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Sanitary Seal for Infrared Microcells

Mortimer M. Elkind[1, 2]

Sloan-Kettering Institute for Cancer Research
New York City

When biological extracts are analyzed through infrared absorption studies, cells having sample volumes of the order of 25 mm³ are often required. The sample is usually contained between two sodium chloride windows for infrared transparency and in a metal cell body for rigidity. Cells suitable for such work should have: (a) sample volumes consistent with adequate absorption thicknesses; (b) a construction which permits ease of assembly, filling, emptying, and cleaning; and (c) a seal between the windows and cell body which does not contaminate the sample or its solvent. Cells which have met requirements (a) and (b) have been reported (*2–5*), and seals based upon cemented (*5*), gasketed (*1, 2*), or amalgam-sealed joints (*3, 4*) have been described. However, because of the excellent solvent action of the commonly used diluents, CS_2 and $CHCl_3$, difficulties resulting from contamination, assembly, or accurate determination of absorption thickness have been experienced. The last-mentioned difficulties can be removed if the use of the intermediary material between the windows and cell body is eliminated and a seal resulting from adhesive attraction is used. A successful technique for such seals is described as it is used in a typical cell employed in ketosteroid absorption studies (Figs. 1 and 2).[3]

Both the sodium chloride windows and the cell body must be finished flat enough for adhesion to result. For the metal body, this is accomplished through a finishing technique of grinding and lapping before the cell fittings are added, but after all other machining operations have been completed. Superfinish can be substituted for lapping, but it is to be noted that flatness rather than smoothness alone is required. This limits the choice of material for the cell body, which should be easily machinable and have proper surface characteristics to permit finishing to optical flatness. Both these requirements can be met through the use of brass or mild steel for cell body machining and a hard, chemically inert plating for surface finishing. The cell body shown in the figures was made from mild steel and plated with hard chromium 0.001 in. thick. To prevent the slight increase in the plating thickness and a porous surface along the periphery of the cell body during plating, which was anticipated from the electrical gradient concentration and increased current density along the outer edge, the cell body was surrounded by a close-fitting ring ground with it to the same thickness. That similar precautions with regard to the fitting holes and cell openings were not required probably resulted from the small size of these openings relative to the body surface. The resulting surface is hard, a fact which permits finishing to optical flatness with cast iron laps and silicon carbide flour pastes.

The sodium chloride crystals were finished through the commonly used rouge lapping technique. Large soft

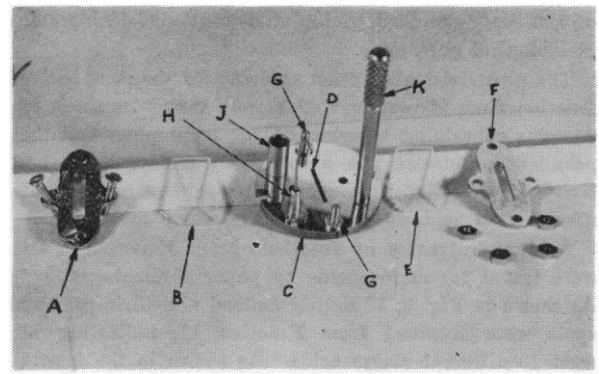

FIG. 1. Disassembled absorption cell. *A*, front cover plate; *B*, front sodium chloride window; *C*, cell body; *D*, front aperture; *E*, rear window; *F*, rear cover plate; *G*, cover plate studs (internally and externally threaded); *H*, hypodermic filling needle; *J*, syringe fitting for emptying and cleaning; *K*, handle. Holes in *C* connect *H* and *J* to the sample container.

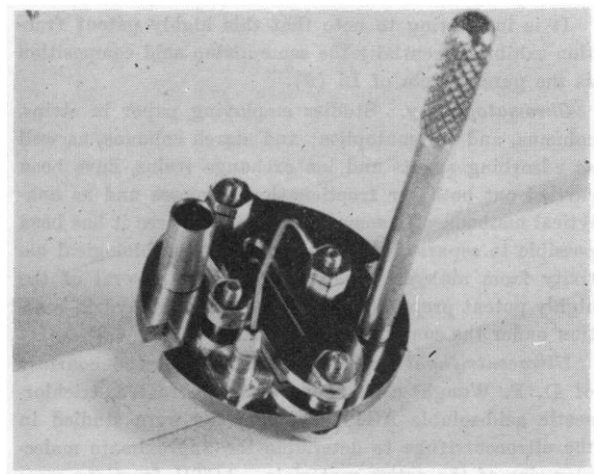

FIG. 2. Assembled absorption cell. Cell body dimensions: thickness 3.00 mm: diam 32.25 mm; front aperture 1.00 mm wide by 12.0 mm long; rear aperture 0.50 mm wide by 12.0 mm long. Window dimensions: 10 mm by 20 mm by 1 mm thick. Sample volume 25 mm³.

