

## **Electronic Supporting Information**

### **A Supramolecular Hydrogel as a Reusable Heterogeneous Catalyst for the Direct Aldol Reaction**

*Francisco Rodríguez-Llansola, Juan F. Miravet\* and Beatriu Escuder\**

## General

**NMR:** NMR experiments were performed in an instrument equipped with a 5-mm PFG probe operating at 500 MHz for proton.

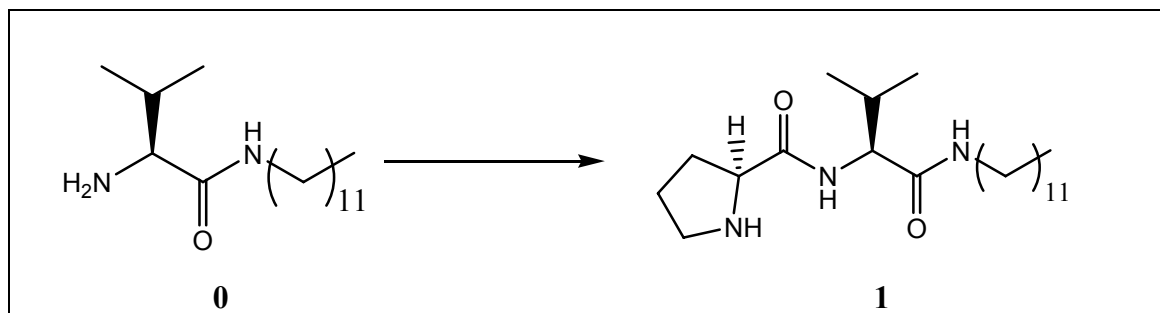
### Scanning Electron Microscopy (SEM).

Scanning electron micrographs were taken with a LEO 440I microscope equipped with a digital camera. A sample of the xerogel was prepared by placing the hydrogel on top of a tin plate and drying of the solvent at room conditions, followed by Pt sputtering.

### X-ray Powder Diffraction.

Data collection was performed at room temperature with a Bruker D4 Endeavor X-ray powder diffractometer by using Cu-K $\alpha$  radiation. A sample of the xerogel was placed on a sample holder and data were collected for  $2\theta$  values between 2 and 40° with a step size of 0.03° and a time step of 10 s.

## Synthesis of compound 1



Compound **0** was prepared as previously described for a propylamide analogue.<sup>1</sup> For the synthesis of compound **1**, commercially available N-(t-butyloxycarbonyl)-L-Proline succinimide ester (1.83 g, 7.75 mmol) was dissolved in 100 mL of dry dimethoxyethane (DME) and then amide **0** (1.28 g, 4.5 mmol) dissolved in 25 mL of dry DME was added dropwise. The reaction was stirred 16 h at room temp under a N<sub>2</sub> atmosphere. After an additional period of 4 h at 50 °C, DME was evaporated and a waxy white solid was obtained. This material was dissolved in 50 mL of CH<sub>2</sub>Cl<sub>2</sub>, washed with saturated sodium bicarbonate (2 x 25 mL), dried over anhydrous sodium sulfate and filtered on a 100 mL round-bottom flask. Afterwards, 15 mL of trifluoroacetic acid were slowly added over the dissolution and stirred overnight. Then, solvent was evaporated under vacuum and residue was dissolved with 50 mL of water, basified and extracted with chloroform (3 x 25 mL). After drying with sodium sulfate anhydrous solvent was evaporated to yield a white solid (1.48 g, 86%). m. p. = 111-112 °C; IR (KBr)  $\nu$  = 3283, 2920, 2851, 1703, 1638, 1543 cm<sup>-1</sup>; <sup>1</sup>H-RMN (500 MHz, DMSO-d<sub>6</sub>):  $\delta$  = 0.75-0.92 (9 H, m), 1.18-1.30 (18 H, m), 1.34-1.42 (2H, m), 1.54-1.64 (2H, m), 1.66-1.72 (1H, m), 1.85-2.00 (3H, m), 2.72-2.79 (2H, m), 3.07-3.18 (2H, m), 3.52-3.58 (1H, m), 4.09-4.16 (1H, m), 8.00-8.05 (1H, br, m), 8.05-8.12 (1H, br, d, 8Hz) ppm; <sup>13</sup>C-RMN (500 MHz, DMSO-d<sub>6</sub>):  $\delta$  = 14.319, 18.155, 19.587, 22.536, 26.303, 26.801, 29.167, 29.416, 29.423, 31.034, 31.758, 31.914, 38.777, 47.181, 56.963, 60.659, 170.826, 174.328 ppm; ESI-MS ( $m/z$ ) = 382.3 [M+H]<sup>+</sup>; C<sub>22</sub>H<sub>43</sub>N<sub>3</sub>O<sub>2</sub>.

