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PORTABLE LABORATORY KIT FOR WATER TESTING UNDER FIELD CONDITIONS

Prof. S.M.DRACHEV and S.D.ZAMYSLOVA

The designer's problem was to make the prototype of a portable laboratory kit, by means of which it would be possible to carry out the approximate quantitative determinations used in water testing in the sanitation field, by the simplest methods and with the greatest possible economy of apparatus and reagents. The making of rapid analyses of water is a necessity which arises in field-survey testing of reservoirs and storage basins, the construction of which is rapidly expanding at the present time; likewise in the testing of wells, springs and other sources of rural water supply. If an analysis can be made on the spot, it cuts down the need for transporting large and awkward samples of water to a laboratory. Making the analysis on the spot likewise obviates those errors which are inevitable when the samples have to be stored until a start can be made on analysing them, errors which are particularly marked when testing water with a high degree of hardness.

In the design of the kit, use was made of fixed color scales, including scales for determining water coloration, hardness, active chlorine and oxygenation. Titration to determine chlorides and alkalinity is carried out in small volumes (1-2 cc) with dilute solutions. For determining transparency the ring method is employed, which uses simpler apparatus.

The reagents are kept in containers of /thin-walled/ blown glass instead of cast glass, the weight of the kit being thus considerably reduced. Pipettes for selecting the reagents are ground to fit the reaction-vessels and are calibrated (Fig.1), which makes it unnecessary to do so much washing and permits them to be used in titration.

Thanks to the above mentioned methods and the use of the calibrated pipettes and blown glass vessels, the water kit with its stock of reagents has a size of only 30 x 13 x 17.5 cm and a weight of 2.5 to 3 kg; that is, it may easily be carried under the arm or on a shoulder-strap.

All the equipment of the kit is packed in a case (Fig.2) made of polished soft wood 8-10 mm thick. The total height of the case is 175 mm, the height to the lid being 155 mm and the height of the lid itself 20 mm. The front of the case swings down. The holding catch is of the portable phonograph type.

Inside the case there are two shelves, one above the other, the lower shelf at a height of 30 mm from the bottom and the upper shelf 50 mm above the lower. The shelves have five parallel rows of round holes of different diameters.

On the right-hand side of the case, in front, there is a recess partitioned off for a storage flask containing distilled water and for porcelain dishes. This recess forms a small internal box 140 mm deep by 69 mm wide. At a height of 100 mm there is a shelf with 30 mm holes.

On the side wall of the main part of the case there are three recesses (3 mm deep) for the pipettes and a revolving clamp to hold them in place. On the lid, space is provided for tables and paper.

With the aid of this kit, quantitative testing of water may be done according to methods worked out at the Erisman Research Institute.

Water testing for sanitation purposes involves determinations of transparency, coloration, odor, pH, alkalinity, carbonate-hardness and total hardness, oxygenation, ammonia nitrogen, nitrite and nitrate nitrogen, iron, sulfates and residual chlorine.

Transparency is determined by the ring method, which was worked out for the field testing of water and does not require the special cylinder with a polished bottom; this makes the equipment lighter.

The color, pH, oxygenation, total alkalinity, nitrogen, iron and residual chlorine determinations are handled by means of diagrammatic scales. This obviates [much of] the necessity of manipulating burettes, pipettes and flasks and cuts down considerably on the reagents used.

Alkalinity, carbonate-hardness and chlorides are determined by titrating 1 cc of water with solutions from dropping-bottles, which also simplifies the work and saves reagents. Sulfates are roughly determined in 10 cc of the water by a nephelometric method. For comparison, a nephelometric [turbidity] scale is supplied, drawn up in mg/l of SO_4 (in quantities 10, 30, 50 and 100 mg/l).

For chlorimetric determinations the kit provides nine colored scales, which are kept in the lid of the case.

For the work of analysis, some chemical education is required, and some experience with chlorimetric testing and titration in small volumes.

This laboratory kit has been used in the testing of water in the mines of the Moscow District [Podmoskovskaya] coal basin; also water-sources in the Stalingrad Region [Oblast']. Reports on it are favorable.

It must be emphasized that the portable laboratory will serve only for approximate testing, for orientation and field-survey purposes. It does not supersede the type of laboratory equipment used at the Sanitation and Epidemiology Stations, equipment which enables water testing to be carried out by standard procedures.

Apparatus for taking water samples from open bodies of water and from wells

The shops of the Erisman Sanitation Research Institute are at present turning out two types of apparatus for taking water samples.

I) A small device (Fig.3) originated by V.G.Diukov consists of a rod I.5 m long in screwed sections, on the end of which there is mounted a round holding-plate for the sampling flask. The flask is locked against this plate by means of a ring mounted on the shaft with a sliding sleeve. When the sampling flask has been locked to the plate by means of the ring, the movable sleeve is secured by tightening a screw.

