

Albuminoid nitrogen is not usually measured by those who study atmospheric chemistry⁴, and when measured has generally been attributed to contamination, though its significance is becoming realized⁵. Since the samples described in this communication were freshly collected snow from regions where no plants or animals exist, contamination from these sources should be negligible. No insoluble inorganic material was visible in the samples, so that cyclic terrestrial dust could not contribute appreciably to the nitrogen found in the samples. This is further supported by the lack of nitrate in the samples. The samples were collected in early winter and thus the pollen contribution would be negligible. Thus it seems that precipitation, at least in New Zealand, does in fact contain organic nitrogen which does not arise from contamination. From considerations of the geographical position of the sampling points with their lack of population and industry, I believe that the nitrogen found in the samples has its ultimate origin in the ocean and does represent a net transfer of nitrogen from ocean to land. This will be discussed in detail in a future communication.

If the results shown in Table 1 are taken as representative of the annual precipitation, it suggests that several pounds of nitrogen per acre are being deposited on New Zealand each year from the surrounding ocean. This might represent a contribution to the nitrogen economy of New Zealand soils.

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¹ Ross, D. J., *N.Z. J. Agric. Res.* (in the press).

² Stevenson, G. B., *Ann. Bot. N.Z.*, 17, 343 (1953).

³ Methods of chemical analysis used as described in "Standard Methods for the Examination of Water and Sewage" (American Public Health Association, 1790 Broadway, New York).

⁴ Eriksson, E., *Tellus*, 3, 215 (1955).

⁵ Rep. Third Ann. Conf. Atmos. Chem. 1956, *Tellus*, 9 (1), 127 (1957).

by removing a little of the emulsion from both sides with a blunt scraper, either on the wet film after processing or after softening the gelatin on a dry film by moistening with 2 N sodium hydroxide. Examination of the film during photographic development is also helpful. Blackening of one side will not show on the other side of an uncleaned film.

Gross over-exposure of a highly active sample should be avoided, since under these conditions even sulphur-35 will produce visible blackening on the second side of the film.

As would be expected, the effect of γ -rays is much smaller than that of β -particles on such a thin, light material as X-ray film. Thus bromine-82, with a β -particle energy of 0.44 MeV., produces a comparatively small amount of blackening on the second side of the film, although it is also a hard γ -emitter; more is produced by iodine-131, which has an average γ -energy less than that of bromine-82, but a higher β -energy (0.61 MeV. for 87 per cent of particles).

From the β -energies, using the equation given by Whitehouse and Putman², the half-thickness for various isotopes has been calculated, and thence the fraction of β -particles that would pass through 'Kodirex' film (which has a surface density of about 28 mgm./cm.²). Approximate values of this factor for a number of useful isotopes are: carbon-14 and sulphur-35, virtually nil; bromine-82, 0.23; iodine-131, 0.40; phosphorus-32, 0.82. These figures are consistent with the relative blackening of the two sides of the film judged subjectively, and suggest that it might be feasible to distinguish more than two isotopes by this method.

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¹ Gillies, M. T., *Nature*, 182, 1683 (1958).

² Whitehouse, W. J., and Putman, J. L., "Radioactive Isotopes", 81, equation 15 (Oxford, 1953).

CHEMISTRY

An Autoradiographic Method for distinguishing Samples labelled with Phosphorus-32 and Sulphur-35

GILLIES¹ has recently described a method for examining insects labelled with sulphur-35 or phosphorus-32. The specimens were covered with two pieces of X-ray film, and autoradiographs made in the usual way. The low-energy sulphur β -particles (0.167 MeV.) were found to blacken only one film, while the high-energy phosphorus β -particles (1.71 MeV.) penetrated the first film and blackened the second also.

This useful method can be simplified by using film coated with photographic emulsion on both sides, as are most commercial X-ray films. In this laboratory, Kodak 'Kodirex' film is used for autoradiography of paper chromatograms, and with this material the two isotopes can be easily distinguished. If there is sufficient blackening of the film (such as is shown in the figure in Gillies's paper), a matt appearance is observed in reflected light and it can readily be seen whether one or both sides are affected. This can also be seen, even after much smaller exposures,

A Chromatographic Technique for studying the Mechanism of Surface Catalysis

Gas chromatography has successfully been applied in the field of catalysis by Emmett and his co-workers¹⁻³, where it is referred to as a "microcatalytic chromatographic technique". This involves placing a small catalytic reactor directly on top of a gas chromatographic apparatus and injecting a small quantity of reactant at the top of the reactor. The slug of the reactant passes through the reactor, into the chromatographic column, and out through the analytical system; thus a rapid survey of the activity of a given catalyst can be carried out. This communication describes another new chromatographic technique for studying the mechanism of catalysis, measuring adsorption during reaction.

The importance of adsorption measurements during surface catalysis has previously been emphasized⁴. The adsorption on catalyst surface during reaction cannot be estimated from the separate adsorption data of each gas involved in the catalysis. The adsorption during reaction also depends upon the rate-controlling step of the overall reaction. Accordingly, if we could estimate the adsorption during catalysis, this should provide information on the rate-determining step of the reaction.

The adsorption measurements during surface catalysis can be carried out using the principle of gas