FIELD METHOD FOR RAPID COLLECTION OF IODINE 131 FROM MILK

Charles R. Porter, M.S., and Melvin W. Carter, Ph.D.

THE SOUTHEASTERN Radiological Health Laboratory, Public Health Service, has developed a field method for the rapid collection of iodine 131 in milk. An anion exchange resin is used to separate radioiodine from other fission products. The method is simple, inexpensive, and applicable to emergency situations.

In unseparated fission products only a few days old, radioiodine is the radionuclide of principal public health interest because, for one reason, it is a potential radioactive contaminant of dietary intake. Unseparated fission products might result from such events as industrial accidents, involving a nuclear reactor or a nuclear fuel processing plant, or from the detonation of nuclear weapons and other nuclear devices (*1*). Iodine 131 is the most prevalent isotope of iodine in unseparated fission products only a few days old, and milk is the significant contributor of iodine 131 to the human diet (*2*). Therefore, the rapid collection and determination of iodine 131 in milk is important from a public health standpoint.

Several methods for the rapid determination of iodine 131 in milk have been described. These methods involve either the adsorption of iodine 131 on anion exchange resin and determination of its activity by gamma counting (*3–5*) or determination entirely by gamma spectroscopy (*6*). Another method involves the adsorption of iodine 131 on anion exchange resin and determination of its activity by chemical processing and beta counting (*7, 8*). The method of collecting iodine 131 described in this report involves a simple, inexpensive, and effective adaption to field use of the first method of determination, adsorption of iodine 131 on anion exchange resin and determination of its activity by gamma counting.

Mr. Porter is director, Surveillance Unit, and Dr. Carter is officer-in-charge, Southeastern Radiological Health Laboratory, Public Health Service, Montgomery, Ala. *Mrs. Estie Pepper, senior technician, performed the laboratory tests, and Charles R. Phillips, physicist, was consulted in regard to counting techniques.*

Apparatus

The following materials are used in the field sampling apparatus.

1. 8-inch plastic funnels (*A*).
2. 1- by 3½-inch transparent threaded vials with plastic screw caps (*B*).
3. 1¼-by 4-inch cartridge containers with covers (*A*).
4. 1¾- by 4½-inch mailing tubes (*C*).
5. Strongly basic quaternary amine type anion exchange resin, 20–50 mesh, chloride form, washed with distilled water (*D*).
6. Data card for recording sampling location, collection time, quantity of milk collected, and other comments.

In assembling the apparatus, a screw cap with a hole drilled in it is welded to the funnel. Approximately ten 2-mm. diameter holes are drilled in the bottom of each vial. Masking tape or Parafilm is placed over the bottom of the vial, and glass wool is placed in the bottom of the vial. Using distilled water, the vial is filled with 40 ml. of anion exchange resin. Glass wool is then placed on the resin, and the vial cap is secured.

For shipment to the field, the vial is placed in a cartridge container and the cartridge container and data card are placed in a mailing tube. The mailing tube with contents and the funnel constitute the complete field model (figs. 1 and 2).

Field Application

The vial containing anion exchange resin should remain sealed with tape or Parafilm and capped to prevent drying until ready to use; this avoids air pockets which cause channeling of the milk as it passes through the system.

A conveniently measured quantity of milk (1 to 4 liters, approximately 1–4 quarts) is poured into the funnel. The tape or Parafilm is then removed from the end of the cartridge, allowing the milk to flow through the cartridge by gravity. The flow rate of the milk through the resin is approximately 125 ml. per minute; this flow rate is controlled primarily by the resin. If feasible, the cartridge is then washed by pouring approximately 100 ml. of distilled water into the funnel. Next the funnel is removed, the cartridge capped securely, the data card completed, and the apparatus reassembled, as previously described, for shipment to the laboratory for counting.

