FUNTIONALISATION OF COBALT NANOPARTICLES OBTAINED BY ELECTROCHEMICAL METHODS

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Functionalisation of magnetic nanoparticles with appropriated organic molecule is very important for many applications. In the present study, cobalt nanoparticles, with an averaged diameter of 2 nm (synthesised by a electrochemical method) were coated with ADCB (4-(9deceniloxi)benzoic acid), in order to protect the particles against the oxidation and to get a structural unity available to attach nanoparticles to many different materials, like drugs, proteins or some other biological molecules.

The ADCB was synthesised in a two steps route, first the alcohol **2** and **3** had been used to obtain the ether **4**, by a typical Mitsunobu reaction, in standard conditions [1]. Finally, the esther **4** was hydrolysed in basic conditions using lithium hydroxide (Fig. 1).

Cobalt nanoparticles were obtained by an electrochemical method developed by M.T. Reetz and coworkers [2], allowing to control the particle size by controlling the current density. The particles were synthesised in a simple electrochemical cell, contaning a platinum cathode as work electrode, a cobalt anode as contraelectrode, and a solution of tetrabutilamonium nitrate 0.1 M in acetonitrile as electrolyte solution, the tetraalquilamonium ions also serve as stabilisers for the metal clusters. The current density applied was 5 mA cm^{-2} during 5400 s. Inert atmosphere and agitation was maintained the whole process.

Finally, the coupling of the cobalt nanoparticles and the ADCB was taken place in inert atmosphere, adding the organic molecule in an appropriated solvent in an excess of more than 100 molecules for cobalt particle. It was observed that the protected nanoparticles were partially dispersed on this solvent while cobalt nanoparticles without ADCB were insoluble in that solvent.

By means of a termogravimetric analysis a molecular formula for the final synthesized compound of Co.103ADCB was derived. This means that a very compact and ordered arrangement of the ADCB molecules on the cobalt nanoparticle surface is obtained.Using IR spectroscopy information about the attachment of the ADCB to the nanoparticle surface was derived. The changes observed in the peaks associated to the vibration of the acid group present in the ADCB molecule, allowed the identification of a bounding between the acid group of ADCB and the particle surface.

References:

[1] O. Mitsunobu. Synthesis **1981**, 1.
[2] M.T. Reetz, W. Helbig. *J. Am. Chem. Soc.* **1994**, *116*, 7041; J.A. Becker, R. Schäfer, R. Festag, W. Ruland, J.H. Wendorff, J. Pebler, S.A. Quaiser, W. Helbig, M.T. Reetz. *J. Chem. Phys*. **1995**, *103*, 2520.

Figures:

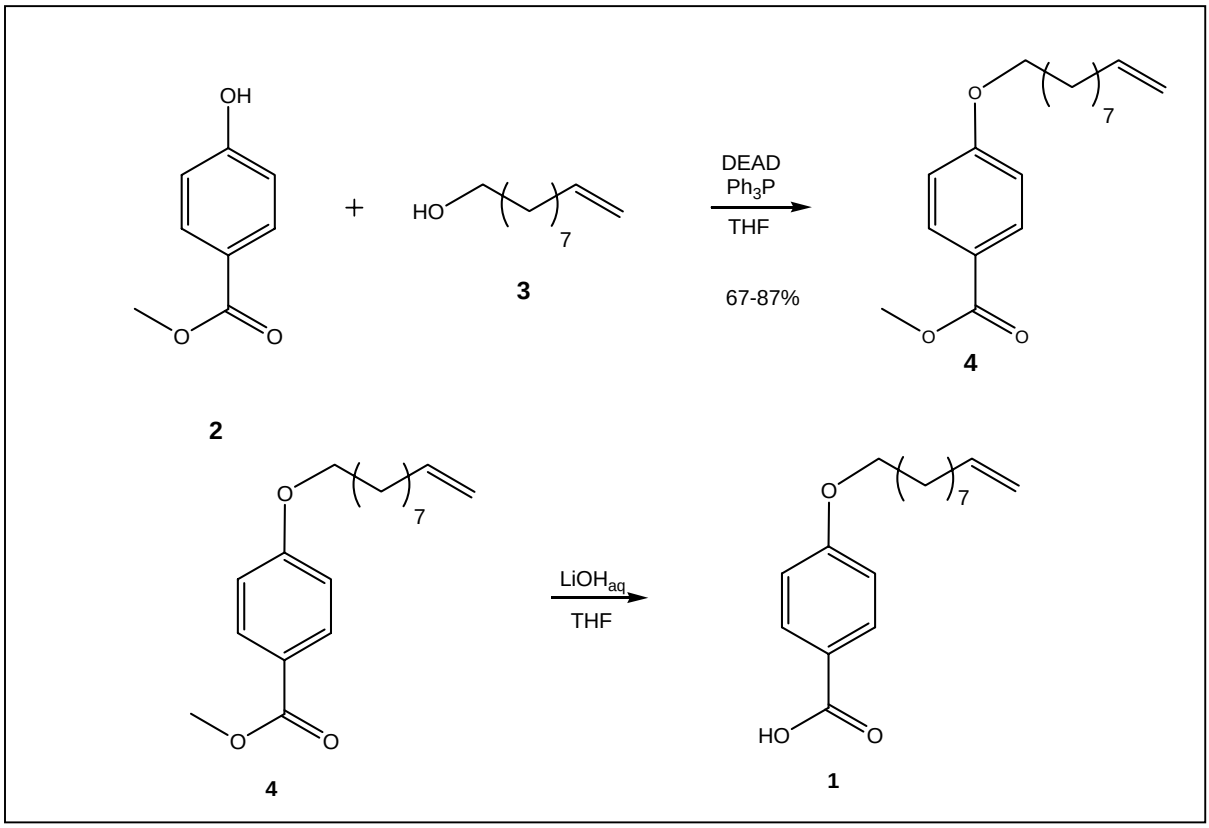

Figure 1