Green chemistry for the production of ß-amino alcohols

VNIVERSITAT DE VALÈNCIA

R+D result

Patent

Knowledge Area

- Organic Chemistry
- Pharmaceutical Chemistry
- Green Chemistry
- Environment

Collaboration

- Technology available for licensing
- Other collaborations

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Procedure for the obtention of ß-amino alcohols

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Background: The β-amino alcohols are products with very high industrial interest because of its applicability in the synthesis of biologically relevant compounds such as amino acids or morpholines. The use of homogeneous catalysts for activation of activated alcohols (benzyl alcohols and their derivatives) is known allowing the alkylation of amines by hydrogen transfer reactions. This may be used for obtaining β-amino alcohols. These homogeneous catalysts have limited industrial applicability because of their cost (most are complexes of Os, Ru, Ir), their instability and the difficulty to be recovered and reused. Moreover, the use of alkali metallic tert-butoxide as co-reactive and organic solvents is required in many of these hydrogen transfer reactions being in some cases incompatible with the presence of water. Therefore, the existence of a process that allows the production of β-amino alcohols in a cost-effective way and in an environmentally friendly manner is necessary and is of special interest.

The invention: Researchers from the Universitat de València have developed a **process for obtaining β-amino alcohols** that is environmentally friendly, uses a heterogeneous catalytic system, is cost-effective, robust and stable under moisture or air. This procedure allows the production of β-amino alcohols directly from ethylene glycol as starting material in a heterogeneous catalyst system which is capable of mono-functionalize ethylene glycol. This method uses diol / water mixtures, no other solvents or halogenated compounds are used. Also, the catalyst can be recovered by filtration and reused since it is heterogeneous. Furthermore, pre-activation of the diol is not necessary. Reagents and solvents do not possess halogen atoms and temperatures are industrially accessible. In addition, yields are superior to all published to date for such a reaction or derived reactions with diethyl carbonate. It is important to note that this procedure is the only one capable of activating diols in a controlled manner avoiding polymerizations; in addition, the catalyst is not able to overreact with β-amino alcohols.

Applications: The invention is applicable in the industrial scale production of β-amino alcohols. These β-amino alcohols would be used for the synthesis of biologically relevant compounds as morpholines or amino acids and for the synthesis of drugs.

Advantages: The main advantages provided by the invention are:

- **Cost reduction**: transition metal in solution and phosphorated ligands are not used, so the cost of the process is significantly reduced. Molecules used in this process do not require anhydrous conditions or inert atmosphere, since catalyst, reactants, solvents and products are stable to air and moisture, so they can be stored in normal containers. Therefore, the use of glove box is not necessary to preserve the catalyst, contrary to many homogeneous catalysis systems. The reagents are commercial and pretreatment of them is not necessary in this procedure and water is used as co-solvent.
- **Reduced waste**: the catalyst can be removed without difficulty, reactivated and reused since it is heterogeneous, thus minimizing waste and maximizing its price. Besides, this procedure is compatible with diols as solvents, avoiding over reaction, generating clean crude reactions and limited side-reaction products. In addition, the purification of the products by selective extraction is also possible, impurities are eliminated in a first step and the amino alcohol is recovered in a second step.
- **Reduction of halogenated compounds**: halo-derivatives (carcinogenic) are not used as reagent or as solvent in extraction or purification.
- **Atom economy**: the diol acts as a solvent and reagent, and it is also activated without chemical transformation; in addition, the reaction only produces as byproduct a water molecule.
- **Moderate temperatures**: the process operates in a temperature range between 130 ºC and 200 ºC, an operating temperature of around 150 °C is preferred, so it can be easily applied industrially.

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