<sup>1</sup>) F. Rodríguez-Llansola et al., *Chem Comm.* **2009**, 209-211.

## CATALYSIS

### Preparation of catalytic hydrogels:

10 mg (0.026 mmol) of **1** were suspended in 4 mL of distilled water in a screw-capped vial and heated until complete dissolution. Immediately, the vial was immersed in an ultrasounds bath at room temperature and sonicated for 1 min. The formation of a hydrogel was evidenced by the formation of a solid-like soft material that did not flow upon inversion of the flask.

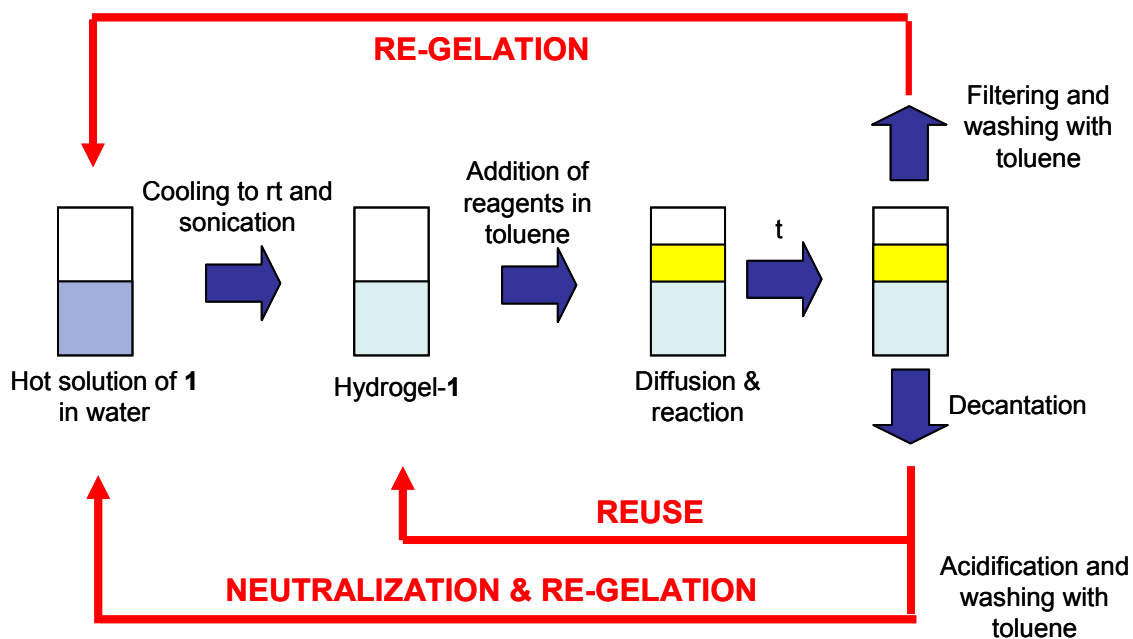
### Catalytic reaction:

