

Standard Operating Procedure (SOP) 3.1.4.3

By Revital Katznelson, Ph.D.

Measurement of pH with a Pocket Meter

1.0 About this SOP

These instructions describe how to measure pH using the battery-operated pocket meters manufactured by Oakton (and sold by LaMotte or Cole Parmer) as the pHTestr series, with or without temperature compensation. pHTestr models are sold in the regular or the waterproof variety. The instructions are relevant - and probably identical - to all other pocket pH meters with dry electrodes (made by Hana, and others). The "distilled water" referred to in the instruction are sold in supermarkets as "distilled water", "deionized water", "purified water", or "drinking water", and are normally prepared by ion-exchange resins or reverse osmosis. Although the pH may be very low at times, the essential feature is zero conductivity and lack of contaminants. The instrument code is PHEL for these meters.

2.0 Equipment List

Apart from this SOP and the pH meter itself, you will need the following:

- Standard pH buffers
- "Distilled water" in a squirt bottle
- Liquid Waste Container (a wide-mouth jar for used reagents and buffers)
- "Field Data Sheet for Water Quality Monitoring" and instructions in SOP-9.2.1.1(Field)
- "Calibration and Accuracy Checks Sheet" and instructions in SOP-9.2.1.2(Calib)

The "distilled water" (DI) referred to in the instruction is sold in supermarkets as "distilled water", "deionized water", "purified water", or "drinking water", and these are normally prepared by ion-exchange resins or reverse osmosis. The essential feature is zero conductivity and lack of contaminants.

3.0 Maintenance and Storage

For storage over a few days, you can keep the electrode moist by leaving a few drops of distilled water inside the cap. For long storage, dry the electrode and cap tightly. Store upright at all times! An air bubble inside the tip of the electrode

can cause erratic readings (contact trouble, presumably) and should always be kept at the top. If the electrode shows a visible layer of covering material, clean it with solution recommended by the manufacturer per manufacturer instructions.

The meters do not have an automatic OFF function, so care must be taken to turn them off. They require 3 button batteries of 1.5 V. Make sure you get the type that is equivalent to the type you already had in the meter. Under normal use, batteries can function for over 30 field days. It is always a good idea to keep a spare set of batteries with the field kit.

4.0 Calibration

Dispense calibration buffers in small quantities (about 1 tablespoon, or 15 ml) into their dedicated 1-oz plastic cups. Follow the manufacturer's directions to calibrate the pH meter with pH 7 buffer at the beginning of each field day, after it has been soaked. About once a month, use both pH 7 buffer and pH 10 buffer for serial calibration to assure that the slope is correct. You may need to re-calibrate at 7 after calibrating at 10. Rinse the electrode carefully with DI after each buffer. Indicate whether you needed any calibration action or whether none was taken, by entering "cal" or "none" into the "action field in your calibration form. Also, record pre-calibration and post-calibration values in the "calibration" form as you work, along with your Instrument ID and Standard IDs (and do not forget the date and time!).

Discard the calibration buffers into the liquid waste container for later disposal into the sanitary sewer system. Alternatively, save the used buffer in a separate container for future use. Never return the buffer from the cup into the original standard bottle. You can adjust the output of a pH meter to test whether the output is accurate by checking what the meter "reads" when measuring a standard buffer solution. Make sure you have colorless standards, and test it in the same way you are instructed to test your samples (see below). Use at least two Standard buffers, one of pH 7 and the other at pH 9 or 10. The buffers for pH 4 are available but they are less useful for the range of pH you may encounter in the environment. When you conduct an accuracy check, be sure to use the "DQM Calibration and Accuracy Checks Sheet" provided with its instructions (SOP-9.2.1.2); this form has placeholders ("Fields") for all the documentation you will need to provide, and is essentially identical to the spreadsheet table in your Excel Project File.

5.0 pH measurements using dry-electrode pH meters

Hydrating the electrode

Before going to collect the sample in the creek, allow the pH meter to soak in distilled water for at least 20 minutes. For this purpose, remove the pH meter protective cap, place the electrode in a small clean container, and pour water into the container so that the tip is dipped about 1” in water. Do not turn the meter on. (Although your meter is equipped with a “dry” electrode, it is necessary to let it soak and equilibrate before calibrating it and using it for measurements).

Sample pH measurement

At each station, either test the water directly or pour some of the water sample from the sampling apparatus into a clean small container, creating a depth of about 1”. Turn the pH meter on, and dip the electrode into sample solution. Do not wet above the cap line! Stir gently for a few seconds, watch the changes in the readings, and keep stirring and watching every few seconds until the readings stabilize. Record reading on the field data sheet, making sure the Instrument ID is entered correctly.

Turn off pH meter. Remove pH meter from sample. Rinse tip with distilled water and discard the wash water into the liquid waste container (It was a good idea to get a WIDE MOUTH container so you can squirt the DI on the electrode directly above the liquid waste container...). If you plan to do more pH measurements within the next few hours, you can fill the cap with DI water, enough to keep the electrode submerged

6.0 Monitoring Tips and advice

Pocket pH meters are inexpensive and readily available, but can only produce reliable data with proper maintenance and regular calibration. This is often difficult to achieve, and unless you can assure the delicate attention needed, avoid using these dry electrode pH meters.

Problems we have encountered include:

- 1) air bubble inside the gel, moving up and down the electrode and interfering with electrical contacts (solution: always keep the meter upright);
- 2) dry mineral crust forming on the electrode interface after prolonged storage (solution - soak in DI for a while before calibration and use);
- 3) very slow response with low buffered waters (solution - monitoring the changes in the reading and waiting several minutes for stabilization, with occasional stirring)

Sources and Resources

This SOP is a part of the guidance compendium created by the Clean Water Team, the Citizen Monitoring Program of the State Water Resources Control Board.