If the milk cannot be poured through the cartridge immediately after collection, 2.0 ml. of a 10 percent aqueous solution of thimerosal (approximately ⅓ tsp.) should be added to each liter (approximately 1 quart) of milk. This addition minimizes decomposition but does not affect the retention of iodine 131 on the resin (*9*). However, a preservative such as formaldehyde should not be substituted since it may destroy the retention of iodine 131 by the resin (*10*).

Determination of Activity

At the laboratory the cartridge with resin is inverted for counting because most of the iodine 131 is in the upper part of the resin when the cartridge is in an upright position. The cartridge is counted preferably in a sodium iodide (thallium-activated) well crystal by a single- or multichannel gamma analyzer, as opposed to counting on a flat crystal. The well

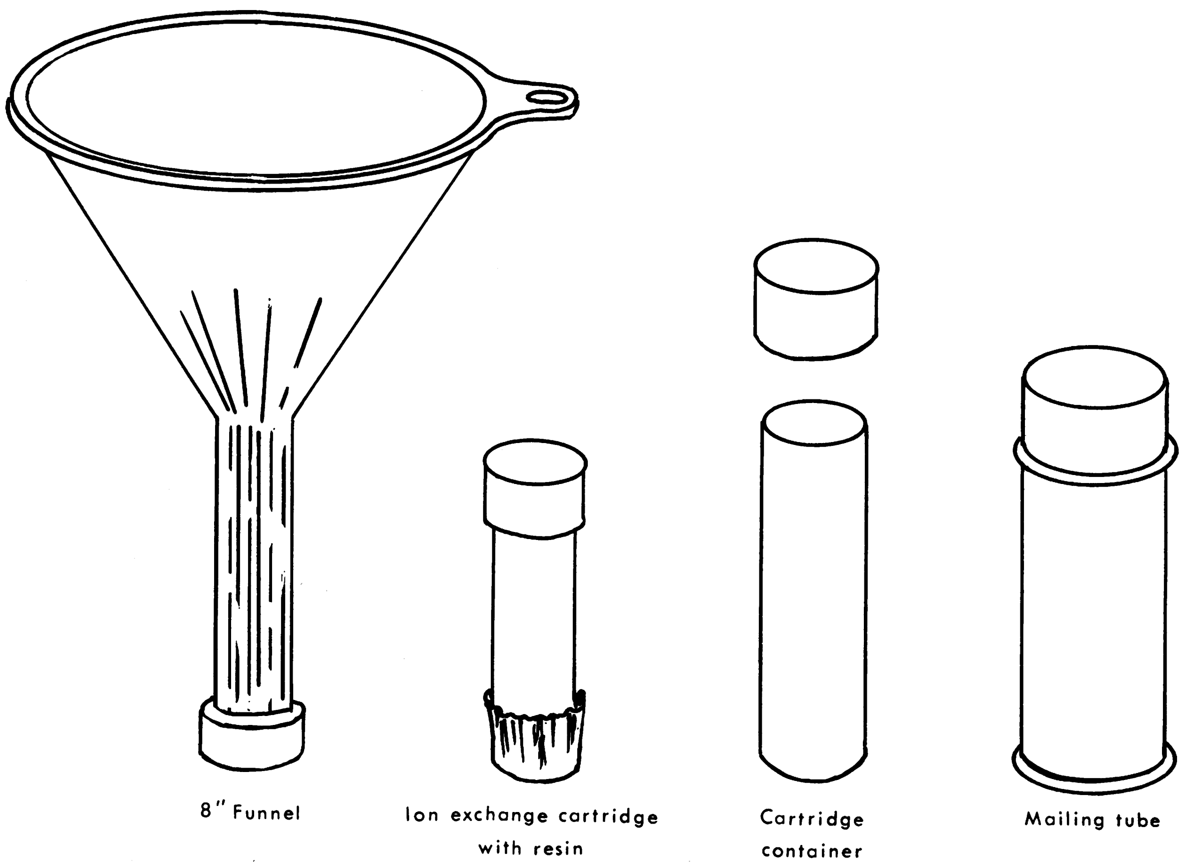

Figure 1. Complete field model for collection of iodine 131 in milk

DATA CARD

SAMPLING LOCATION: ______________________

TIME OF COLLECTION: ______________________
(DATE AND HOUR)

QUANTITY OF MILK (ml): ______________________

COMMENTS: ______________________

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Figure 2. Data card

crystal provides better geometry and hence greater counting efficiency. However, in an emergency the use of a gross gamma counter would suffice.

