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COLLECTION OF WATER SAMPLES FOR LABORATORY TESTING

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Abstract. This article describes the rules for correct collection, storage, transportation and documentation of water samples for laboratory assessment of water quality. Errors in sampling may affect the results of physico-chemical and microbiological analysis. Therefore, the type of water source, the purpose of the test, the choice of container, sample volume, temperature and the time of delivery to the laboratory are important hygienic requirements. It is shown that the reliability of an analytical result depends not only on laboratory equipment but also on where, in what container and under what conditions the sample was taken.

Keywords: water sample, laboratory analysis, drinking water, microbiological testing, physico-chemical indicators, sterile container, sample transportation, sanitary control.

INTRODUCTION

Water quality is of great importance in protecting public health. If drinking water contains disease-causing microorganisms, chemical contaminants or excessive amounts of natural substances, it may pose a risk to human health. Laboratory tests are carried out to determine the safety of water. However, the reliability of an analytical result depends not only on laboratory equipment but also on where the sample was taken, in what container and under what conditions.

A sample must represent the actual state of the water source. Taking a sample from a wrongly chosen place, a dirty container, keeping the sample in the heat for a long time or insufficient information on the label may distort the results. Therefore, sampling is planned in advance and carried out on the basis of the relevant sanitary rules and the approved instructions of the laboratory.

Aim of the study: to systematize the requirements for the collection, storage, transportation and documentation of water samples for laboratory testing.

Objectives: (1) to define the purposes of water sampling; (2) to describe preparation for sampling and the sampling procedure; (3) to describe the requirements for storage and transportation; (4) to outline hygienic and laboratory control and the most frequent errors with ways of preventing them.

MATERIALS AND METHODS

This work is a theoretical and analytical review based on international guidance on drinking-water quality, the standard on sampling for microbiological analysis, and national sanitary rules and laboratory instructions on drinking-water quality control. The data were processed by content analysis, comparison and systematization.

The sampling process was examined in sequence, from the purpose of sampling, preparation and procedure to storage, transportation, laboratory acceptance and quality control. Exact

requirements for storage temperature, permissible time and sample volume depend on the indicator tested and the laboratory method, and should be taken from the laboratory's current instructions.

RESULTS

Purpose of water sampling

The main purpose of taking water samples is to assess the suitability of water for the intended use, to identify sources of contamination and to check the effectiveness of water purification or disinfection processes. Samples may be taken from drinking-water sources, wells, water supply networks, reservoirs and treatment facilities.

The purpose of the test is determined in advance: physico-chemical analysis, microbiological testing or detection of specific contaminants. The type of container, sample volume, storage temperature and delivery time may differ for each analysis. Therefore, it is not correct to use the same container or the same storage method in all cases.

Preparation for sampling

Before sampling, a test plan is drawn up and the sampling points are designated. The person taking the sample uses clean gloves, necessary protective equipment and appropriate instruments. Containers must correspond to the laboratory's instructions: clean containers made of a suitable material are usually used for chemical analyses, and sterile containers for microbiological tests. It is not allowed to touch the inner surface of the container or to contaminate the inner part of the lid.

If the tap or point from which the sample is taken is contaminated externally, it is cleaned in the established manner. Whether water must be run for a certain time before sampling from a tap depends on the purpose of the test and the current protocol. For example, one procedure may be used to assess the quality of water in the network and another to determine the effect of the tap or fittings. Therefore, the sampling method is chosen according to the instructions of the laboratory or the sanitary service.

Sampling procedure

The sample is taken from a clean, designated point. The container is filled in accordance with the laboratory instructions; for microbiological testing, the inner part of the sterile container must not be touched after it is opened. If the container contains a special preservative, it must not be emptied out or rinsed. The sample volume must be sufficient for the analyses ordered.

Immediately after the sample is taken, the container is tightly closed and labeled. The label shows the sample code, place of collection, date and time, the person who took the sample and, if necessary, the water source or type of analysis. Additional information is recorded in a separate act or sample submission sheet. The data in the documents must match the label on the container.

