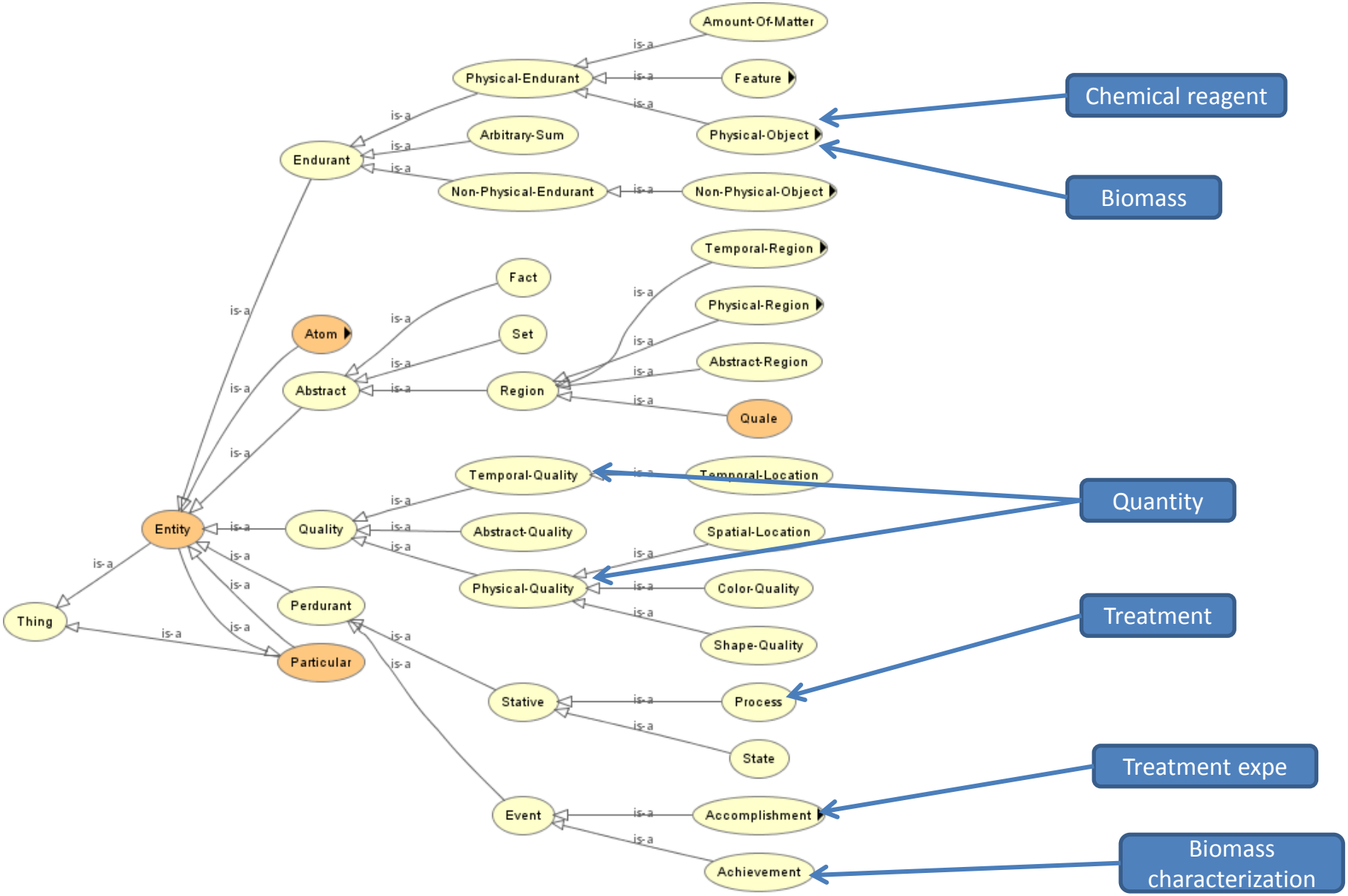
Conclusion

- A generic and reusable ontological model to capitalize experimental data
- Ontology consistency management
- Data reliability assessment
- Manual annotation guided by the ontology using text-mining assistant
- Flexible querying of annotated data combining 3 kinds of reasoning (specialization, fuzzy pattern matching, reliability satisfaction)