Discussion

Since there was no detectable iodine 131 in the environment when this method was developed, the effectiveness of the apparatus was determined by tracer experiments. Iodine 131 in the iodide form was added to milk 24 hours before passage through the resin to duplicate the characteristics of metabolized iodine (*10*). The anion exchange resin retained approximately 96 percent ± 2 percent of the radioiodine in the first liter of milk, and there was an approximate 2 percent loss of retention with each additional liter up to 4 liters. There may also be an additional reduction when the milk from only a few cows is analyzed because some of the protein-bound radioiodine may not be adsorbed on the anion exchange resin; in a sample representing many cows, this would probably lead only to a small underestimation of the radioiodine concentration (*10*).

The low cost of this method is one of its major advantages. The price of components for one complete field model is approximately $3, and all components are reusable with the exception of the vial with resin which costs approximately $0.50. In view of the possible contamination from previous use of the cartridge and resin and their modest cost, it does not seem feasible to reuse these. Also, the cost of shipping the cartridge and the resin is much less than the shipping cost for 1 to 4 liters of milk, the quantity needed for other rapid analytical methods (*3–6*).

The simplicity of this method for collecting iodine 131 facilitates the rapid determination of iodine 131 in milk. When environmental sampling programs are stepped up to meet specific needs—for example, following the release of radioactive materials from the detonation of nuclear weapons—it is very important that large numbers of samples are analyzed rapidly to define the radioactive release as quickly as possible.

During such emergencies and also during field sampling programs, it is believed that the field method for the rapid collection of iodine 131 in milk, described in this report, would be a simple, inexpensive, and effective technique of use to public health officials concerned with radiological health activities at the Federal, State, and local government levels.

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(*9*) Lamanna, A., Holmes, J., Abbott, T. P., and Yancik, V.: Thimerosal, a preservative for milk to be tested for radioactivity. Health Phys. In press.

(*10*) Murthy, G. K., Gilchrist, J. E., and Campbell, J. E.: Method for removing iodine-131 from milk. J. Dairy Science 45: 1066–1074 (1962).

EQUIPMENT REFERENCES

(*A*) Funnel, No. 4262; cartridge container No. 6250, Nalgene Co., Inc., Rochester, N.Y.

(*B*) Threaded vial with plastic screw cap. Lermer Plastics, Inc., Garwood, N.J.

(*C*) Mailing tubes, No. M-1050, Scientific Products, Evanston, Ill.

(*D*) Anion exchange resin, 2-X8(Cl^-), Dowex, J. T. Baker Chemical Co., Phillipsburg, N.J.

Psychiatry Courses for Physicians

Postgraduate courses in psychiatry offered under grants from the National Institute of Mental Health, Public Health Service, have attracted 4,400 family physicians in the 4-year period 1959–62. More than half of the participating physicians are in general practice, with 20 percent in pediatrics and internal medicine.

The courses are conducted in 21 States, with highest enrollments in California, New York, Utah, Michigan, and Pennsylvania. As part of a federally supported program for strengthening the psychiatric knowledge of the modern physician, the postgraduate education is designed to increase the physicians' understanding of mental health problems and to emphasize the often close tie between emotional and physical difficulties.

The Federal program also provides grants for psychiatric residency training to more than 100 institutions across the country. The grants support both intensive 6-month to 1-year residency training for general practitioners and other medical specialists and full residency training for physicians wishing to become psychiatrists. From 1959 through 1962, a total of 469 physicians received support for 1 or more years under this program.