

STUDIES ON THE DETECTION OF ADULTERATION OF BONE-MEAL DURING ROUTINE ANALYSIS

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The importance of phosphorus in plant nutrition is well recognised and many types of phosphates are used as fertilisers. Bone-meal is a much favoured phosphatic manure especially for paddy cultivation in the acid soils of Kerala. The higher unit cost of phosphate in bone-meal leads to its adulteration with materials like rock phosphate with less unit cost and the adulterated material generally conforms to the standards laid down by the Indian Standards Institution (Anon. 1956) for bone-meal, raw. Further, bone-meal containing as much as 20 percent insolubles often satisfies the ISI specifications. These point to the need for laying down more rigid standards to detect the adulterations. Studies were hence undertaken on the possible adulterants and on a suitable method of analysis for bone-meal with reference to its quality control. The results of these studies are presented in this paper.

Materials and Methods

Samples of bone-meal having a total N content of over 3 percent and a total P_2O_5 content of less than 20 percent were adulterated with the different common adulterants as given in Table 1. The mixtures

were made in such a manner that they conformed to the ISI specifications. The adulterated mixtures were prepared by mechanically compounding the bone-meal with the adulterants. The determinations of P_2O_5 and moisture in the samples were carried out using the techniques and methods laid down by the ISI (Anon. 1956) with the following modifications for the estimation of nitrogen and acid-insolubles.

Water-insoluble nitrogen:—About 1 to 1.5 g of the prepared sample were accurately weighed into a clean beaker, stirred well with distilled water for a few minutes, warmed gently and filtered through Whatman No. 2 filter paper. This was repeated twice. The residue with the filter paper was carefully put into a Kjeldahl digestion flask and digested with concentrated sulphuric acid in the presence of potassium sulphate and copper sulphate.

Water-soluble nitrogen:—About 5 g of the prepared sample were accurately weighed into a clean beaker, stirred well with distilled water, warmed and filtered through Whatman No. 2 filter paper into a Kjeldahl digestion flask. The residue

TABLE 1

Test analysis of the adulterated samples of bone-meal

Compound sample No.	Bone-meal			Adulterants used (ing)			Calculated value		Analytical result	
	g used	N %	P ₂ O ₅ %	Urea*	Rock phosphate**	Sand	N %	P ₂ O ₅ %	N %	P ₂ O ₅ %
1	100	3.3	19.6	1.1	15.0	4.0	3.2	20.1	3.1	20.2
2	100	3.5	19.0	2.5	25.0	---	3.6	20.8	3.8	21.0
3	100	3.5	18.6	1.0	22.0	---	3.2	20.5	3.2	20.4
4	150	3.2	18.8	2.5	25.0	---	3.4	20.1	3.3	20.0

* Containing 46% N

** Containing 30% total P₂ O₅

was washed with the minimum amount of distilled water and collected in the flask. The filtrate was digested with conc. Sulphuric acid in the presence of potassium sulphate and copper sulphate.

Acid-insolubles:—About 2 to 3 g of the prepared sample were accurately weighed into a crucible and ignited gently until all organic matter was oxidised. The crucible along with the residue was cooled in a desiccator, the residue extracted twice with warm dilute (1:1) nitric acid, filtered through Whatman 40 filter paper and the residue on the filter paper washed with distilled water. The filter paper along with the residue was then dried in an air oven at 110° C for one hour, incinerated to constant weight in a previously weighed crucible and the quantity of insolubles determined as percentage by weight of the sample.

Results and Discussion

Table 1 presents the composition and test analysis for N and P₂ O₅ of the

adulterated samples of bone-meal. Table 2 presents the data on the analysis for N and P₂ O₅ in the four adulterated samples prepared in the laboratory as determined by the ISI method and by the modified method used in the present studies. It may be seen that by the modified method the water-soluble nitrogen, if any, in bone-meal can be determined. Pure bone-meal does not contain water-soluble nitrogen and hence the presence of water-soluble nitrogen can indicate adulteration of bone-meal with soluble nitrogenous fertilizers. This is a practice generally resorted to, to compensate for the decrease in nitrogen following adulteration with rock phosphate.

It is further shown that high amounts of acid-insoluble materials like sand can be added to bone-meal and using suitable adulterants like urea and rock phosphate the materials can be made to conform to the ISI specifications. The importance of the determination of acid-insolubles in the analysis of bone-meal is thus emphasised. The ISI specification for bone-meal, raw have, subsequently been modified in the light of these findings (Vide IS 853-1964).

TABLE 2

Results of analysis of adulterated bone-meal

Sample	Analysis as per IS 853-1956		Analysis by the modified method			
	N%	P ₂ O ₅ %	N%		P ₂ O ₅ %	
	Total	Total	Water-soluble	Water-insoluble	Total	Total
1	3.1	20.2	0.5	2.8	3.3	20.1
2	3.8	21.0	0.8	2.9	3.7	20.8
3	3.2	20.4	0.4	2.7	3.1	20.5
4	3.3	20.0	0.8	2.6	3.4	20.0

Summary

To evolve a method for the detection of the nature and extent of adulteration of bone-meal, a few adulterated samples of raw bone-meal were artificially compounded in the laboratory, satisfying the Indian Standards. Rock phosphate, urea and sand were used for preparing these adulterated samples. The methods prescribed by the Indian Standards Institution were modified to include the determination of water-insoluble nitrogen and the acid-insoluble residue. The test analysis revealed the suitability of the modified method for the detection of adulteration of bone-meal with water-soluble nitrogenous fertilisers and acid-insolubles. The needs for the determination of water-insoluble nitrogen and for fixing limits on acid-insoluble residues were indicated in these studies. The specification for bone-meal, raw as

well as the methods of test for the modification of specification were accordingly amended and refixed by the Indian Standards Institution in IS-853-1964.

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References

- Anon. 1956. Indian Standard Specification for bone-meal, raw (IS. 853-1956).
- Anon. 1964. Indian Standard Specification for bone-meal, raw. (IS. 853-1964).

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