

NITROGEN-15 LABELLED UREA

Comprising two samples; ~ 50 and ~ 250 ‰ ¹⁵N vs air

BACKGROUND

The increasing application of stable isotopes as tracers in medical, biological and agricultural studies has focused interest on the need for reliable analytical measurements.

One of the topics of current interest in human nutrition research is the use of ¹⁵N tracer to investigate the utilization of protein and amino acids during enteral or parenteral nutrition and to establish recommendations for the optimal composition of such "diets". Further, nutritional needs in pathological conditions are poorly understood in comparison with those in health. Amino acid requirements in disease states or in malnutrition are not well-established. In this connection there is a need for reliable analytical measurements of ¹⁵N in a wide variety of biological materials.

An important requirement in such work is the application of appropriate analytical quality control procedures based, in part, on the use of certified reference materials. Although several laboratory control samples are now in common use by some analysts, none is yet available that can be regarded as an ideal reference material for checking the accuracy and precision of different analytical methods at the levels of enrichment needed for medical and biological tracer studies. It is hoped that the IAEA enriched stable isotope reference materials described in this reference sheet will to some extent fulfil this role.

TYPE OF MATERIAL AND UNIT SIZE

Urea (¹⁵NH₂)₂ CO) in solid, crystalline form in two separate vials each containing ~100 mg. Both nitrogen atoms are labelled.

ENRICHMENT VALUES TO BE DETERMINED

Enrichments should be determined in terms of the "δ-value" ‰ (per mille deviation in isotope ratio) relative to ¹⁵N in air.

To calculate the δ-value from the abundance, "a" (in atom %), use the relationship:

$$\delta - 1000 \cdot \left(\frac{a(100 - 0.3663)}{0.3663(100 - a)} - 1 \right)$$

Note: With respect to the monomolecular reaction of urea with hypobromite (WALSER et al., J. Chem. Phys. 22 (1954) 1146) and the possible non-binominal distribution of N₂ - molecules, the calculation of the isotopic ratio should be made in this special case additionally on the basis of the 28, 29 and 30 mass intensities.

RECOMMENDED VALUES

Sample	Isotope	Enrichment* per mille	95% Confidence Interval
310A	¹⁵ N	47.2	46.0 - 48.5
310B	¹⁵ N	244.6	243.9 - 245.4

* vs air

PREPARATION

Two materials were prepared from highly enriched ¹⁵N-labelled urea by dilution with the unlabelled compound in bidistilled water. After mixing, evaporation, freeze drying, crystallization and further mixing, the materials were transferred to the IAEA's laboratory. The final homogeneous products were dispensed into small vials containing approximately 100 mg each and stored at room temperature.

PURITY

The materials may all be considered as equivalent to an analytical grade substance.

MOISTURE CONTENT / STORAGE

The moisture content may vary depending on pretreatment and storage conditions but this will not influence the isotope ratios. A reproducible dry weight can be obtained by drying for two hours at 70°C. This method is recommended for establishing the dry weight of the material analysed (preferably by measurements on a separate sub-sample) and for the chemical determination of the nitrogen content (optional).

The material should *not* be stored near or in an ammonia-polluted atmosphere.

ORDERING INFORMATION

Orders should be submitted on the order form at the back of the current AQCS Catalogue [1]. Samples IAEA-310A and IAEA-310B are only available as a pair - they may NOT be ordered separately.

EVALUATION REPORT

A full report on the results of the intercomparison on which the recommended values are based is available upon request [2].

ACKNOWLEDGEMENTS

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CONTACT ADDRESS

Any enquiries concerning the reference materials described in this reference sheet, or new results, should be addressed to:

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RELATED IAEA REFERENCE MATERIALS

IAEA-305 Ammonium sulphate (2 samples; ~ 40 and ~ 400 ‰ ^{15}N vs air)
IAEA-311 Ammonium sulphate (1 sample; ~ 2 atom % ^{15}N)

REFERENCES

1. AQCS, Analytical Quality Control Services, IAEA, Vienna (issued annually in January).
2. Parr, R.M., Clements, S.A., Intercomparison of enriched stable isotope reference materials for medical and biological studies, NAHRES-5, IAEA, Vienna, 1991.

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Vienna, March 1991