This apparatus is suitable for taking bacteriological samples and samples for dissolved oxygen determinations, using a flask of I00-I50 cc capacity.

Since the threaded sections of the rod are only 25 cm long and the plate at the bottom is hinged, the apparatus when taken apart is very compact and light (0.3 to 0.4 kg).

2) For taking samples of large volume, V.G.Diukov has designed and turned out a second piece of apparatus, differing from the first in the size of holding-plate and in the fact that it has three rings slidably mounted on the shaft (Fig.4). The rings are of different diameters, making it possible to use flasks of any size for taking samples. The shaft differs in that the component-sections are longer (0.5 m). In addition, this model is provided with a weight which screws onto the lower end of the shaft, and a ring which screws onto the top section. This permits samples to be taken from wells deeper than I.5 m, by attaching the weight to the bottom and tying a cord of the necessary length to the top.

The apparatus is basically intended for taking surface samples (from 0.2 to I m), but it is possible to take samples from deeper strata of the water by corking the flask before immersing it and attaching a string to the cork. At the right depth the cork is pulled out, and the flask held at that depth until no more bubbles appear on the surface of the water.

Samples can be taken with this apparatus from open bodies of water (off a boat, launch, steamer, bridge, or dam), and also from wells, springs, reservoirs, etc.

The quality of the materials used permits sterilization of the apparatus or of its component parts, both under laboratory conditions and at the place of taking the sample, by means of an alcohol flame.

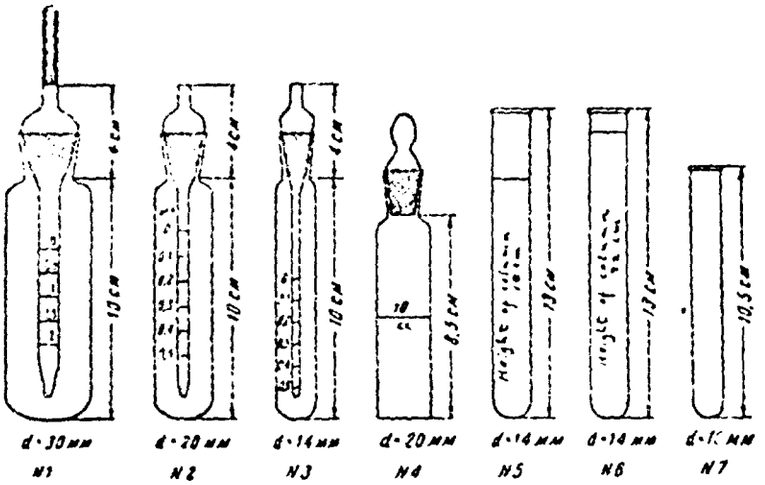

Fig.1. Equipment for portable laboratory kit.

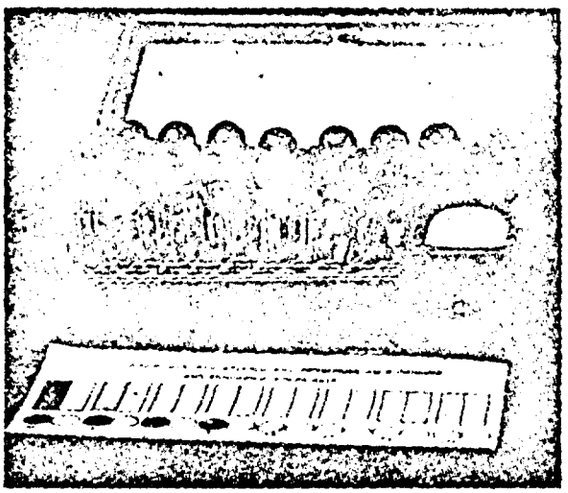

Fig.2. The kit as a whole.

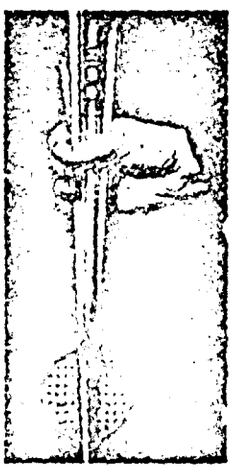

Fig.3. Device for taking samples of small volume.

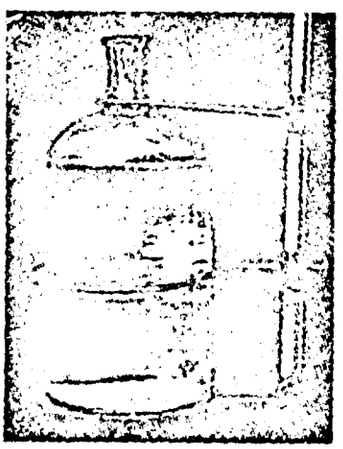

Fig.4. Device for taking samples of large volume.