

## **EXPERIMENT 17**

**Date:**

### **OBJECTIVE:**

Estimation of Primary Productivity in freshwater bodies

### **Introduction**

The primary production in the aquatic ecosystem starts with the synthesis of organic compounds from the inorganic constituents of water by the activity of plants / phytoplankton in the presence of sunlight. The inorganic constituents which form the raw material for this synthesis are water, carbon dioxide, nitrate ions, phosphate ions and various other chemical substances. The products are mainly carbohydrates and proteins and fats in very small quantities. Organic production by plants is the first step in tapping energy by living beings from non-living natural resources and hence called primary productivity.

The method of estimating primary productivity by dark and light bottle method was introduced by Gardner and Gran (1930). In this method, the water samples are incubated for a certain period in light and dark bottles which are then suspended at the same depths from where the samples are taken. In light bottles, oxygen is released as a result of photosynthesis and a part of oxygen is used for community respiration. In the dark bottles, only oxygen consumption takes place as a result of respiration. The amount of oxygen liberated by phytoplankton during photosynthesis is considered as a measure of primary production.

### **Material required**

BOD bottle (2 light / transparent and 1 dark), Nylon or Jute ropes, Burettes, Reagents (Manganous sulphate solution, Alkaline iodide azide solution, Sodium thiosulphate, Concentrated Sulphuric acid, Starch indicator solution) etc.

### **Procedure:**

- a. Fill three BOD bottles with water sample in round stoppered bottles (1 Light bottle, 1 dark bottle and 1 control light bottle) avoiding air bubbles.
- b. Water sample in the control bottle is immediately fixed by using Winker's fixatives
- c. The dark bottle is wrapped with aluminum foil and kept in a black bag to protect from light.
- d. Use one of the light bottles for estimating the initial dissolved oxygen As control)
- e. Suspend both light and dark bottles exactly at the depth from where the sample was drawn are then suspended on to a raft and anchored.
- f. The bottles are normally incubated for a period of 3-4 hrs between dawn to midday or sunset in the respective depths
- g. At the end of incubation period, the bottles are retrieved and fixed with oxygen fixatives.
- h. The oxygen content in the sample is determined by using Winkler's method.

### Calculation

Let the initial oxygen level be - IB

Let the final oxygen level in dark bottle be - DB

Let the final oxygen level in light bottle be - LB

Net oxygen production - LB – IB

Oxygen consumed for respiration - IB – DB

Gross production of oxygen - LB – DB

Let 't' be the number of hours of incubation

Therefore the Primary productivity can be calculated from the formula:

$$\text{Gross primary productivity} = \frac{\text{LB} - \text{DB} \times 1000 \times 0.375}{1.25 \times t} \text{ mg C/m}^3/\text{hour}$$

$$\text{Net primary productivity} = \frac{\text{LB} - \text{IB} \times 1000 \times 0.375}{1.25 \times t} \text{ mg C/m}^3/\text{hour}$$

$$\text{Community respiration rate} = \frac{\text{IB} - \text{DB} \times 1000 \times 1 \times 0.375}{t} \text{ mg C/m}^3/\text{hour}$$

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Sample No	Point of Collection	Observed Levels	Date of Collection	Time of Collection	Recommendations

**Rough work**

