THE USE OF NITROSO-R-SALT IN THE DETERMINATION OF EXCHANGEABLE POTASSIUM IN SOILS

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Many methods are to be found in the literature for the determination of exchangeable potassium in soils. Yet when determination of exchangeable potassium is desirable, the choice of methods is usually a difficult one. Even after the choice of an extracting solution has been made, the method of determination to be applied to the extract must be decided.

Since its introduction by Schollenberger (4), ammonium acetate is rather widely used as an extracting solution and in this country has become almost a standard extractant for exchangeable potassium. On the other hand, there are some workers who prefer to use a dilute acid. Hydrochloric, nitric, and acetic acids are commonly used. Where it is desired to effect replacement by a bivalent cation, barium is often proposed and solutions of its salts are used as extractants.

After extraction, most methods for determining the content of potassium involve precipitation as sodium cobaltinitrite, although precipitation as the chloroplatinate is still preferred by some. After precipitation, the potassium may be determined by gravimetric, turbidimetric, volumetric, or colorimetric methods.

The gravimetric method is seldom used. Turbidimetric estimation is usually considered inaccurate. A volumetric method proposed by Volk (7), involving titration with permanganate, is in rather wide use. Among the most common colorimetric methods is one employing Nitroso-R-salt (disodium salt of 1-nitroso-2-hydroxy-3,6-naphthalene disulfonic acid). This method has been described by Pech (3).

It was felt desirable to obtain some fundamental information on comparison of extractants and methods for the determination of exchangeable potassium in these extracting solutions.

In this investigation three extracting solutions were studied, viz., ammonium acetate \((1.0 \text{ N at pH 7.0})\); hydrochloric acid \((0.05 \text{ N})\); and barium chloride \((0.2 \text{ N buffered with triethanolamine at pH 8.1})\) (1).

Methods for determining potassium in these extractants were \(a\) precipitation as the chloroplatinate, \(b\) precipitation as the cobaltinitrite, \(c\) precipitation by titration with permanganate, and \(d\) precipitation by dilute sodium acetate followed by colorimetric determination with potassium nitrosor-salt.

For some undetermined reason, the method did not prove at all satisfactory. Results are obviously "off", it was omitted from the average of these 10 readings was taken. If a reading was obviously "off", it was omitted from the average.

EXPERIMENTAL METHODS

Solutions of each of the three extracting solutions containing known concentrations of potassium added were compared to expected if these solutions resulted from soil extractions. The potassium was then determined colorimetrically by means of the Nitroso-R-salt.

**TURBIDIMETRIC METHOD**

\(a\) Ammonium acetate solution.—The solution was evaporated to dryness; the residue was taken up in dilute \(\text{NaOH}\) several times and evaporated to dryness each time. The residue was leached with \(0.2 \text{ N } \text{HCl}\), taken up in 50 ml of water, and filtered. The potassium was then determined as described below for the \(\text{HCl}\) solution.

\(b\) HCl solution.—In the case of potassium concentrations of less than 5 p.p.m. it was possible to precipitate potassium directly in the \(\text{HCl}\) solution. Where the concentration of potassium was lower, 100 ml of solution was leached with 50 ml of \(\text{BaCl}_2\) buffer and 50 ml of water. This was then taken up in 10 ml of 0.16 N acetic acid and the precipitation, etc., carried out according to Volk's procedures followed for precipitation of potassium in the \(\text{BaCl}_2\) solution. The turbidity was measured at \(17^\circ \text{C}\) using a Klett-Summerson photoelectric colorimeter. For each determination 10 aliquots of 5 ml were used and 10 turbidity readings were made. The average of these 10 readings was taken as the turbidity. The procedure followed for precipitation of potassium in the \(\text{BaCl}_2\) solution was published by Volk.

**COLORIMETRIC METHOD**

In all details that of Volk (7).

\(b\) HCl solution.—A solution of potassium hydrochloric acid and the precipitation, etc., carried out by the procedure described under **Colorimetric Method**.