7.4 PROTOCOL FOR SEDIMENT OXYGEN DEMAND MONITORING

Overview

Sediment oxygen demand (SOD) is a measure of the oxygen consumed by biochemical decomposition of organic matter in stream or lake deposits. SOD over a defined time period can be measured in-situ using a chamber method, or sediment cores can be taken for subsequent incubation and SOD measurement in a controlled environment.

Sources

Alberta Environment (2006 a)

At a glance

This method refers to the measurement of SOD using an *in-situ* chamber. However, it should be noted that this may not be applicable to all sites because of issues such as vandalism or accessibility.

Filling the chambers

1. Choose representative substratum for the site. Substratum composition ideally should be cobble and gravel interspersed with fines. Substrate should not be so large as to not fit inside the chamber. Chambers should be placed in areas of flowing water. Ideal working depth (from ice surface to substrate) is between 50-70 cm, but no greater than 90 cm. Ensure that sufficient distance between bottom of ice and top of velocity vanes exists to allow vanes to spin freely.
2. Check that each chamber has all stoppers attached to the lid (use light-duty chain and epoxy cement) and that rubber and foam gaskets are secured and in good condition on the chamber. Foam gaskets on ALL chambers should be completely changed before undertaking any new work.
3. Ensure that the lid fits snugly on the chamber (each chamber has the same exclusive number for the lid and base) and that the snap-down clips operate correctly.
4. Check that the water vanes rotate freely and the Teflon washers are in good condition
5. A total of four chambers will be filled with substratum; and one “control” chamber to be filled with river water.
6. Choose representative substratum for the sites to be used in the study area.
7. Fill chambers with ambient water to about ¼ of its depth. Fill ¼ of the chamber with finer material such as gravel and sand to form a base on which the larger cobble can rest on.
8. Using a shovel, carefully remove undisturbed cobble and gravel from the substrate and place atop the sand/gravel base in the chamber. Arrange rocks (epilithic cover must face up) such that they are representative of substratum conditions at the sample site.
9. Equal amounts and type of substratum should be placed in

each chamber. Compare with other chambers.

10 The chambers are usually filled between 1/3 and 1/2 of the chamber depth to leave room for the water vane unit on the inside of the chamber.

11 Place the chamber, without the lid, very carefully into the water and allow it to fill very gradually to reduce disturbance to the substratum in the chamber.

12 Position the chamber on the stream bottom in a level fashion.

13 Leave the chamber in position until the sediment in the chamber has settled or flushed. This is important since the suspended material in the water column may increase oxygen demand in the chamber.

Closing the chambers

1 Ensure that the rubber and foam gaskets and the water sample tube are free from ice or sediment.

2 Remove the stoppers from the portholes in the lid and place the lid gently onto the chamber making sure that no bubbles are trapped between the flange and the lid.

3 In deeper depths, another chamber (that has been turned over onto the substrate) can be used as a platform to elevate the chamber to a suitable working depth.

4 Check that the foam gasket on the lid is snugly fitted onto the chamber base.

5 Ensure that the four snap-down clips on the chamber lid have been extended equally (clockwise to tighten, counter-clockwise to loosen) for easier clamping and to prevent warping of the lid.

diagonally opposite clips

6 It is very IMPORTANT to close two diagonally opposite clips on the lid simultaneously, and repeat with remaining clips. It may be necessary to adjust the clips so that they snap down briskly onto the base, giving a secure fit.

time of lid closure

7 Making sure that the chain is not wrapped around the base of the vane, replace the stoppers securely in the portholes. Having some slack in the chain will allow for some give if the chain is struck by ice or debris. IMPORTANT: Record time of lid closure for each chamber to the nearest minute on field sheet.

8 Depending on river velocity and site location, it may be necessary to anchor the chambers. This can be accomplished by using rope secured to one or more t-posts pounded into the ice surface (in winter conditions) and tied to the chamber handles.

9 In higher velocity locations, rocks may be piled up against the base of the chambers for extra stability.

10 Measure river ambient DO concentrations.

Obtaining the sample

1 Take note of any unusual conditions: stopper not in porthole, retaining clip open, vane performance (spin or no spin), chamber

tipped over, etc., and record on SOD field sheet.

2 Rotate water vane of all the chambers very slowly to achieve complete mixing of water.

3 Remove from river and record chamber number, date, and time.

4 Open the smallest stopper, gently rotating the vane, place Tygon tubing over the water sample tube and carefully siphon water into the Winkler bottle. Note: Sample should be discarded if air bubble or ice is present in Winkler bottle. Replace Tygon tubing if freezing occurs.

5 Preserve with Winkler chemicals.

6 After water samples for DO measurement have been taken, remove lid of the chamber.

calculating chamber volume

7 In order to measure the volume of the chamber, place the depth-profile measuring device over the opening of the chamber and secure using the 3 alignment pins. Place the depth-profile measuring rod (pre-marked in 0.5 cm increments) through one of the holes in the Plexiglas plates until the rod touches the substratum. Record the depth as indicated on the rod and subtract 0.5 cm (width of the Plexiglas as it sits above the chamber flange) from the total. This measurement will give the distance from the top of the rock to the underside of the Plexiglas. Record on field sheet.

8 Record dissolved oxygen of the water within the chamber.

Photo 17. SOD chamber
(Alberta Environment (2006a))