K.L.E SOCIETY's

S.NIJALINGAPPA COLLEGE

II BLOCK RAJAJINAGAR, BENGALURU - 10

College with potential for excellence UGC-CPE

Re-accredited at 'A+' grade by NAAC

A MANUAL OF PRACTICAL ZOOLOGY

THIRD YEAR B.Sc – V SEMESTER.

PRACTICAL V

ENVIRONMENTAL BIOLOGY AND ETHOLOGY.

(AS PER BENGALURU CITY UNIVERSITY SYLLABUS)

CBCS – 2018 ONWARDS

CHIEF EDITOR : Dr. TEJASWINI. V. NANDI.

ASSISTANT PROFESSOR

V SEMESTER B.Sc, ZOOLOGY PRACTICAL – V

ENVIRONMENTAL BIOLOGY AND ETHOLOGY

15 UNITS

I. Limnological studies: - 06 Units.

1. Examination of water samples from nearby ponds and tanks for the identification of phytoplankton and zooplankton.
2. Estimation of Dissolved Oxygen by Winkler's method.
3. Estimation of dissolved salt by Mohr's method.
4. Estimation of dissolved organic matter.
5. Estimation of total hardness.
6. Estimation of pH using pH meter / pH paper / Titrimetry.

II. Ecological Adaptations: - 03 Units.

1. Tubiculous worms: Arenicola and Chaetopterus.
2. Fussorial (Burrowing) forms: Dentalium.
3. Sedentary forms: Sea anemone and Lepas.
4. a. Passive fliers: Exocoetus and Draco.
   b. Active fliers: insects and Bat.
5. Animal associations:
   a. Polymorphic forms: Physalia.
   b. Facultative mutualism: Hermit crab and Sea anemone.
6. Desert form: Phrynosoma.
7. Arboreal form: Hyla.

III. Ethology: - 03 Units.

1. Demonstration of Drosophila behaviour: Response of Drosophila flies to different culture media. (ripe banana, rava, curds).
2. Social behaviour in termites: Study of different castes.
3. Mimicry / Camouflage: Stick insect and Chameleon.

IV. Project report submission: - 03 Units.

a. Toxicology – Analysis of water (polluted), solid waste management, Air pollution (Tie up with Pollution control Board, BWSSB, PG dept of Environmental Science, DST and NGOs may be useful).
b. Rain water harvesting.
c. Visit to Wild Life Sanctuary, National Park, Bio-reserve and Sacred Groove.
d. Social Organization in Termites and Primates (monkey and apes).
(*Field / industrial visits for the topics related to project report is recommended*)

SCHEME OF PRACTICAL EXAMINATION

V SEMESTER: B.Sc ZOOLOGY

ENVIRONMENTAL BIOLOGY AND ETHOLOGY: PRACTICAL – V

Duration: 03 hrs. **Max. Marks: 35**

01. Limnology: **08 Marks.**

Identify and Comment on the observed Plankton/s in the given water sample.

OR

Estimate -------- in the given water sample and discuss the result.

(Experiment from serial number 2 to serial number 6 of Unit I)

02. Ecological adaptations: Identify, draw a neat labelled diagram and comment on the ecological adaptations of **A, B** and **C**. **12 Marks**. (4X3)

03. Ethology: Identify and discuss on the behaviour of **D** and **E**. **05 Marks.**

04. Project report submission. **05 Marks**.

05. Class records. **05 Marks**.

Total 35 Marks.

Note: Question 3 – Ethology – D from 2 of unit – III;

E from 3 of unit - III

ESTIMATION OF DISSOLVED OXYGEN BY WINKLER'S METHOD.

AIM: To estimate the amount of Dissolved Oxygen in the given water sample by Winkler's method.

APPARATUS: Burette, Burette stand, 25 ml pipette, conical flask, 250 ml reagent bottle, measuring jar.

CHEMICALS REQUIRED: 0.025 N Sodium thiosulphate, 40% manganous sulphate, Alkaline Iodide (Winkler's reagent), Conc. H_2SO_4, 1% starch solution.

PRINCIPLE: Addition of Manganous sulphate, Alkaline Iodide and Conc. H_2SO_4 to the water sample eventually liberates certain amount of molecular Iodide which corresponds to the amount of dissolved oxygen in the sample. Amount of molecular Iodide is estimated by titrating it against the burette solution $Na_2S_2O_3$.

Winkler's method is a standard method for determining dissolved oxygen (DO). It is widely used and based on oxidation reduction reactions.

Sodium hydroxide present in the alkaline Iodized will react with manganous sulphate to give a white precipitate of manganous hydroxide.

$$\mathbf{MnSO_4 + 2NaOH \text{-----}\rightarrow Mn(OH)_2 + Na_2SO_4.}$$

Manganous hydroxide, so formed in the presence of oxygen, in a highly alkaline medium, gets oxidized to form a brown precipitate of manganous oxyhydrate ($MnO(OH)_2$). This occurs in direct proportion to the amount of oxygen present. Thus the amount of oxygen present may be judged from the intensity of brown colouration of the precipitate.

