

## **A New Synthesis of Aminodiols and Hydroxyaziridines using Acetate and Carbonate Ions on a Polymeric Support**

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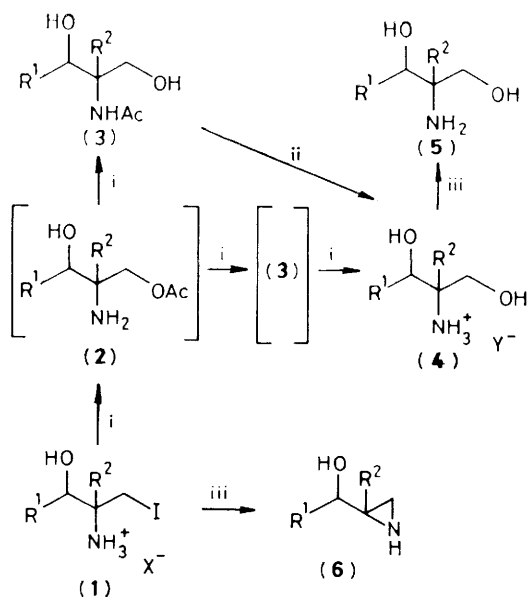
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A new and practical synthesis of 2-amino-1,3-diols, 3-amino-1,4-diols, and hydroxyaziridines, by hydrolysis of certain salts of the iodoaminoalcohols with polymer supported anions, is described.

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In the preceding communication we reported a new method for the regioselective iodoamination of allylic and homoallylic

alcohols.<sup>1</sup> The iodoaminoalcohols, obtained easily by mild hydrolysis of the corresponding 1,3-oxazolines or dihydro-



**Scheme 1.**  $X^- = Cl^-: CCl_3CO_2^-$  in a 1:1 mixture.  $Y^- = Cl^-$  or  $AcO^-$ . Reagents: i, Amberlyst A 26  $AcO^-$  form; ii, 2 M HCl; iii, Amberlyst A 26  $CO_3^{2-}$  form.

**Table 1**

Substrate (1)	Product yield, % <sup>a</sup> (5)
a $R^1 = H, R^2 = Me$	95
b $R^1 = C_6H_{11}, R^2 = H$	92
c $R^1 = CHMe_2, R^2 = H$	94
(7)	(8)
	94

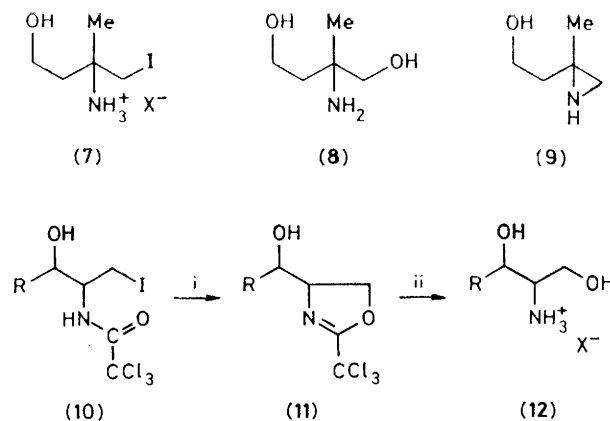
<sup>a</sup> Yields refer to pure isolated products. All new compounds gave satisfactory analytical and spectral data.

1,3-oxazines,<sup>2</sup> in neutral or acidic medium, are recovered as the ammonium salts (1) or as the trichloroacetamides (1a). On the other hand it is well known that  $\beta$ -haloamine salts afford aziridines under basic conditions.<sup>3</sup>

We now report a new method that leads to the 2-amino-1,3-diols (5) and 2-amino-1,4-diols (8), starting from the compounds described above. The most interesting feature of this new synthesis is the use of polymer supported acetate which, besides preventing the formation of the aziridine, avoid the difficulties connected with an aqueous work-up, owing to the high water solubility of the products.

The reaction was performed by treating the salt (1), dissolved in methanol, with 4 equiv. of acetate ions supported on Amberlyst A 26 at reflux temperature for 2 h. Depending on the structure of (1), the acetamido diol (3) or the aminodiols (4) were obtained simply by filtering off the resin and evaporating the solution *in vacuo* (Scheme 1).

To explain this result we suggest that iodide ion displacement by polymer supported acetate occurred first to give (2), followed by intramolecular aminolysis to the corresponding 2-acetamido-1,3-diol (3). Hydrolysis of (3) yielded the salt (4). Treating (4) with carbonate ion on Amberlyst A 26 in refluxing methanol for 1 h<sup>4</sup> gave the 2-amino-1,3-diol (5) in a quantitative yield. Following the same reaction scheme, 2-amino-2-methylbutan-1,4-diol (8) was isolated in 95% yield, starting from the corresponding salt (7). Table 1 summarizes the results obtained.



**Scheme 2.**  $R = \text{alkyl}$ ;  $X^- = Cl^-: CCl_3CO_2^-$  in a 1:1 mixture. Reagents: i, Amberlyst A 26  $CO_3^{2-}$  form; ii, 2 M HCl.