Future works

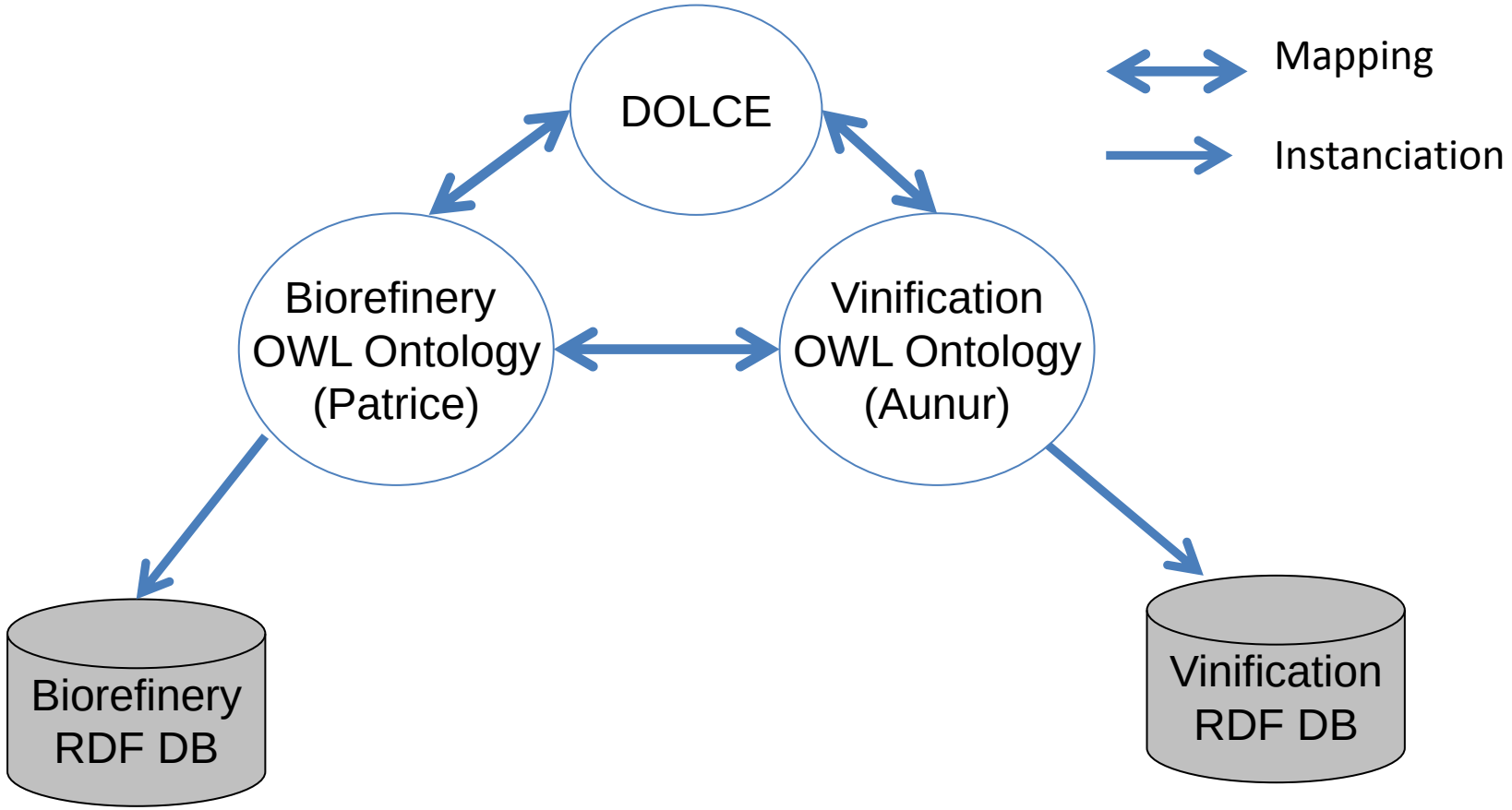
- CSV data file import
- RDF DB consistency management in case of ontology evolution
- Ontology mapping for Linked Open Data
- Assistant development to facilitate the manual annotation work
  - Text mining approach
  - Guidelines formalization using rules (OBDA approach)
- Extending core ontology to represent semantic links between n-ary relation concepts (temporal links, …)

