BIOPSIL

Ecofriendly catalytic materials based on biopolymers and ionic liquid

CP2D 2008

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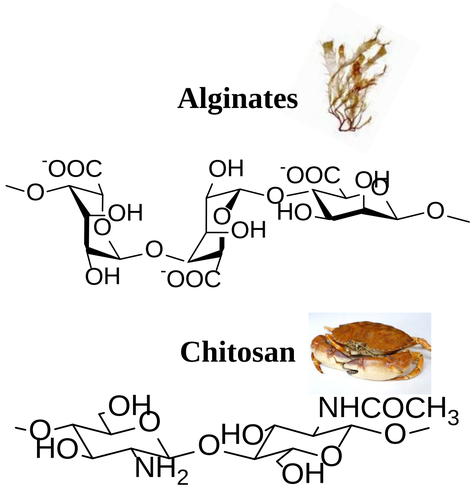
BIOPSIL project was carried out by: Nathalie Clousier (PhD funded by ANR), Claire Jouannin (PhD funded by ANR), Renaud Moucel (PhD) and Dr. Prashant Naik (Post-doc)

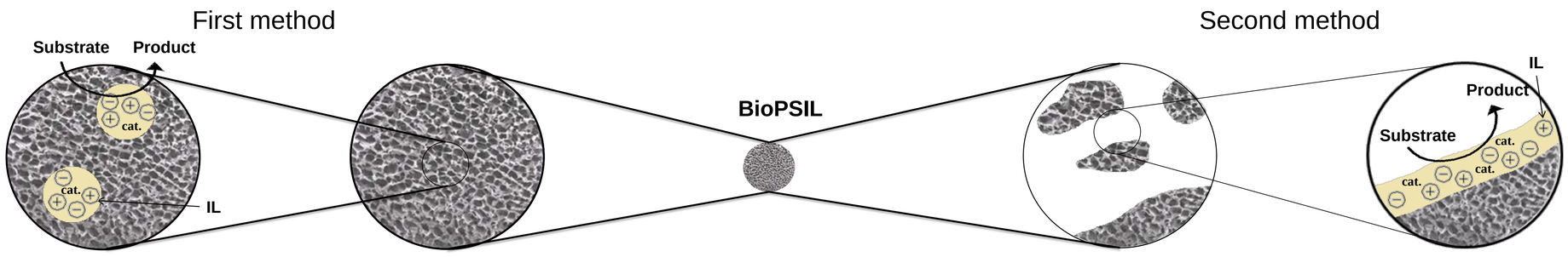
Project issue

Combining advantages of **homogeneous catalysis** (high activity and selectivity) with those of **heterogeneous catalysis** (easy product/catalyst separation, recycling and reuse of the catalyst) is a high interest for economical and ecological points of view.

Our aim was to develop innovative and sustainable **catalytic materials** by the immobilization of a transition metal catalyst in an **ionic liquid** (IL) phase supported on a biopolymer.

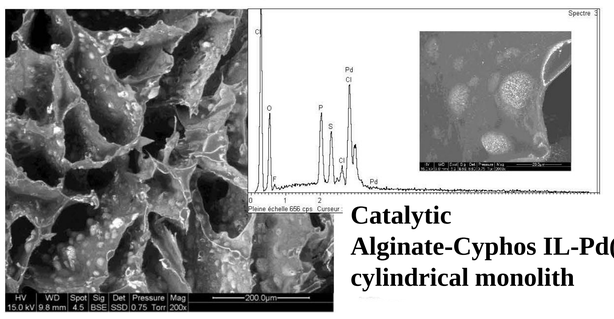
Our **BioPSIL** (**BioP**olymer **S**upported **I**onic **L**iquid) materials were prepared from two marine polysaccharides, **alginates** and **chitosan**, using two strategies.





First method: confinement of the IL

Porous BioPSIL materials were prepared in the form of **cylindrical monoliths**, **discs** or **beads**.



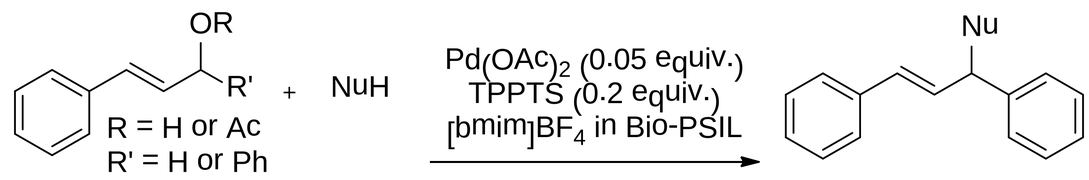
Catalytic Alginate-Cyphos IL-Pd(0) cylindrical monolith

The BioPSIL were characterized and successfully applied for the **Pd-catalyzed hydrogenation** of **4-nitroaniline** and **nitrophenol** in aqueous solution, with complete conversions in 15 min and conversions of 93 % after 4 days in continuous flow systems.

This study showed the **influence** of the **nature of the biopolymer support** and the **nature of the IL** on **textural properties** of the BioPSIL materials and on their **catalytic activity**.

Second method: adsorption of the IL

BioPSIL materials (**beads** or **scaffolds**) were successfully applied for the **Pd-catalyzed allylic substitution** reaction of allylic acetate or allylic alcohol.



For soft nucleophiles, BSA/ AcOK was used to deprotonate *in situ* the nucleophile.
For allylic alcohols, phenylboronic acid was used to activate the -OH group.

BioPSIL were proved to be compatible in basic or acidic conditions used to performed the reactions.

BioPSIL materials provided high **activities** and **recyclability** up to **10 cycles**. Both the **nature of the biopolymer** support and its **conditioning influence** the BioPSIL materials catalytic properties.

Project outcomes

BioPSIL were proved to be compatible with both Pd-catalyzed reactions, stable in the reaction conditions and reusable. They lead to low leaching of Pd and should be efficient in continuous flow processes.

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