# ENZYMATIC DEPOLYMERIZATION OF POLYURETHANES THROUGH ALCOLYSIS

Riccardo Moro[1*]; Daniel Grajales Hernández[2] and Fernando Lopez Gallego[3]

[1] *CIC biomaGUNE, San Sebastián, Spain*
[2] *CIC biomaGUNE, San Sebastián, Spain*
[3] *CIC biomaGUNE, San Sebastián, Spain*
* *Corresponding author: rmoro@cicbiomagune.es*

Polyurethanes represent a crucial category of polymers with extensive applications across various industries. Unlike more commonly recycled polymers such as PET, polyurethane recycling presents greater challenges due to its unique chemical characteristics and molecular structure.[1] Hydrolysis is the widest approach for chemical depolymerization of PUs, however, this process is high-energy demanding, cannot recover the isocyanates and the quality of the recovered polyols is low. [2] Methanolysis has been proposed as an approach instead of hydrolysis of PUs.[3] Methanolysis allows obtaining the corresponding polyol and diurethane compounds which can be directly recycled into virgin PUs, increasing the sustainability and the efficiecy of the plastic degradation.[3]

Here we aim the **enzymatic methanolysis of PUs** in neat methanol, which has never been projected, to perform a new sustainable and bioorganic process in the plastic depolymerization area. To do so, we have screened **6 lipases**, **3 proteases**, **2 Cutinases** commercial preparations in the methanolsysis of ***p*-nitrophenylbenzyl carbamate** as model substrate in solvent free conditions. **ROL** (*Rhizopus oryzae lipase*) and **TLL** (*Thermomyces lanuginosus lipase*) are the most efficient enzymes studied for this kind of reaction. Additionally, we evaluate the reaction perfomance with different alkyl chain alcohols (figure 1). In these conditions, **ethanol** offered the best results, for which was selected for further experiments. After **24 hours** of reaction, we have achieved the totally convension of *p*-nitrophenol carbamate into corresponding ethylbenzyl carbamate and *p*-nitrophenol.

The best enzymes under the optimal conditions were confirmed in the alcoholysis of dicarbamates and low-molecular weight polyurethanes.

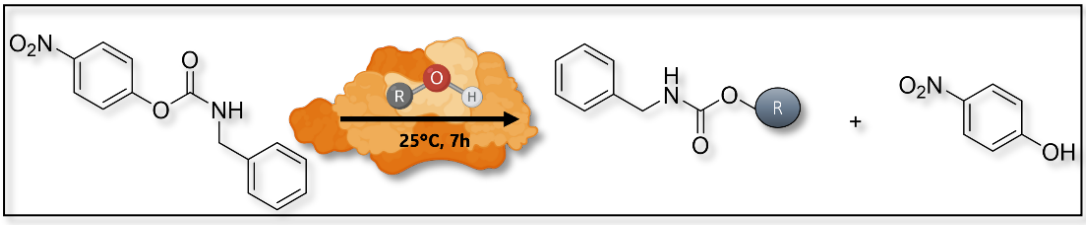


**Figure 1:** Alcoholysis reaction with lipases.

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