Mapping to DOLCE upper ontology



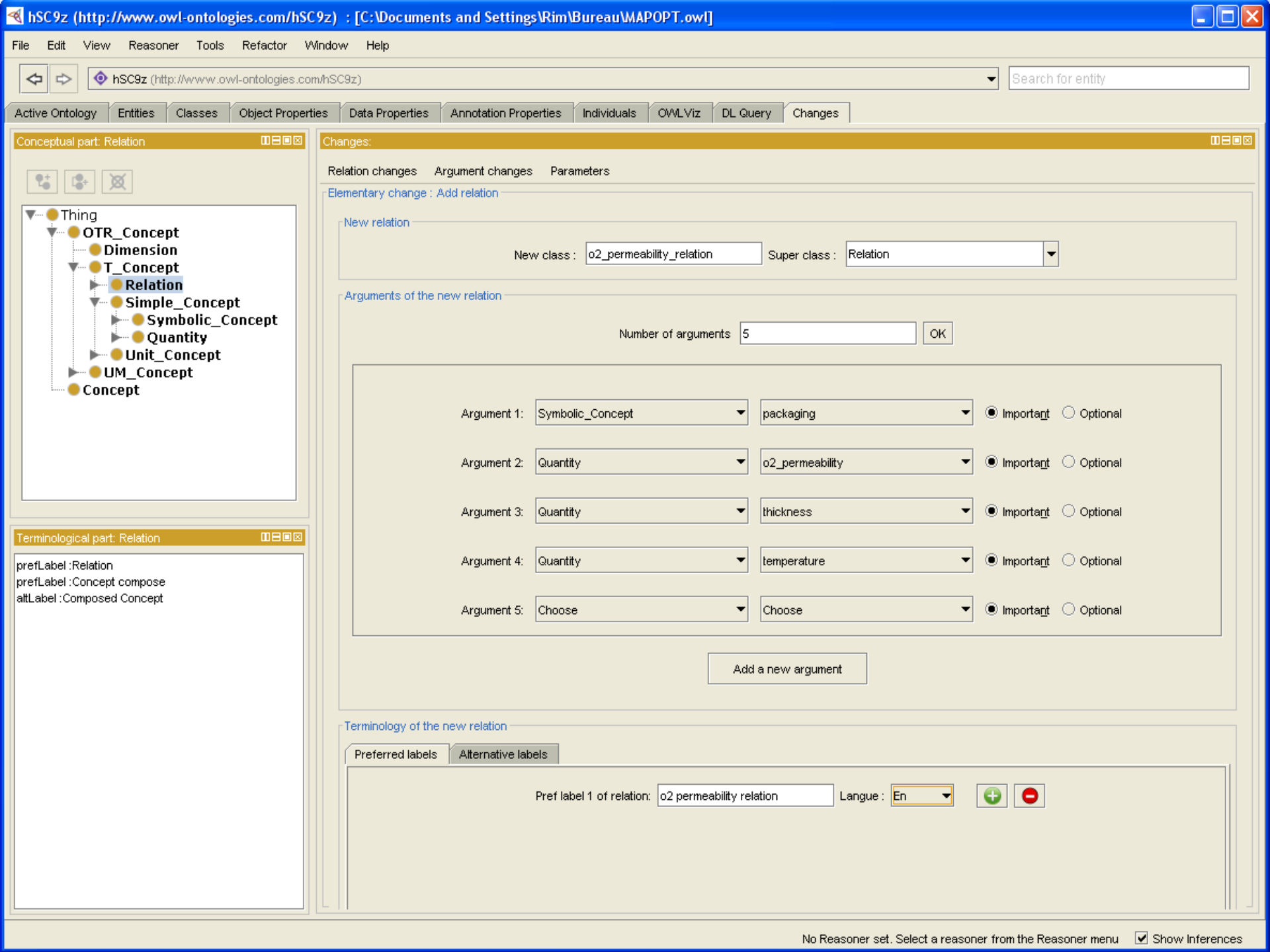
Linked Open Data

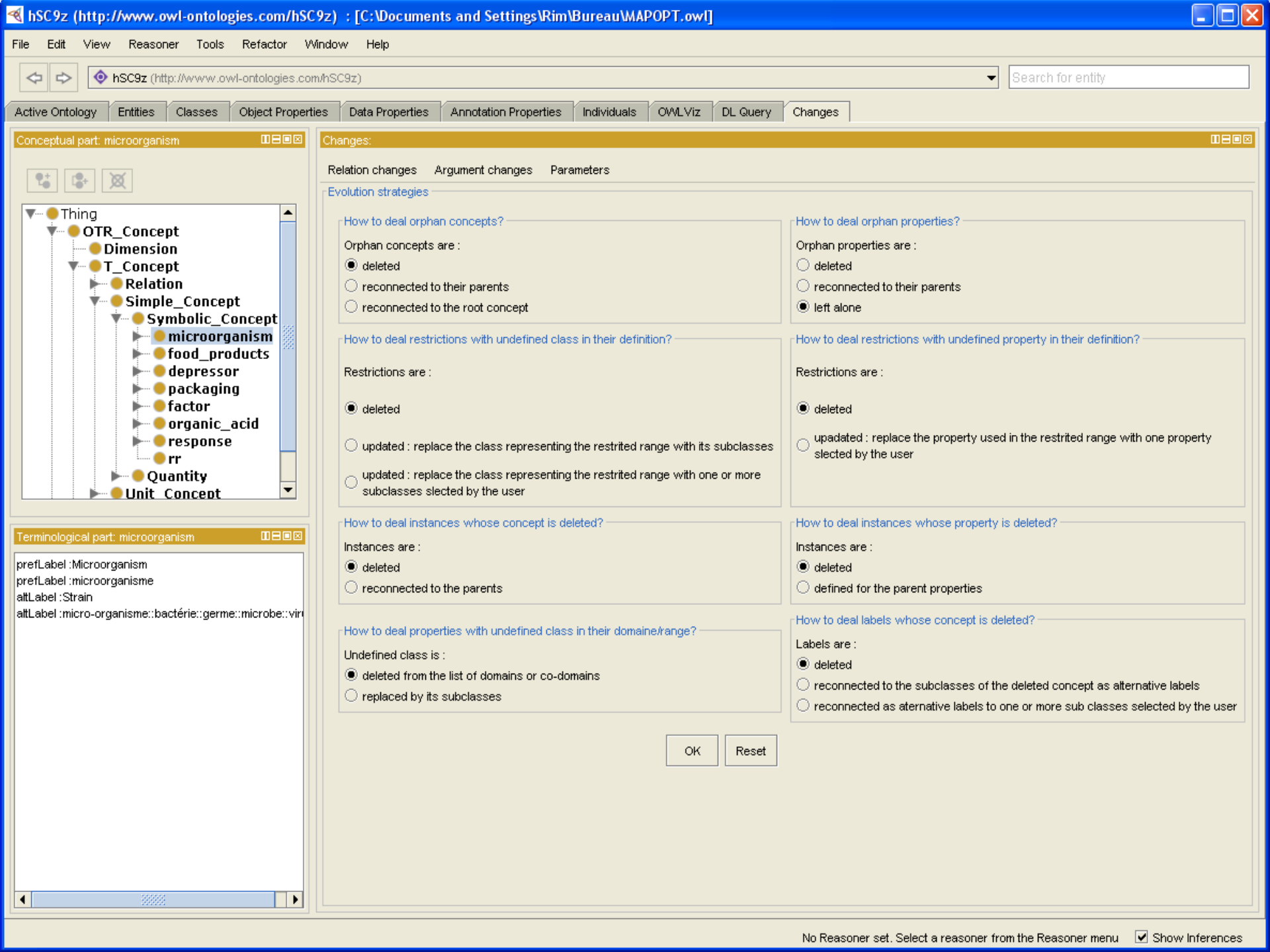
Which varieties of grapes having a “high” rate of tannin extraction from marc (vinification co-product) and “good” wine color parameters ?



