A Water Sampler

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Many teachers tend to ignore several phases of laboratory work because of the lack of expensive pieces of equipment. The authors have designed a useful and efficient water sampler which may be constructed by students at a nominal cost for work in high school marine and aquatic science.

The growing utilization of marine products is making truth of past promises by scientists that the sea would play an increased role in the future of mankind. Our present and future students will unquestionably benefit more from the exploitation of the seas than any other humans in history. As beneficiaries of current research in marine sciences, they will bear the burden of furthering progress in the field.

It is gratifying that colleges training marine scientists and technologists are increasing in number. Unfortunately, the student confronted with choosing a major course of study is too often poorly prepared to make an intelligent decision. The passive problem is obvious; the student unfamiliar with the marine field does not elect it. This ignorance is most undesirable in that it restricts the free choice of a vocation. The active form of the same problem is often academically tragic for students. Misinformed, they select a marine science as their area of major study to find that it is not what they expected. Well before the first semester ends they are found wandering through the academic world, lacking motivation and without direction.

Earlier exposure to marine study seems to be a means of reducing these problems. In the already very busy high school curriculum it might be best to introduce marine biology and oceanography in an extra-curricular capacity.

Limited topics can be presented as individual student projects while broader concepts (e.g., marine ecology) might involve an entire science club. Members of the science department at our institution are currently planning experimental protocols for high school marine science projects. These will include marine microbiology, chemical stratification, and detergent contamination studies. Planning these activities seems, in all cases, to be dominated by a single major problem. The highly specialized equipment for marine work is often not available to the high school science teacher.

The single most important piece of equipment required for many projects is an efficient water sampler. A water sampler applicable to most projects must be able to take uncontaminated samples from specific depths. Such devices are available commercially; however, their cost is often prohibitive. To solve this problem we have devised a sampler which may be constructed by students for a nominal expenditure.

General Function

The functional portion of the sampler is simply an evacuated heavy walled flask. The vacuum is maintained by sealing the flask with a rubber stopper and a closed glass tube. The flask is immersed to the desired depth for sampling and a weight is used to break the glass tube. Water immediately enters the flask.

Valve

In theory, as the flask is retrieved, water will be continually moving out due to the decreasing external pressure. Nevertheless, there is the danger that eddy currents will contaminate the sample with water from other than the desired depth.

To minimize this problem a valve is incorporated in the rubber stopper.* The valve is made by cutting horizontally, part-way through the rubber stopper (¼″ from bottom) prior to boring. A hole to accommodate the glass tubing is bored (Fig. 1).

When the small but inevitable air pocket within the flask begins to expand during retrieval, the valve will close prohibiting the escape or entrance of water. Proper function of the valve demands that this air pocket be maintained. Consequently, the samples must be taken with flasks either inverted or horizontal to prevent the escape of air.

Closed Glass Tube

The terminal closed glass tube is the only expendable component of the apparatus. These tubes can be constructed by sealing one end of a length of ordinary soft glass tubing. However, we have found in our trials that small (inexpensive) test tubes are admirably suited for this purpose.

The Messenger

The messenger is the weight which will break the closed glass tube and trigger the mechanism. It may be purchased commercially or may be made by the students. A suitable messenger can be constructed by filling a 1½ inch length of 1 inch (i.d.) iron pipe with molten lead. When the lead cools a ¼ inch hole is bored longitudinally through the center (Fig. 2).

The messenger is threaded on the line supporting the sampler. When the unit reaches the desired depth, the messenger is released to slide down the line.

Bracket

The bracket accomplishes three purposes. It must: 1) support the flasks in a horizontal position, 2) provide the ballast to submerge the evacuated units, 3) firmly support the glass tubing in the proper position to permit breakage. In addition the strength of the bracket must be sufficient to withstand the impact of the messenger. A bracket fulfilling these requirements is illustrated in Fig. 3. The two flasks accommodated by this bracket fill simultaneously when the glass tubing is broken. This maintains the flasks balanced in a horizontal position throughout the sampling.

