IN THE LABORATORY

An Improved Radioactivity Measuring Cup[1]

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The usual laboratory procedure for the measurement of radioactivity in samples of either biological or chemical origin currently involves the preparation of a solution containing the active isotope and the placing of an aliquot of this material upon some type of flat, circular cup or planchet. Most of the containers employed for this have a diameter of the order of 1″ and a depth of not over ⅛″. This allows the sample to be placed as close to the counter window as the protective structure of the latter will admit and thus maximize the geometric advantage of the setup. It is frequently found, however, that when aliquots or liquid residues are pipetted onto the sample cup, surface tension causes the liquid to accumulate toward the periphery and, in the course of drying, often to creep over onto the outside of the cup. Apart from the sample loss and the contamination to handling forceps and cup holders which this may entail, the effect characteristically gives rise to a serious loss of uniformity in sample density over the cup area; this leads correspondingly to a varying degree of self-absorption in the sample. The latter will also depend upon the energy of emission, but may assume serious proportions, especially with soft beta emitters.

Labaw (*1*) has recently developed an inside multiple sample counter for soft beta emitters in which he employs a planchet consisting of a small brass disc (area, ~ 1.2 cm²) cut from lathe stock. The face of this disc is grooved to give a series of concentric rings, and upon this surface the sample is pipetted and dried. By this technique Labaw has been able to obtain uniform sample densities to the extent of agreement between emission rates from subareas as small as 0.2 cm².

Most specimen cups now available on the market are pressed from thin sheet metal such as copper, aluminum, or platinum, and the expedient to be described here is a modification of Labaw's method which will apply equally well to most of these containers. It entails the production of a series of concentrically placed, raised circular ridges on the surface of the container by means of a suitably machined punch and die and press. On the face of the die is machined a series of concentric depressions, and on the counterpart a corresponding series of concentric raised rings. In addition, the receiver usually must be so designed as to fit closely the outer dimensions of the sample cup, especially for light metal cups with thin walls, in order to avoid distortion and warping of the sample cup during the stamping.

The die currently being used in this laboratory was machined from tool steel after the above manner and placed in an arbor press. It was found that, with a little practice, the plain sample cups obtained commercially could be stamped quickly to give the desired concentric circular embossments. The spacing for the rings produced by the particular die described here happened to be such that the outermost ring, 11/16″ in diameter, surrounded two more concentric rings at 3/32″ intervals, leaving a central area 5/16″ in diameter. In the material used, the individual rings or embossments were approximately .015″ in width and raised .010″ from the floor of the cup. This proved sufficient to retain aliquoted material of 0.2-ml volume easily within the outermost ring and allowed it to dry uniformly over the surface without creeping. It was found that meticulously clean cups were essential and, further, that a drop of alcohol placed in the central space contributed materially to the uniform spreading and distribution of the sample over the surface.

By way of improvement, it is suggested that injection-molded plastic blocks, embossed as described here, might prove even more satisfactory in routine laboratory counting work, since backscatter would be reduced. This appears not yet to have been attempted, although a number of laboratories are now using plastic cups usually produced individually by turning from suitable round stock. This latter procedure, however, is so expensive as to discourage the convenient practice of discarding cups after a single usage, even though proper cleaning and checking are both time consuming and frequently futile.

Sample cups of the design reported here have been successfully used by the present authors in the measurement of P^{32}, I^{131}, and Co^{60}, but have not yet been applied in studies with either C^{14} or S^{35}. No studies of backscatter characteristics have been made as yet to determine whether or not this factor is increased by the narrow raised ridges here described, and detailed study is needed of the self-absorption characteristics as a function of surface tension relative to ridge spacing and dimensions.

[1] The opinions expressed in this article are the personal ones of the authors and do not necessarily reflect the official views of the Navy or the Naval Service at large. The mechanical features described here were designed and built by the authors at the Naval Medical Research Institute.

Reference

1. LABAW, L. W. *Rev. sci. Instr.*, 1948, in press.