[1] At present at the National Cancer Institute, on assignment to MIT, Cambridge, Mass.

[2] The author is indebted to Drs. K. Dobriner and J. D. Hardy for presenting the problem and having the seal tested.

[3] The first cells of this type were due to the excellent efforts of Mr. R. J. Zabelicky, of the Sloan-Kettering Institute Instrumentation Shop.

crystals can be lapped to flatnesses of the order of three rings of sodium light. Though this is difficult to obtain with small, thin crystals, the thinness of the crystal and its soft surface permit a satisfactory seal when it is clamped to the metal body. Seals of this type were found to hold CS_2 for several hours without any perceptible signs of leakage.

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Electromagnetic Enrichment of Fe^{58} Content and Concurrent Impoverishment of Fe^{54} Content in Iron[1]

C. P. Keim, H. W. Savage, and Boyd Weaver

Carbide and Carbon Chemicals Corporation, Y-12 Research Laboratory, Oak Ridge, Tennessee

The radioactive isotope Fe^{59} (half-life = 47 days) is important in physiological studies. It can be produced in the thermal neutron reactor by the following reaction: Fe^{58} (n, γ) Fe^{59}. The Fe^{54} content of the iron being irradiated must be low to minimize the formation of Fe^{55} (half-life = 4 years) by the reaction: Fe^{54} (n, γ) Fe^{55}.

TABLE 1

ABUNDANCE OF FE ISOTOPES IN IRON ENRICHED IN Fe^{58}

	(a) Shipment No. 1	(b) Shipment No. 2	(c) Best collection	(d) Natural abundance
	%	%	%	%
Fe^{54}	0.8	0.6	0.3	5.81
Fe^{56}	50.4	21.0	12.3	91.64
Fe^{57}	6.9	2.7	1.4	2.21
Fe^{58}	42.0	75.7	86.0	0.34
Fe^{58}/Fe^{54} ratio	53	126	287	0.06

The normal abundances of Fe^{58} (0.34%) (*1*) and of Fe^{54} (5.81%) (*1*) and the neutron cross sections of Fe^{58} (0.36 barn) (*2*) and of Fe^{54} (2.5 barns) (*2*) favor the formation of the long-lived Fe^{55} when normal iron is irradiated by neutrons. Iron enriched in Fe^{58} and impoverished in Fe^{54} has been produced electromagnetically in the calutrons at the Y-12 Research Laboratory. Table 1 summarizes mass analyses of three representative Fe^{58} collections. Columns (a) and (b) are the analyses of two shipments of Fe^{58} that have been used for the production of Fe^{59} low in Fe^{55} by neutron irradiation. Column (c) summarizes the best collection of Fe^{58} to date and is illustrative of the quality that can be obtained.

The accomplishments reported here are the combined efforts of the professional and operational personnel performing calutron operations and associated chemistry. Particular credit is due L. O. Love, W. A. Bell, E. H. Swanson, S. F. Fairbourne, and L. O. Gilpatrick. The mass analyses of the enriched isotopes were done under the direction of R. F. Hibbs.

[1] This report is based on research carried out under contract for the Atomic Energy Commission by the Isotope Research and Production Division at the Carbide and Carbon Chemicals Corporation, Y-12 Research Laboratory, Oak Ridge, Tennessee.

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The Eosinophil Response: Immediate vs. Delayed Eosinopenia[1]

Jules H. Last, Paul Jordan,[2] Isadore Pitesky, and Epperson Bond

Departments of Pharmacology and Surgery, University of Illinois, College of Medicine, Chicago

With the growing interest in physiology of the adrenal cortex, the eosinophil response has become an important criterion of adrenal cortical discharge. In fact, it is reputed to be the most sensitive indicator of release of C-11 type steroids from a functioning adrenal cortex. In man the administration of either adrenocorticotropic hormone (ACTH) (*2, 7*), Compound E (*3, 5*), or epinephrine (*4, 6*) produces an eosinopenic response which occurs gradually, reaching its maximum in 3–4 hr. The fate of the disappearing eosinophils remains an unsolved mystery.

In this study, the eosinophil response to epinephrine and histamine was observed in a series of unanesthetized, trained dogs. Dunger's method was employed in counting the circulating eosinophils (*1*). All drugs were injected intravenously. Histamine and epinephrine[3] solutions were infused at a constant rate over a 60-min period. Two control counts were done on each animal prior to administration of any drug. If variation in the two counts exceeded 10%, a third count was made and the average taken as the base line. Statistical analysis of a series of hourly counts on eight dogs in control experiments revealed a mean coefficient of variation of 5.6%, with a range of 3.2%–13.5%. Changes in counts were recorded as percent deviations from the control counts.

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[2] Public Health Service Research Fellow of the National Heart Institute.

[3] Epinephrine used was obtained through the kindness of Dr. E. A. Sharp of Parke-Davis & Co.