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SHORT COMMUNICATIONS

Catalytic Synthesis of New Halogen-Containing Tetrahydroquinolin-8-ols

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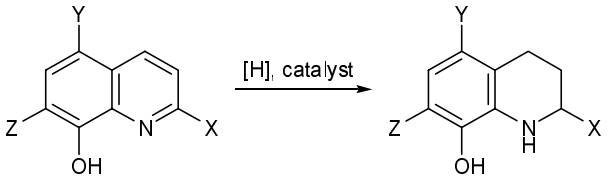
Catalytic hydrogenation of 8-hydroxyquinolines is a promising method for the preparation of the corresponding 8-hydroxy-1,2,3,4-tetrahydroquinolines which are used in the synthesis of practically important heterocyclic compounds, e.g., pharmacologically active oxazepine derivatives [1] and oxazines possessing unique photophysical properties [2]. With a view to extend the series of tetrahydroquinolin-8-ols obtained in the presence of spongy palladium [3] or platinum black [1] we performed catalytic synthesis of previously unknown dihalo derivatives **IIa**–**IId**. It should be noted that hydrogenation of halogen-containing quinolines may be accompanied by undesirable hydrodehalogenation process [4]. In this respect, platinum catalysts are clearly more advantageous than palladium compounds due to high selectivity of the reduction process [5].



Ia–Id IIa–IId

X = H, Y = Z = Cl (**a**), Br (**c**); X = Me, Y = Z = Cl (**b**); Y = Cl, Z = I (**d**).

Preliminary experiments showed that the contribution of hydrodehalogenation in the hydrogenation of 5,7-dichloroquinolin-8-ol (**Ia**) and 5,7-dichloro-2-methylquinolin-8-ol (**Ib**) over a low-percentage platinum catalyst (0.5% Pt/Al_2O_3; 15 wt % relative to the substrate) was 0.6–0.8 mol %; in the catalytic reduction of 5,7-dibromoquinolin-8-ol (**Ic**), the degree of hydrodehalogenation was 3.5–4 mol %. The target products, compounds **IIa**–**IId** were obtained in 71–87% yield, the reaction time being 6–8 h. Thus the low-percentage aluminum–platinum catalyst used in petroleum processing is clearly superior to the known high-cost catalysts [1, 3]. However, the hydrogenation of iodine-containing hydroxyquinoline **Id** over 0.5% Pt/Al_2O_3 occurred with a low selectivity: the contribution of hydrodehalogenation process was 14–17 mol %, tetrahydroquinoline **IId** was contaminated with by-products, and we failed to isolate it as individual substance.

In order to enhance the selectivnity we have developed a novel procedure. Taking into account the ability of 8-hydroxyquinolines to form complexes with metal ions, we used as an alternative catalytic system, platinum(IV) complexes with the initial hydroxyquinolines. During the reaction, platinum(IV) was reduced to platinum(0) to form metal clusters which were likely to act as catalytic species [6]. Following the developed procedure, we succeeded in obtaining 5-chloro-7-iodo-1,2,3,4-tetrahydroquinolin-8-ol (**IId**) in 87% yield and raising the yield of compound **IIc** from 71 to 89%.

5,7-Dichloro-1,2,3,4-tetrahydroquinolin-8-ol (IIa). A solution of 0.03 g (0.06 mmol) of $H_2[PtCl_6]\cdot 6H_2O$ in 2 ml of water was added to a solution of 10 g (0.047 mol) of 5,7-dichloroquinolin-8-ol in 150 ml of propan-2-ol, and insoluble platinum complex separated from the mixture. The resulting suspension was transferred into a hydrogenation reactor, and the reduction was carried out at 90–95°C under a hydrogen pressure of 2–2.0 MPa. The product was isolated according to the procedure described in [1]. When the reduction

was complete, the mixture contained finely dispersed metallic platinum. The solution was separated from the metal by decanting. The catalyst can be reused for 3–4 times without appreciable loss in activity and product yield and purity. Yield of **IIa** 8.87 g (87%), mp 89–91°C. IR spectrum, ν, cm^{-1}: 1562 ($C=C_{arom}$), 3340 (NH), 3619 (OH). ^1H NMR spectrum, δ, ppm: 1.91 t (2H, 2-H), 3.29 m (2H, 3-H), 2.69 t (2H, 4-H), 4.76 br.s (1H, OH), 6.32 s (1H, 6-H), 8.45 br.s (1H, NH). Found, %: C 49.5; H 4.17; Cl 33.04; N 6.42. $C_9H_9Cl_2NO$. Calculated, %: C 49.54; H 4.13; Cl 33.03; N 6.42.

Compounds **IIb**–**IId** were synthesized in a similar way. The reduction in the presence of 0.5% Pt/Al_2O_3 was performed under the same conditions.

5,7-Dichloro-2-methyl-1,2,3,4-tetrahydroquinolin-8-ol (IIb). Yield 86%, mp 77–78°C. IR spectrum, ν, cm^{-1}: 1580 ($C=C_{arom}$), 2973 (CH_3), 3334 (NH), 3615 (OH). ^1H NMR spectrum, δ, ppm: 1.18 s (3H, CH_3), 2.70 t and 2.60 t (1H each, 3-H), 1.89 t and 1.43 t (1H each, 4-H), 3.31 s (1H, 2-H), 5.25 br.s (1H, OH), 6.59 s (1H, 6-H), 9.05 br.s (1H, NH). Found, %: C 51.68; H 4.72; Cl 31.06; N 6.35. $C_{10}H_{11}Cl_2NO$. Calculated, %: C 51.72; H 4.74; Cl 31.03; N 6.03.

5,7-Dibromo-1,2,3,4-tetrahydroquinolin-8-ol (IIc). Yield 89%, mp 100–101°C. IR spectrum, ν, cm^{-1}: 1551 ($C=C_{arom}$), 3350 (NH), 3603 (OH). ^1H NMR spectrum, δ, ppm: 1.88 t (2H, 2-H), 3.27 m (2H, 3-H), 2.29 t (2H, 4-H), 5.20 br.s (1H, OH), 6.78 s (1H, 6-H), 8.43 br.s (1H, NH). Found, %: C 35.08; H 2.89; Br 52.10; N 4.62. $C_9H_9Br_2NO$. Calculated, %: C 35.18; N 2.93; Br 52.12; N 4.56.

5-Chloro-7-iodo-1,2,3,4-tetrahydroquinolin-8-ol (IId). Yield 87%, mp 136–138°C. IR spectrum, ν, cm^{-1}: 1545 ($C=C_{arom}$), 3214 (NH), 3652 (OH). ^1H NMR spectrum, δ, ppm: 1.80 t (2H, 2-H), 3.19 m (2H, 3-H), 2.62 t (2H, 4-H), 5.40 br.s (1H, OH), 6.87 s (1H, 6-H), 8.59 br.s (1H, NH). Found, %: C 34.77; H 3.2; Cl 11.56; I 40.89; N 4.42. $C_9H_{10}ClINO$. Calculated, %: C 34.73; H 3.22; Cl 11.58; I 40.84; N 4.5.

The IR spectra were recorded on a Specord M-80 spectrophotometer from samples dispersed in mineral oil. The ^1H NMR spectra were measured from 5% solutions in DMSO-d_6 on a Bruker AC-500 instrument using TMS as internal reference. The contribution of hydrodehalogenation was calculated from the concentration of halide ions in the reaction mixture, which was determined by potentiometric titration with silver nitrate [7]. The elemental compositions were determined on a CHN-1 analyzer.

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