SHORT COMMUNICATION

Activity Determination of Phosphorus-32 Sources with High Solid Content

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Activation probes are frequently used for fast neutron flux density determinations. With the aid of Californium-252 as neutron source cross-sections for a number of activation probes were to be determined at the Physikalisch-Technische Bundesanstalt. To do this a quick, reliable and accurate method of activity determination was desired; its error should be less than 2% as other uncertainties are in the same order of magnitude. At last liquid scintillation counting was chosen, because it fulfilled best the condition of being more or less independent of the solid content of the sample.

One of the possible activation probes is NaCl, which results in samples with a relatively low specific activity of Phosphorus-32. As the use of $4\pi\beta$-counting for the activity determination had to be excluded because of the large self-absorption, the following experiments were performed.

At first a mixture of 65% scintillator Insta-Gel and 35% water was shaken with a well calibrated carrier-free Phosphorus-32 solution. The count rate of weighed portions of this gel was measured in the balance point mode. For that purpose the gain was adjusted so that the count rate for a chosen window of 20–1000 divisions gave a maximum. The counting efficiency for these samples was about 97% with the standard deviation 0.4%. The contribution of the statistical error amounts here to 0.2%. In further determinations with increasing NaCl quantities up to 2 g per sample (or up to 1 g $NaH_2PO_4 . H_2O$) nearly the same efficiency value was obtained, whilst the standard deviation rose to about 1%. It can be assumed that the main source of error beyond the counting statistics is the instability and inhomogeneity of the gel.

The activity determination of the samples described above with the extrapolation method led to results 5% in excess.

It can be concluded that liquid scintillation counting using the internal standard method is a suitable procedure of activity determination in cases of high solid content.

DISCUSSION

J.F. Stoutjesdijk: Why didn't you use Cerenkov measurement?

E. Günther: The properties of our measuring equipment (e.g. no bialkali multipliers) have not been optimal for this type of measurement. We plan, however, such measurements in the near future. Thank you for this suggestion.