Influence of microwave irradiation on lipase-catalyzed kinetic resolution of (±)-mandelonitrile

Sandra S. Ribeiro, Julieta R. de Oliveira, André L. M. Porto*
Instituto de Química de São Carlos, Universidade de São Paulo, Av. Trabalhador São-carlense, 400, 3560-970, São Carlos, SP, Brazil, "sandrinhasr@iqsc.usp.br

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INTRODUCTION

The synthesis of optically pure cyanohydrins is an area of growing interest in synthetic chemistry. Microwave irradiation has also attracted considerable interest in recent years because of their advantages, such as reduced chemical reaction time, reduced side reactions, increased yields and improved reproducibility. The objective of this study was to investigate the kinetic resolution of (±)-mandelonitrile (1) using lipase from Candida antarctica under microwave irradiation and conventional conditions.

RESULTS AND DISCUSSION

The kinetic resolution of (±)-mandelonitrile 1 was made with the lipase of Candida antarctica (160 mg) using (80 µL, 0.067 mmol) of rac-mandelonitrile in toluene (10 mL) and vinyl acetate (500 µL) under microwave irradiation and conventional heating. Microwave irradiation experiment was performed with Discover System from CEM Corporation: The whole reaction mixture was placed in the microwave oven and irradiated at 80°C, about 200 W. The reaction progress was monitored by collecting samples (2 µL) according to the time indicated in Table 1, which were analyzed by GC-FID with chiral stationary phase, while conventional heating lipase-catalyzed acylation reaction was made in an orbital shaker at 32°C and 130 rpm. The results are summarized in Table 1.

The microwave irradiation showed to be efficient for the enzymatic resolution providing decrease in reaction time and good yield and enantiomeric excess. In addition, the conventional kinetic resolution was performed in 7 days producing (S)-mandeloniitrile 2 (Table 1). The (R)-mandeloniitrile (1) unreacted, by conventional and microwave reactions, resulted spontaneously in a chemical equilibrium producing the benzaldehyde (Scheme 1).

CONCLUSION

This study shows the first efficient kinetic resolution of (±)-mandeloniitrile (1) by lipase from C. antarctica under conventional and microwave conditions, producing exclusively the (S)-mandeloniitrile acetate (2) in high selectivity (> 98% ee). The kinetic resolution in toluene proceeded with rate enhancement reducing chemical reaction time in microwave irradiation in comparison with conventional experiment.

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REFERENCES