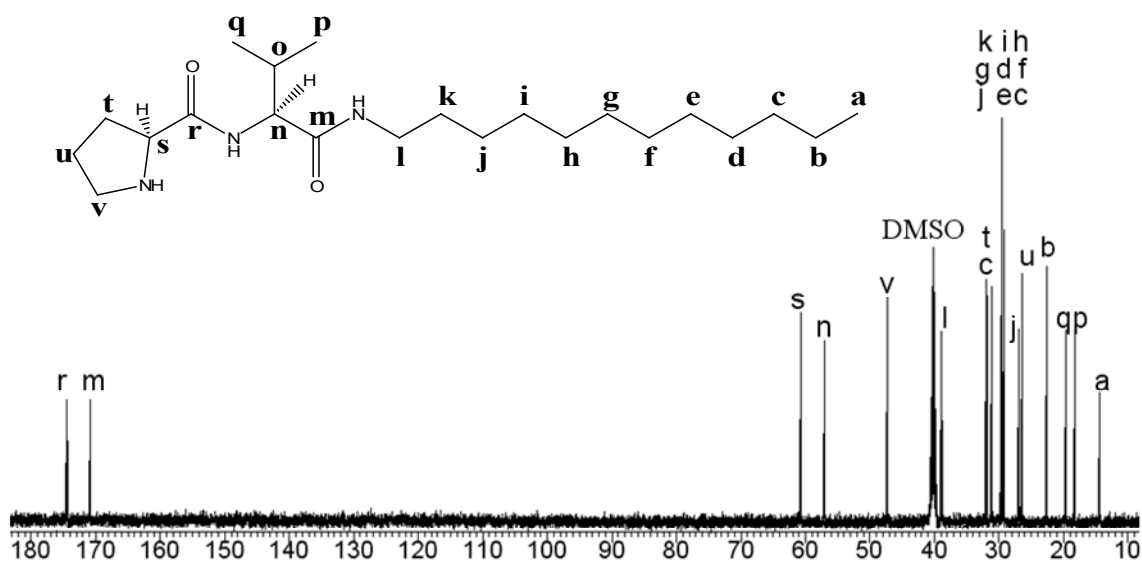
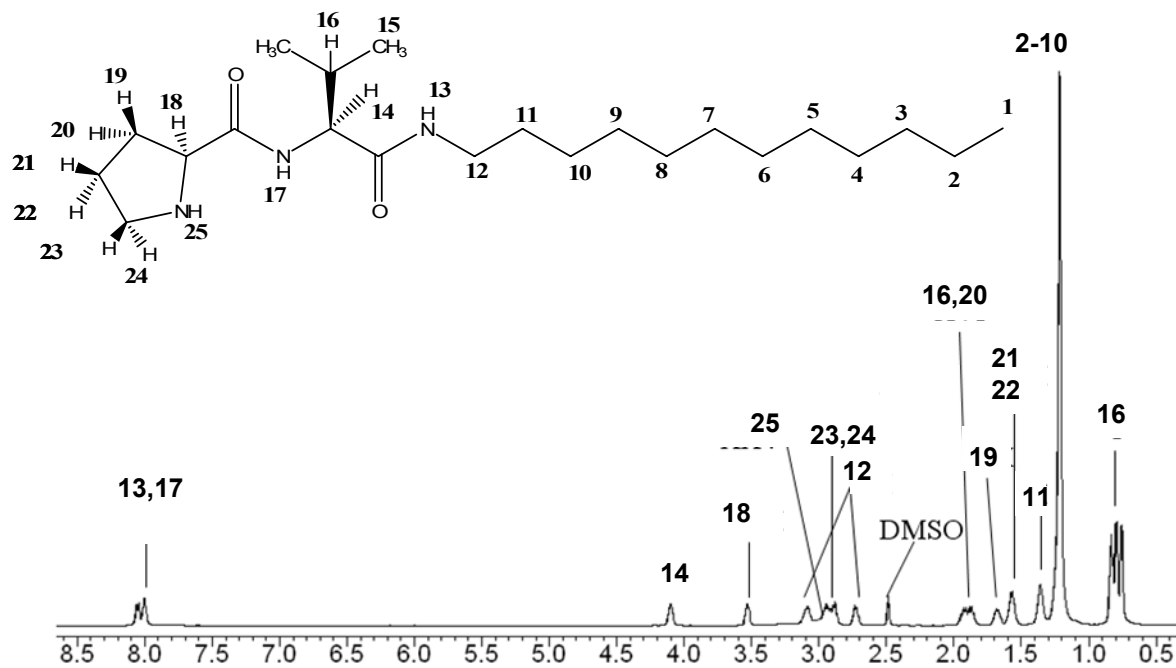
0.13 mmol of 4-nitrobenzaldehyde and 2.6 mmol of cyclohexanone were dissolved in 1 mL of toluene, added on top of the hydrogel and left to diffuse and react at the desired temperature. Reaction process can be monitored by taking aliquots of the upper toluene phase. After the reaction is completed the catalyst can be recovered as discussed in the text.

