

Catalytic Hydrogenation Reaction of Naringin-Chalcone. Study of the Electrochemical Reaction

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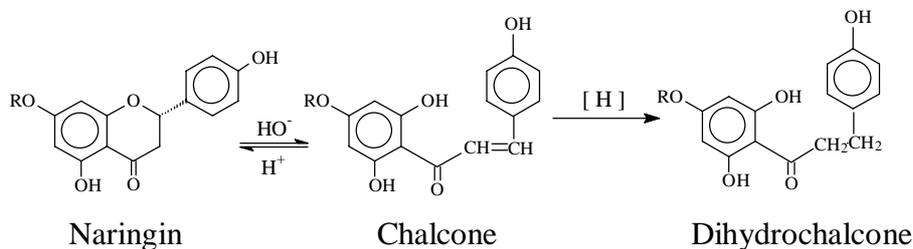
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Abstract: The electrocatalytic hydrogenation reaction of naringin derivated chalcone is studied. The reaction is carried out with different catalysts in order to compare with the classic catalytic hydrogenation.

Introduction

The electrocatalytic hydrogenation reaction of an unsaturated organic molecule involves mechanisms implicating a hydrogen electroadsorption process and the adsorption of the substrate on the catalyst surface [1]. The difficulties of the hydrogenation reactions result from the competence between this reaction and the chemical or electrochemical desorption of the hydrogen. The electrocatalytic reaction can be carried out in more moderate conditions of pressure and temperature compared with the classic catalytic one [2]. Some electrochemical hydrogenation reactions of compounds such as aromatics molecules, alkenes and oils have been done using catalysts as Raney nickel, palladium, platinum and rhodium [3].

Naringin, a flavonoid extracted from the peel of some citric fruits and responsible for their bitterness, is the precursor of dihydrochalcone compound. This kind of substances derived from flavonoids presents a very intense sweet taste [4] therefore their synthesis become interesting because of their industrial potential as a sweetener.



R= β -D-ramnosyl-(1,2)-D-Glucose

Experimental

In order to study the reaction where the dihydrochalcone is formed, the experiences were carried out in alkaline media (pH = 12) where the equilibrium between the flavanone and the chalcone is shifted to the chalcone form. The position of this equilibrium was evaluated by UV-Vis absorption spectroscopy. The electrochemical reductions were carried out in a glass with a two-compartment cell where working electrode was separated from the counter electrode by a glass sinter. Platinum sheet was used as counter electrode and saturated calomel as reference separated by a bridge containing potassium hydroxide solution. Different kinds of working electrodes were used: pure platinum sheet (geometric area 1 cm²), a palladium-gold net and a carbon paste modified with PtO₂ (geometric area 49 m²/g). The hydrogenation reaction products were analyzed by UV-Vis absorption spectroscopy, HPLC and TLC.

Results and Discussion

Considering that the catalysts nature and their active area are very important, different catalysts were studied. For initial studies of chalcone oxidation-reduction behavior a pure platinum electrode was used. Current-potential curves were performed to analyze the electrochemical reactivity of chalcone solutions. The results show that there is no evidence of chalcone reaction in the potential region of both hydrogen and oxygen evolutions. On the other hand, the adsorption of organic molecule on platinum was also studied. The chalcone was adsorbed in the hydrogen electroadsorption potential zone. These results show that reaction is possible.

The electrocatalytic hydrogenation reactions were performed at constant potential with PtO₂ and palladium-gold electrodes and the dihydrochalcone was obtained. The classic hydrogenation reaction was also done using PtO₂ as catalyst for comparing purposes of the yields. Although both results are quite similar, work is in progress to further improve the efficiency of the process.

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References and Notes

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