N-(2-AMINOETHYL)SUCCINAMIC ACID

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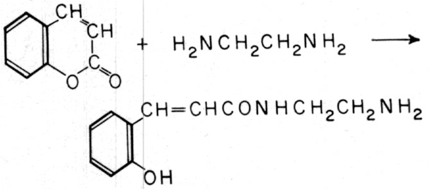
In an earlier publication (Yohe et al., 1959) it was reported that the titration of succinic anhydride and of di-*tert*-butylsuccinic anhydride with sodium aminoethoxide in ethylenediamine solution gave neutral equivalent values corresponding to the utilization of one equivalent of base per mole of anhydride.

This is analogous to the behavior of certain lactones which Glenn and Peake (1955) titrated with sodium aminoethoxide in ethylenediamine. They found that coumarin, for example, required only one equivalent of base because the formation of the amide left only the phenolic hydroxyl available for titration:



Although the hydrolysis of an anhydride gives two molecules of acid:

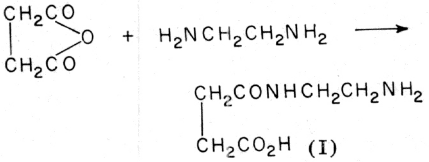
$$(RCO)_2O + H_2O \longrightarrow 2\ RCO_2H$$

the ammonolysis of the same structure gives only one:

$$(RCO)_2O + R'NH_2 \longrightarrow RCO_2H + RCONHR'$$

The acid (or more probably its amine salt, RCO_2NH_3R') produced in the latter reaction is sufficiently acidic to be titrated by sodium aminoethoxide in ethylenediamine, but the amide is not. Acetamide, for example, behaved as a neutral compound toward this reagent.

Thus the behavior of succinic anhydride in requiring only one equivalent of base when titrated in ethylenediamine solution could be explained by the formation of N-(2-aminoethyl)succinamic acid (I):



(I)

This explanation has been confirmed by the isolation and identification of compound I.

EXPERIMENTAL

N-(2-Aminoethyl)succinamic Acid—In the preparation of this compound, a solvent was used in order to avoid difficulties in purification.

A solution of 1.0 g. of succinic anhydride in 10 ml. of anhydrous 1,4-dioxane was added to a solution of 40 ml. of anhydrous ethylenediamine in 40 ml. of dioxane, stirred, and allowed to stand overnight. The white crystals were filtered off, washed with dioxane, and recrystallized twice from absolute ethanol and once from dioxane. The compound charred without melting at 204°C. The infrared spectrum (potassium bromide pellet) showed absorption at 3325, 3070, 3000-2400, 2180 (weak), 1635, 1550-1525, 1395, 1335 (weak), and 1175-1150 cm. $^{-1}$ (weak).

Analysis calculated for $C_6H_{12}N_2O_3$: C, 44.99; H, 7.55; N, 17.49 per cent. Found: C, 45.2; H, 7.4; N, 18.1 per cent.

The analysis indicates that this compound is the succinamic acid (I) or its "inner salt" rather than the salt it would form with another molecule of ethylenediamine ($H_2NCH_2CH_2NH_3OCOCH_2CH_2CONHCH_2CH_2NH_2$), as the values calculated for $C_8H_{20}N_4O_3$ are: C, 43.62; H, 9.15; N, 25.44.

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