Modeling Guidelines associated with processes as rules

- Topic Bioref-PM,This Topic must contain experiences with only one milling followed by the enzymatic hydrolysis. It does not include a physico-chemical step but it can include a washing and separation step. (en)
- Topic Bioref-PM-PC-EX-PS, This Topic must contain experiences composed of a pre-milling step, then a physico-chemical treatment and an extrusion treatment and finally a press and separation step (washing and filtration) followed by the enzymatic hydrolysis step. (en)
- Topic Bioref-PM-PC-PS, This Topic must contain experiences composed of a least one pre-milling step, then a physico-chemical treatment and a washing and filtration step (washing and separation) and finally the enzymatic hydrolysis step. (en)
- Topic Bioref-PM-PC-UFM, This Topic must contain experiences composed of a pre-milling step, then a physico-chemical treatment followed by an ultrafine milling step (ball milling…) and finally the enzymatic hydrolysis step. This topic doesn't require a step of press and separation because it's a process with a low intake of effluent. The second milling step must give an "Output solid constituent size" smaller than 1 mm. (en)
- Topic Bioref-PM-PC-UFM-PS, This Topic must contain experiences composed of a pre-milling step, then a physico-chemical treatment followed by an ultrafine milling step (wet milling…) and a press and separation step (washing and filtration) and finally the enzymatic hydrolysis step. This topic requires a press and separation step because there are a lot of effluents in the physico-chemical step or because the milling is made with effluent. The second milling step must give an "Output solid constituent size" smaller than 1 mm. (en)


hSC9z (http://www.owl-ontologies.com/hSC9z) : [C:\Documents and Settings\Rim\Bureau\MAPOPT.owl]
File Edit View Reasoner Tools Refactor Window Help
hSC9z (http://www.owl-ontologies.com/hSC9z)
Search for entity
Active Ontology Entities Classes Object Properties Data Properties Annotation Properties Individuals OWLViz DL Query Changes
Conceptual part: Relation
Thing
OTR_Concept
Dimension
T_Concept
Relation
Simple_Concept
Symbolic_Concept
Quantity
Unit_Concept
UM_Concept
Concept
Terminological part: Relation
prefLabel :Relation
prefLabel :Concept compose
altLabel :Composed Concept
Changes:
Relation changes Argument changes Parameters
Elementary change : Add relation
New relation
New class : o2_permeability_relation
Super class : Relation
Arguments of the new relation
Number of arguments 5 OK
Argument 1: Symbolic_Concept packaging Important Optional
Argument 2: Quantity o2_permeability Important Optional
Argument 3: Quantity thickness Important Optional
Argument 4: Quantity temperature Important Optional
Argument 5: Choose Choose Important Optional
Add a new argument
Terminology of the new relation
Preferred labels
Alternative labels
Pref label 1 of relation: o2 permeability relation
Langue : En
No Reasoner set. Select a reasoner from the Reasoner menu
Show Inferences


hSC9z (http://www.owl-ontologies.com/hSC9z) : [C:\Documents and Settings\Rim\Bureau\MAPOPT.owl]
File Edit View Reasoner Tools Refactor Window Help
hSC9z (http://www.owl-ontologies.com/hSC9z)
Search for entity
Active Ontology Entities Classes Object Properties Data Properties Annotation Properties Individuals OWLViz DL Query Changes
Conceptual part: microorganism
Thing
OTR_Concept
Dimension
T_Concept
Relation
Simple_Concept
Symbolic_Concept
microorganism
food_products
depressor
packaging
factor
organic_acid
response
rr
Quantity
Unit_Concept
Terminological part: microorganism
prefLabel :Microorganism
prefLabel :microorganisme
altLabel :Strain
altLabel :micro-organisme::bactérie::germe::microbe::vir
Changes:
Relation changes
Argument changes
Parameters
Evolution strategies
How to deal orphan concepts?
Orphan concepts are :
deleted
reconnected to their parents
reconnected to the root concept
How to deal orphan properties?
Orphan properties are :
deleted
reconnected to their parents
left alone
How to deal restrictions with undefined class in their definition?
Restrictions are :
deleted
updated : replace the class representing the restrited range with its subclasses
updated : replace the class representing the restrited range with one or more subclasses slected by the user
How to deal restrictions with undefined property in their definition?
Restrictions are :
deleted
upadated : replace the property used in the restrited range with one property slected by the user
How to deal instances whose concept is deleted?
Instances are :
deleted
reconnected to the parents
How to deal instances whose property is deleted?
Instances are :
deleted
defined for the parent properties
How to deal properties with undefined class in their domaine/range?
Undefined class is :
deleted from the list of domains or co-domains
replaced by its subclasses
How to deal labels whose concept is deleted?
Labels are :
deleted
reconnected to the subclasses of the deleted concept as alternative labels
reconnected as aternative labels to one or more sub classes selected by the user
OK
Reset
No Reasoner set. Select a reasoner from the Reasoner menu
Show Inferences