### Blank experiments:

Different reagent solutions were added on top of several hydrogels (10 mg of **1** in 4 mL of toluene) *Blank 1*, 0.742 mL of toluene; *Blank 2*, 0.258 mL of cyclohexanone and 0.742 mL of toluene; *Blank 3*, 19.8 mg 4-nitrobenzaldehyde and 0.742 mL of toluene.

### Reuse and recycling scheme:





Determination of diastereoisomeric ratios (d.r.):

Diastereoisomeric ratios were determined by NMR (anti,  $\delta = 4.73$  ppm; syn,  $\delta = 5.29$  ppm)<sup>2</sup>

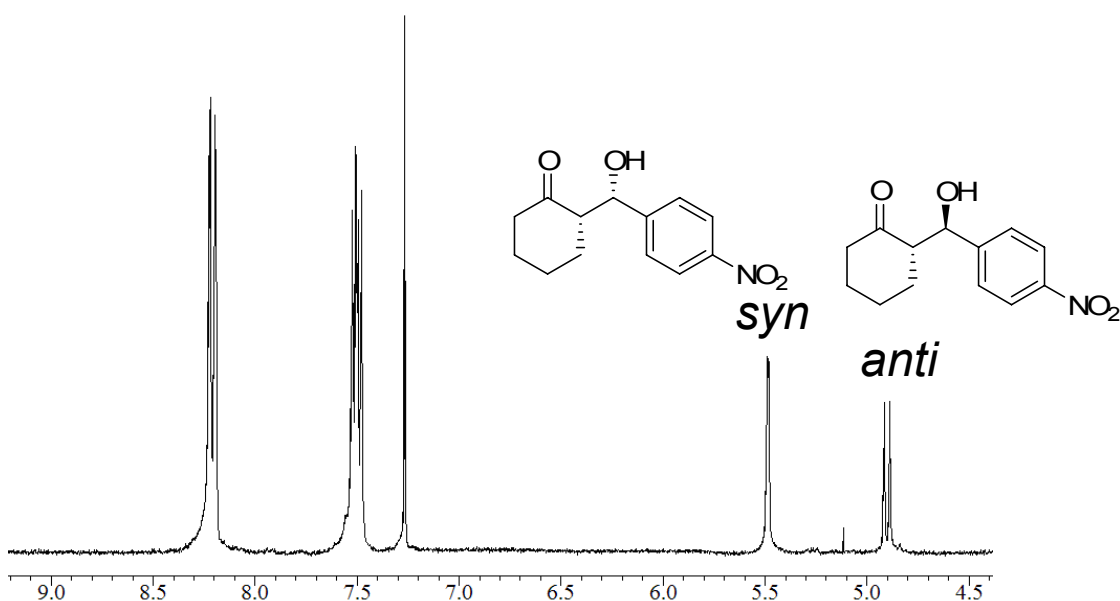


Figure S3. Determination of d.r.

Determination of e.e.:

Enantiomeric excess was determined by HPLC using a Chiralpack IA column,  $\lambda = 250$  nm, hexane/THF (v/v: 75/25), flow rate = 1 mL/min; syn ( $t_1 = 7.72$  min;  $t_2 = 8.47$  min), anti ( $t_3 = 10.29$  min.;  $t_4 = 21.57$  min.).