**Table 2**

Substrate (1)	Product yield, % <sup>a</sup> (6)
a $R^1 = H, R^2 = Me$	96
b $R^1 = C_6H_{11}, R^2 = H$	95
c $R^1 = CHMe_2, R^2 = H$	95
(7)	(9)
	96

<sup>a</sup> Yields refer to pure isolated products. All new compounds gave satisfactory analytical and spectral data.

However, treatment of the salt (1) with carbonate ions supported on Amberlyst A 26 in methanol at room temperature gave the corresponding hydroxyaziridines (6) in quantitative yield. A similar result was obtained with the salt (7) giving the hydroxyaziridine (9) (Table 2).

Since the aminodiols are useful intermediates for the synthesis of natural products, we accomplished a second pathway to (5). It is known that  $\alpha$ - and  $\beta$ -haloamides undergo halogen displacement by the carbonyl group in basic media, to give 1,3-oxazolines and dihydro-1,3-oxazines, respectively.<sup>5</sup> Thus, we converted the trichloroacetamides (10) into (11) simply by stirring with polymer supported carbonate in methanol at room temperature. Compound (11) was hydrolysed to the ammonium salt (12) by treatment with HCl (Scheme 2).

We consider that these procedures for the synthesis of aminodiols will be of great use in the preparation of amino-sugars and related natural compounds, since they allow the introduction of a functional group pattern into a chiral target structure.

In a typical procedure, Amberlyst A 26 in the  $AcO^-$  form (10.5 g; ca. 40 mol. equiv.) was added to a solution of (1a) (10 mmol) ( $X^- = Cl^-: CCl_3CO_2^-$  in a 1:1 mixture) in methanol (20 ml). The suspension was stirred for 4 h at reflux temperature and then filtered. After evaporation of the organic phase, 2-amino-2-methylpropan-1,3-diol acetate (4a) ( $Y^- = AcO^-$ ) was obtained (1.56 g; 95% yield); m.p. 133–134 °C; i.r. (nujol):  $\nu$  3300 (OH), 2200 ( $NH_3^+$ ), and 1565 ( $C=O$ )  $cm^{-1}$ ;  $^1H$  n.m.r. ( $CD_3OD$ ):  $\delta$  1.2 (s, 3 H,  $CH_3$ ), 1.88 (s, 3 H,  $CH_3CO$ ), and 3.55 (ABq, 4 H,  $CH_2OH$ ;  $J$  12 Hz). Under the same reaction conditions, the acetamides (3b) and (3c) were isolated from the salt (1b) and (1c), respectively; further hydrolysis with 2 M HCl afforded the salts (4b) and (4c) ( $X^- = Cl^-$ ).

Amberlyst A 26 in  $\text{CO}_3^{2-}$  form (5 g; *ca.* 20 mol. equiv.) was added to a solution of the acetate (**4a**) in methanol (20 ml) and the suspension was stirred for 1 h at reflux temperature. After filtration of the resin and removal of the solvent *in vacuo*, 2-amino-2-methylpropan-1,3-diol (**5a**) was obtained in a quantitative yield; m.p. 109–110 °C (lit.<sup>6</sup> 109–111 °C); i.r. (nujol):  $\nu$  3250 (OH, NH) and 1630 ( $\text{NH}_2$ )  $\text{cm}^{-1}$ ;  $^1\text{H}$  n.m.r. ( $\text{CD}_3\text{OD}$ ):  $\delta$  1 (s, 3 H,  $\text{CH}_3$ ) and 3.4 (s, 4 H,  $\text{CH}_2\text{OH}$ ). Following the same pathway, the salts (**4b**) and (**4c**) ( $\text{X}^- = \text{Cl}^-$ ) afforded the corresponding aminodiols (**5b**) and (**5c**).

As an example of the preparation of the hydroxyaziridines (**6**), the salt (**1a**) ( $\text{X}^- = \text{Cl}^-$ ;  $\text{CCl}_3\text{CO}_2^-$  in a 1:1 mixture) (10 mmol) was stirred in methanol (20 ml) with Amberlyst A 26 in the  $\text{CO}_3^{2-}$  form (5 g; *ca.* 20 mol. equiv.) at room temperature. After 1 h the resin was filtered off and the solvent removed *in vacuo* to give the hydroxyaziridine (**6a**) (835 mg; 96% yield) as an oil; i.r. (neat):  $\nu$  3300 (OH, NH)  $\text{cm}^{-1}$ ;  $^1\text{H}$  n.m.r. ( $\text{CD}_3\text{OD}$ ):  $\delta$  1.3 (s, 3 H,  $\text{CH}_3$ ), 1.55 (s, 1 H,  $\text{CH}_2\text{NH}$ ), 1.75 (s, 1 H,  $\text{CH}_2\text{NH}$ ), and 3.52 (ABq, 2 H,  $\text{CH}_2\text{OH}$ ;  $J$  12 Hz).

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