

SELECTIVE HYDROGENATION OF CARBON-CARBON DOUBLE BONDS OF CHALCONES
BY THE AID OF A MICROORGANISM

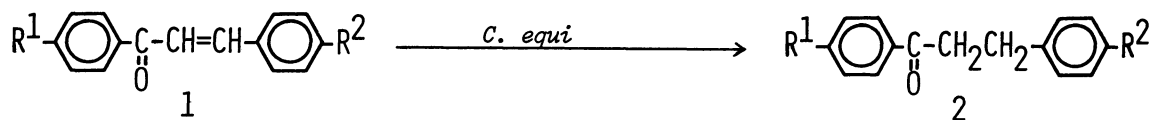
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Chalcone and substituted chalcones are selectively hydrogenated on C=C double bonds by incubation with *Corynebacterium equi* IFO 3730, to give the corresponding saturated ketones.

Microbial reduction of carbon-carbon double bonds plays an important role in selective transformations of organic compounds.¹⁾ However, enzymatic hydrogenation of C=C bonds of α,β -unsaturated enones has been known to sometimes suffer concomitant reduction of the carbonyl functions resulting in the formation of saturated alcohols.²⁾ Because one of the advantages of microbial transformation of organic substances lies in its high selectivity, strict distinction between the two functional groups is desirable. In the course of our studies on microbial transformation of organic molecules,³⁾ we found that *Corynebacterium equi* IFO 3730, a known strain of bacteria, catalyzed the selective hydrogenation of C=C bonds of chalcones.

To 50 ml of medium (pH 7.2)⁴⁾ contained in a 500-ml Erlenmeyer flask were added 2 ml of *n*-hexadecane as a source of carbon, 100 mg of chalcone (1a) and a small amount of a pre-cultivated suspension of *C. equi*. The flask was shaken on a rotary shaker at 30 °C for 3 days, and the broth was extracted with diethyl ether. The ethereal layer was washed with brine and dried over anhydrous sodium sulfate. Evaporation of solvent gave 1,3-diphenyl-1-propanone (2a) in a quantitative yield. The product was identified by IR, NMR, and mass spectra.⁵⁾ No products which would be formed by reduction of the carbonyl group were detected by GLC analysis. Thus, the microbial hydrogenation appeared to be highly chemoselective. This reaction can be applied to chalcones having a variety of substituents on either of the two aromatic rings. As the results listed in Table 1 show, both substrates with electron-releasing (b, d, f) and electron-withdrawing (c, e, g) groups underwent

Table 1. Hydrogenation of Chalcones by *C. equi*^{a)}

Compound	R ¹	R ²	Conversion (%)	Yield ^{b)} (%)
a	H	H	100	100
b	H	<i>p</i> -CH ₃ O	95	95
c	H	<i>p</i> -NO ₂	83	78
d	<i>p</i> -CH ₃ O	H	70	55
e	<i>p</i> -NO ₂	H	68	68
f	<i>p</i> -CH ₃	H	94	94
g	<i>p</i> -Cl	H	96	96

a) Substrate: 100 mg/50 ml, Cultivation: 3 d at 30 °C. b) Isolated yield.

smooth hydrogenation. Accordingly, it is concluded that the electronic effects of the substituents are small.

In summary, while the reaction is chemoselective for a C=C double bond in the presence of a carbonyl group, it has a wide applicability for substrates with a variety of substituents, including a nitro group, on the aromatic rings. These excellent characteristics will be expected to find a usefulness in synthetic chemistry.

References

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- 4) The medium consists of: (NH₄)₂HPO₄ (10 g), K₂HPO₄ (2 g), MgSO₄·7H₂O (0.3 g), FeSO₄·7H₂O (10 mg), ZnSO₄·7H₂O (8 mg), MnSO₄·4H₂O (8 mg), yeast extract (0.2 g), and H₂O to make 1000 ml (pH 7.2).
- 5) The product from **1a** gave the following spectra. NMR (CDCl₃) δ 2.9-3.5 (m, 4H), 7.27 (m, 5H), 7.47 (m, 3H), 7.96 (m, 2H); IR (KBr disk) 1690, 1600, 1500, 1450, 1410, 1370, 1290, 1080, 980, 710 cm⁻¹; MS m/z (rel intensity) 210 (50, M⁺), 105 (100), 77 (31), 51 (8). Mp 67-68 °C. All the other products showed agreeable spectra.

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