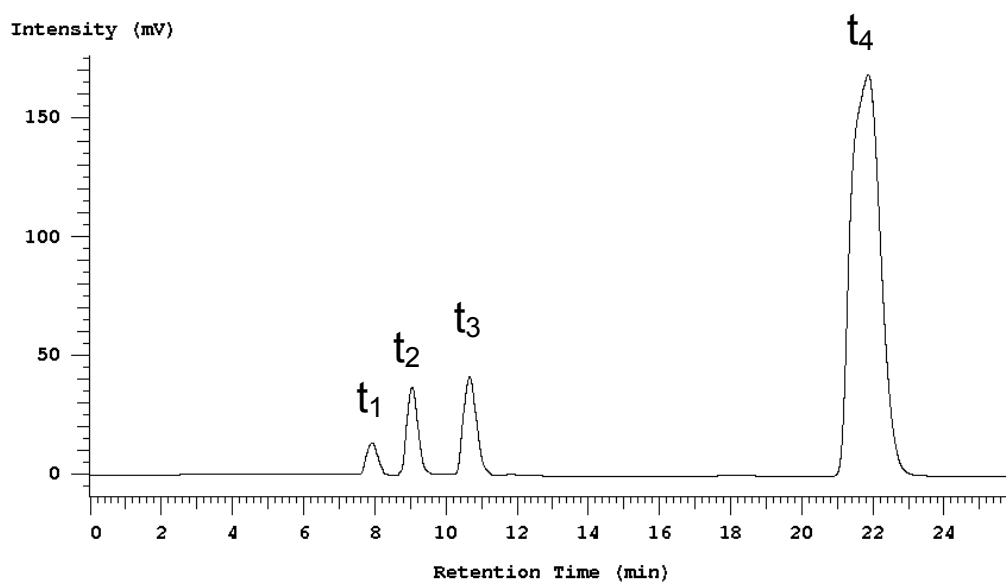


Figure S4. Determination of e.e.

<sup>2</sup> L. He et al., *Tetrahedron: Asymmetry*, **2007**, *18*, 265-270.

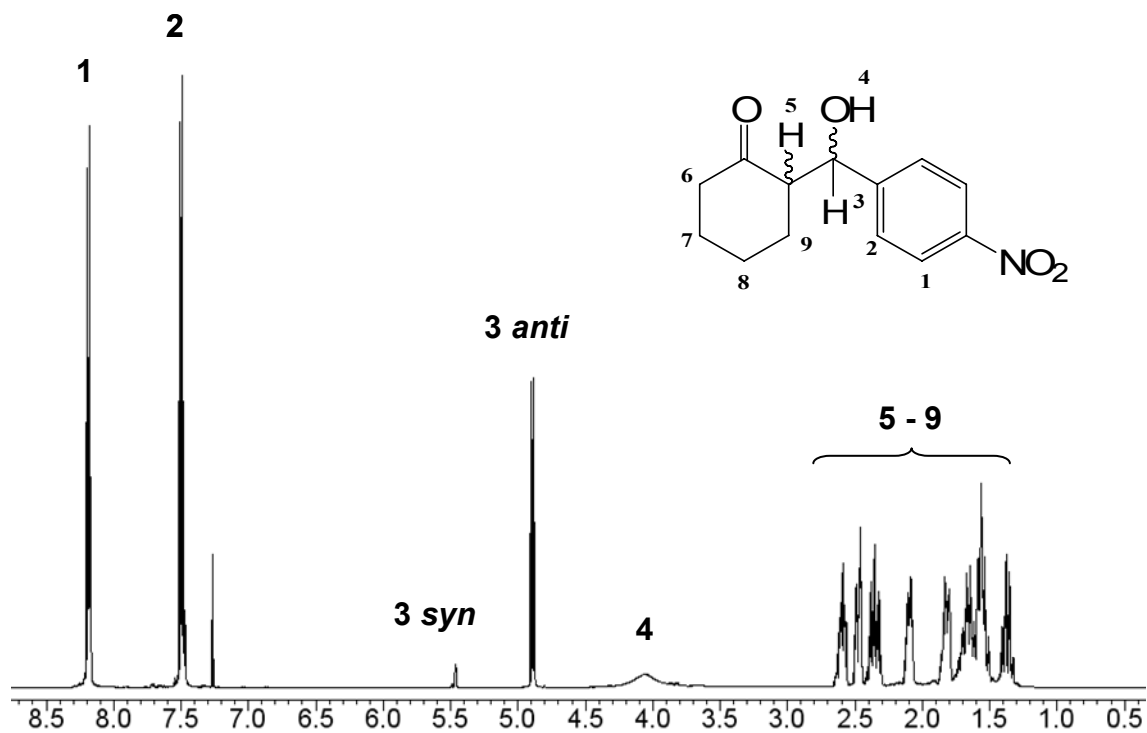


Figure S5. <sup>1</sup>H-NMR (CD<sub>3</sub>Cl) spectrum of the crude toluene phase directly taken from the reaction flask and dried under air current.