

Chemo- and Stereoselective Reduction of Polyfunctional Carbonyl Compounds by *Mucor rouxii*

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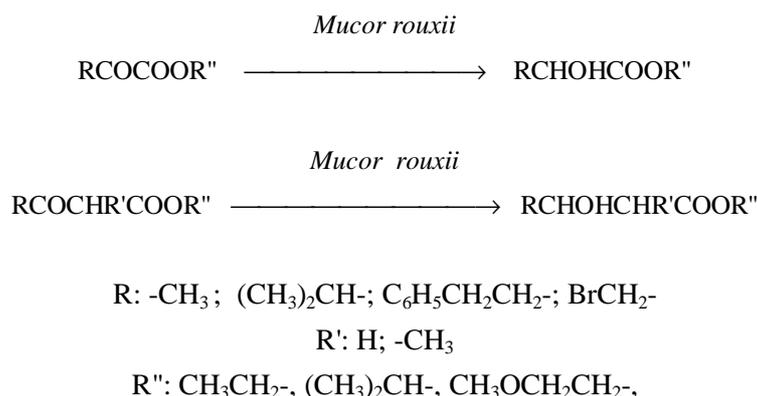
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Abstract: Several polyfunctional carbonyl compounds, such as α - and β -ketoesters, were chemo- and stereoselectively reduced by *Mucor rouxii* cultures in water and in organic solvents. Results show that reductions can be carried out in a variety of organic solvents.

Introduction

In recent years, microorganism whole cells as sources of biocatalysts have widely been used in the laboratory and industry [1]. It is well known the application of baker's yeast oxidoreductases in reduction of carbonyl compounds such as aldehydes, ketones, ketoesters and ketoacids [2-4]. Recently, it has been reported their use in presence of organic solvents [5]. In order to extend this methodology to other microorganisms, we have studied the behavior of fungus *Mucor rouxii* in the reduction of polyfunctional carbonyl compounds, such as α and β ketoesters:



Mucor rouxii is a saprophytic and dimorphic fungus with spores that can germinate as a cenocytic mycelium or as yeast-like cells.

Experimental

Oxidoreductase activity was assayed on the biomass of fresh cultures, grown in rich medium YPG (yeast extract, peptone, glucose) harvested immediately before the assays. The incubations with the different substrates were performed in a nutrient-free medium, in order to avoid the putative metabolism of the substrates by the fungal cells. Biomasses obtained from cultures at different growth stages were incubated with different organic solvents such as ethyl acetate, toluene, hexane, dioxane, etc, alone or in biphasic systems mixed with sterile water; pure water and water plus glucose were also used. The substrates to be analyzed were added to these systems and incubations were performed at 28°C with agitation at 120 rpm for different times. The reaction was stopped by centrifugation at 10000 rpm; the supernatants were removed and when applied, water phases were extracted with ethyl acetate. Extracts were analyzed by GC and isolated products identified by spectroscopic methods: ¹H NMR and MS. Optical purity of products was determined by specific rotation.

Results and Discussion

It was observed the complete and chemoselective carbonyl group reduction of β-ketoesters to give the corresponding β-hydroxyesters, keeping ester carbonyl group unchanged by working with both mycelium and yeast-like cells. This behavior was observed in aqueous medium and in mixtures of water and organic solvents such as toluene and hexane by using yeast like-cells. Microorganism suspension in pure hexane showed a 100% conversion to alcohol in 21 hs. On the other hand, pure toluene and dioxane afforded lower yields. Stereoselectivity was variable and dependent on the polarity of the solvent. High stereoselectivity (93% e.e. of *S*-alcohol) was observed when the biocatalytic reduction was performed with yeast-like cells in hexane. In water, % e.e. decreased in both morphologies.

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References and Notes

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