Querying the RDF base

Query Summary

Query scope

Ontology	MAPOPT
Topics	"PackPermeability"
Relation	O2 Permeability_relation

Value domains wanted for attributes

Mandatory
(1) O2 Permeability : [5e-13 ; 1.27e-11 ; 1.5e-11 ; 1e-10] - unit : Mole per Meter per second per pascal

Parameters

Run query

@Web graphical user interface

Query Results

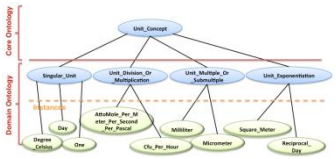
Ontology: MAPOPT - Topics: PackPermeability
Relation: O2 Permeability_relation

■Mandatory □Desirable

rank	reliability score	O2 Permeability [[5.000e-13;1.270e-11;1.500e-11;1.000e-10],mol/m/s/Pa]	Temperature	Thickness	Relative Humidity	Packaging	Partial pressure difference
row 0_318							
1		[2.950e+01;3.150e+01],cm3.mm.m-2.day-1.atm-1	[2.400e+01;2.600e+01],°C	[2.000e+02;2.200e+02],µm	[-inf, +inf] %	Polylactic acid	[1.000e+00],atm
row 1_318							
1		[2.290e+01;2.490e+01],cm3.mm.m-2.day-1.atm-1	[2.400e+01;2.600e+01],°C	[2.000e+02;2.200e+02],µm	[-inf, +inf] %	(1wt%)Ag/Polylactic Acid	[1.000e+00],atm
row 4_318							
1		[1.680e+01;1.880e+01],cm3.mm.m-2.day-1.atm-1	[2.400e+01;2.600e+01],°C	[2.000e+02;2.200e+02],µm	[-inf, +inf] %	(5wt%)Cellulose nanocrystals/(1wt%)Ag/Polylactic Acid	[1.000e+00],atm
row 0_2604							
1		[7.000e-01;1.800e+00],cm3.mm.m-2.day-1.atm-1	[2.300e+01],°C	[8.500e+01],µm	[0.000e+00],%	Chitosan/paper	[1.000e+00],atm
row 5_318							
1		[1.160e+01;1.360e+01],cm3.mm.m-2.day-1.atm-1	[2.400e+01;2.600e+01],°C	[2.000e+02;2.200e+02],µm	[-inf, +inf] %	(5wt%)Modified cellulose nanocrystals/(1wt%)Ag/Polylactic Acid	[1.000e+00],atm
row 3_318							
1		[1.320e+01;1.520e+01],cm3.mm.m-2.day-1.atm-1	[2.400e+01;2.600e+01],°C	[2.000e+02;2.200e+02],µm	[-inf, +inf] %	(1wt%)Modified cellulose nanocrystals/(1wt%)Ag/Polylactic Acid	[1.000e+00],atm

@Web graphical user interface

Semi-automatic method



Iterative enrichment of the ontology

Raw corpus

Learning corpus

Model

Set of descriptors

Learning on Packaging corpus

Biorefinery Corpus

New similarity measure

SM_{DB}

Reduction of the search space for unit of measure

Identification of new units of measure

Experimentation and results

Data

« Corpus Biorefinery »

- **243** scientific documents
- Unit terms extracted from the ontology : **36** terms

« Corpus Packaging »

- **115** scientific documents
- Unit terms extracted from the ontology : **211** terms

Locate relevant information by learning

Reduction of « Corpus Biorefinery »

↓

90 %

Reduction of « Corpus Packaging »

↓

86 %

Enrichment of the termino-ontological resource

Enrichment « OTR Bioraffinerie »

↓

+ than 100 %
of new units

Enrichment «OTR Packaging»

↓

18 %
of new units