

Letters to the Editor

Purification of glycyrrhizates through the lead salt

SIR,—In a reported method for the preparation of glycyrrhizic acid (Lythgoe & Trippett, 1950; Kuboki & Hoshizaki, 1954; Ito, Kirita & Kuroda, 1955) the precipitate produced by adding lead acetate to an aqueous solution of crude ammonium glycyrrhizate is suspended in aqueous ethanol and decomposed with hydrogen sulphide; the precipitate is removed, and the solid obtained on evaporating the filtrate recrystallised. The reaction sequence would be expected to produce lead glycyrrhizate, which is subsequently decomposed to give lead sulphide and glycyrrhizic acid, but Marsh & Levvy (1956) using the same process, claimed that mono-ammonium glycyrrhizate was the end product. Thus the lead derivative could be a mixed lead-ammonium salt, and to investigate this possibility we prepared the compound and examined it. Mono-ammonium glycyrrhizate, prepared as described previously (Gilbert & James, 1964) was dissolved in 30% ethanol and made alkaline to litmus with ammonia. Excess lead acetate solution was added giving a white precipitate which was removed, washed six times with water, and dried *in vacuo* at 50°.

Gravimetric determination as chromate gave Pb 20.00%; $(C_{42}H_{59}O_{16})_2Pb_3$ requires Pb 27.41%; $C_{42}H_{59}O_{16}NH_4Pb$ requires Pb 19.83%. Ammonia distillation gave NH_4 1.56%; $C_{42}H_{59}O_{16}NH_4Pb$ requires NH_4 1.63%.

Thus mono-ammonium glycyrrhizate is the logical product, providing the first pK_a value is lower than that of hydrogen sulphide (pK_a 7.04), for if hydrogen sulphite were the stronger acid it would replace the ammonium in the lead-ammonium salt with hydrogen. Potentiometric titration of glycyrrhizic acid with sodium hydroxide gave only one inflection, which showed that the pK_a values for all three carboxyl groups lay between 3.5 and 5.0, while pH measurements of mixtures of mono-ammonium glycyrrhizate and hydrochloric acid gave a mean first pK_a value of 3.74 at 25°. Decomposition of the lead ammonium glycyrrhizate with hydrogen sulphide gave a product identical with mono-ammonium glycyrrhizate.

Examination of the papers which described the products as glycyrrhizic acid revealed some support for our conclusions. Both Kuboki & Hoshizaki (1954) and Ito & others (1955) quoted the melting-point of their product as 170°, mono-ammonium glycyrrhizate turns yellow at this temperature, but the acid does not. It would therefore appear that the material these workers described as glycyrrhizic acid was the mono-ammonium salt.

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