Evacuation and Sterilization

If a vacuum pump is used, side arm flasks are required. The flask is first completely assembled, then evacuated through the side

*Suggested by Professor Matthew Rudden

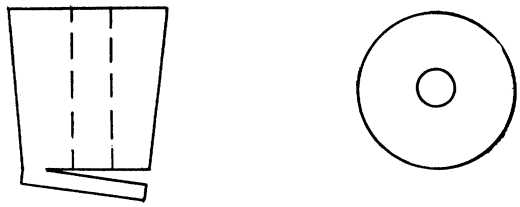

Fig. 1. Valve detail.

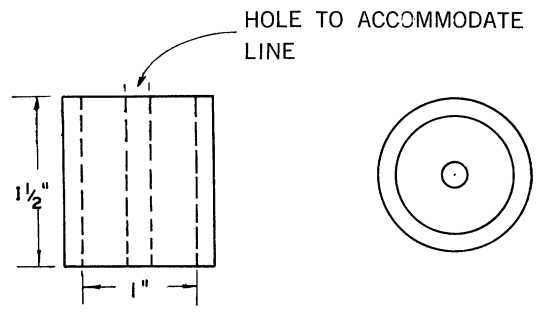

Fig. 2. Messenger detail.

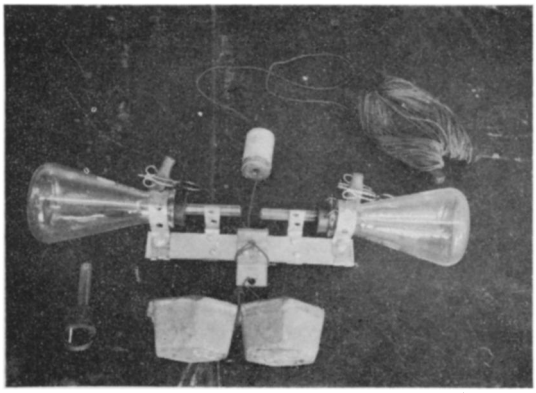

Fig. 3.

arm. Before the pump is removed, the vacuum is sealed by the use of a pinch clamp on the evacuating hose. Fig. 3 illustrates evacuated side arm flasks.

Steam may be used as an alternate method of evacuation. The advantage of this method is that it may be used in the field. In this case a side arm flask is not required. The flask is assembled and the stopper removed. A delivery hose from a steam generator is inserted in the flask and steam is allowed to replace the air. After a few minutes, the steam hose is removed and the flask is immediately stoppered. Condensation of the steam renders the flask suitably evacuated.

If the experiment demands sterilization of the unit, it is sterilized after evacuation. The vacuum will not be lost by autoclaving for twenty minutes at 15 psi steam pressure. After sterilization, the unit should not be used until it returns to room temperature.

Suggestions for Maximum Efficiency

1. If the unit is to be used in sea water, galvanized metal should be used whenever possible.
2. The closed glass tube should be scored to increase its fragility, thus insuring breakage.
3. Rubber bands may be used to secure the closed glass tubes in the path of the messenger.
4. Five to ten pounds of lead ballast may be added to the bracket.

The sampler, as described above, has been tested and found to be functional in depths to 150 feet. This unit should be a useful but inexpensive tool for high school science projects and limited research in marine and aquatic science.

High School Student Journal

The *Sierra High School Science Journal*, available through Sol Taylor, Chairman, Science Department, Sierra High School, Whittier, California, 90605 is a journal of long standing and is written by high school students. Several back issues are available as well as current issues, and they may be obtained at 15¢ per copy from Mr. Taylor. The journals contain fairly sophisticated project reports.

Pollution Kills Animals

It is no secret that water pollution can result in massive fish kills, destroy aquatic habitat, and indicate potential human health hazards. But many people do not realize that certain kinds of pollution can kill aquatic animals, or animals using rivers, lakes and streams for drinking purposes. During 1966, the Ohio Department of Natural Resources' Division of Wildlife field officers investigated 58 pollution cases which killed more than 794,900 animals. Greatest animal kill came from metal manufacturing sources (459,077), other manufacturing (112,068) and coal mining (106,522). Over 58,000 wild animals were killed in the "Buckeye State" last year from sewage pollution.

Teaching Materials

The Oregon Science Teacher, editor, Gene Doty, Hillsboro High School, Hillsboro, Oregon 97123, has a surplus of material developed for science teachers describing classroom demonstrations, science humor, metric system conversion, polarized light, and science calendars which are available at a small cost from the editor. All orders must have a ZIP code.