Protecting the sample from secondary contamination is especially important for microbiological testing. Such a sample is delivered to the laboratory as quickly as possible.

Storage and transportation

After sampling, storage and transport conditions must be observed so that the composition of the sample does not change. Sunlight, high temperature, long delay and improper closing of the container may affect some indicators. Therefore, samples are transported in a suitable transport box

and, where necessary, with cooling elements. The sample is usually transported in cold conditions without freezing; it is not mixed directly with ice and is not frozen unless the method specifically requires it. Exact requirements must be taken from the laboratory's current instructions.

Some chemical analyses require a special preservative or a separate container. The type and amount of preservative must match the analytical method; adding it arbitrarily may give an incorrect result. When the sample is handed over, the time of acceptance, the condition of the container and the storage conditions are recorded. If the requirements have been violated, the laboratory may refuse to accept the sample or place restrictions on the result.

Hygienic and laboratory control

Water samples are usually tested for physical, chemical and microbiological indicators (Table 1).

Table 1

Indicators usually tested in water samples

Group of indicators	Examples of parameters
Physical	Temperature, color, odor, turbidity
Chemical	pH, mineral salts, nitrates, iron, hardness and, depending on the water source, other substances
Microbiological	Indicators of fecal contamination, including Escherichia coli

For quality control, a repeat sample, a control sample or a blank sample is used where necessary. Observations such as the sampling point, date and time, weather or the state of the source help in interpreting the results. The laboratory conclusion is compared with the current sanitary norms and relevant standards.

Errors in sampling and their prevention

The most frequent errors and the measures for preventing them are summarized in Table 2.

Table 2

Common sampling errors and preventive measures

Common error	Preventive measure
Use of a non-sterile container	Prepare containers in advance in accordance with the laboratory instructions
Touching the inside of the container or lid	Follow standard operating procedures; do not touch the inner surface

Common error	Preventive measure
Sampling from the wrong point	Plan the inspection and designate sampling points beforehand
Incomplete labeling	Fill in labels on site; document who took the sample, when and where
Sample left in the heat for a long time; late delivery to the laboratory	Control transport conditions; use a transport box and, if necessary, cooling elements; deliver as soon as possible
Rinsing a container where this is not allowed, or omitting the required preservative	Regular staff training; follow the laboratory's instructions on preservatives and containers

The sampling process must be documented, and it must be clearly recorded by whom, when and where the sample was taken.

DISCUSSION

The findings show that the quality of laboratory results begins at the sampling stage. Even a well-equipped laboratory cannot correct a sample that was taken from an unrepresentative point, placed in an unsuitable container, kept too long in the heat or labeled incompletely. For this reason, all stages from sampling to the laboratory conclusion must be performed in accordance with sanitary and hygienic rules and approved methods.

No single procedure fits all situations. Container type, volume, storage temperature, delivery time and the need to run the tap before sampling depend on the purpose of the test and the indicator, so the laboratory's current instructions or the sanitary service's guidance should be followed in each case. Documentation is equally important, because the data on the label and in the accompanying documents allow the result to be correctly interpreted.

It should also be noted that a single result may not fully reflect the condition of a water system at all times; therefore, regular monitoring is carried out depending on the level of risk. A limitation of this work is that it is a review and does not give numerical values for volumes, temperatures or storage periods, since these depend on the method and the laboratory.

CONCLUSION

Correct collection of water samples for laboratory tests is one of the basic conditions for reliable assessment of water quality. Choosing the sampling point correctly, using a suitable and, where necessary, sterile container, completing the label fully and observing the storage and transport requirements ensure the accuracy of the analytical results.

All stages, from sampling to the laboratory conclusion, must be carried out on the basis of sanitary and hygienic rules and approved methods. This serves the control of drinking-water safety and the prevention of waterborne diseases.

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