In a strongly acidic medium, Manganic ions are freed. Free Manganic ions will react with potassium iodide and release free iodide ions.

$$\mathbf{MnO(OH)_2 + 4NaHSO_4 + 2KI \text{--------}\rightarrow MnSO_4 + K_2SO_4 + 2Na_2SO_4 + 3\ H_2O + I_2\uparrow}$$

The amount of free Iodide liberated will be equal to the amount of oxygen present in the sample. Iodine thus set free can be estimated by titrating against sodium thiosulphate. If 100 ml of sample is titrated then every milliliter of 0.025N thiosulphate consumed will be equivalent to 1 mg of oxygen per litre. If smaller samples say 25 ml is used then the litre value should be multiplied by 4 to give the result for 100 ml.

PROCEDURE: WRINKLER'S METHOD.

Fill the reagent bottle with water completely till it overflows. Now stopper the bottle. Remove the stopper and measure the volume of water using a measuring jar. It gives the volume of the reagent bottle.

Take the reagent bottle whose volume is determined and immerse it in the same taking care to avoid diffusion of atmospheric air. Once the bottle is completely full, remove it and stopper it.

Remove the stopper of the reagent bottle containing the sample whose oxygen content is to be determined and add 1 ml of 40% manganous sulphate solution and 1 ml of alkaline iodide. Stopper it; leave it in a dark place to avoid photo oxidation, until the brown precipitate formed settles down.

TRIALS	I	II	III
Final burette reading (ml)			
Initial burette reading (ml)			
Volume of $Na_2S_2O_3$ run down (ml)			

1. **Volume of sodium thiosulphate rundown = ----------.**
2. **Volume of sample bottle used = ----------.**
3. **Volume of sample taken for titration = ----------.**
4. **Volume of reagents added = 03 ml.**

$$K = \frac{\text{Volume of sample bottle used}}{\text{Volume of sample bottle used} - \text{Volume of reagents added}}$$

$$DO = \frac{K \times 200 \times \text{Volume of } Na_2S_2O_3 \text{ rundown} \times 0.698}{\text{Volume of sample taken for titration}} \text{ gms / ltr.}$$

After 10-20 minutes remove the reagent bottle, remove the stopper and add 1 ml of concentrated sulphuric acid along the sides. Stopper the bottle and shake well till the precipitate dissolves completely.

From the acidified sample pipette out 25 ml into a conical flask. To this add one drop of 1% freshly prepared starch solution. The yellow colour solution turns blue. Now titrate against 0.025 N sodium thiosulphate till blue colour just begins to disappear. Stop adding sodium thiosulphate and note down the amount of sodium thiosulphate run down. Repeat the experiment with sample till concordant values are obtained.

RESULTS: The amount of dissolved oxygen in a given sample is ----------.

DISCUSSION: one of the critical factors in an aquatic environment is the amount of oxygen most living organisms require oxygen for respiration. It facilitates the combustion of the calorific compounds like fats and carbohydrates to generate energy in the cell system. Oxygen is the most essential chemical component of life processes dissolved in fresh waters. The aquatic medium which is close with atmosphere contain an abundance of oxygen that reaches the water either by direct diffusion or by movements of water like wave action or water circulation.

Moving water of streams and rivers has high percentage of oxygen. Aquatic plants, rooted vegetation of shallow water zones and floating phytoplankton of open waters produce oxygen.

Oxygen in fresh water body is utilized by organisms in respiration and decomposition of dead organisms in the aquatic environment. Oxygen is reduced in stagnant pools with a lot of decaying vegetation. Oxygen is very less in distilled water.

ESTIMATION OF DISSOLVED SALT BY MOHR's METHOD.

SAMPLE A

TRIALS	I	II	III
Final burette reading (ml)			
Initial burette reading (ml)			
Volume of $AgNO_3$ rundown (ml)			

Volume of $AgNO_3$ rundown = ----------ml.

N_1 = Normality of AgNO3 (0.005)

N_2 = Normality of sample.

V_1 = Volume of $AgNO_3$.

V_2 = Volume of sample (10ml).

$$N_1V_{1\,(AgNO_3)} = N_2V_{2\,(sample)}.$$

$$N_2 = \frac{N_1V_1}{V_2}$$

Chlorinity = N_2 X Equivalent weight of chlorine (35.5).

Salinity = (Chlorinity X 1.805) + 0.03 grams / ltr.

ESTIMATION OF DISSOLVED SALT BY MOHR's METHOD.

AIM: To estimate the concentration of Cl^- / Br^- ion (salt) in the given water sample.

APPARATUS REQUIRED: Conical flask, pipette, burette, burette stand, 500 ml measuring cylinder.

CHEMICALS REQUIRED: 0.005 N $AgNO_3$, 10% K_2CrO_4 (indicator)**.**

PRINCIPLE: In Mohr's method Ag^+ ion of $AgNO_3$ reacts with Cl^- ion to form white precipitate of AgCl since Ag^+ ions are taken in excess amount. So after all the Cl^- ions get converted to AgCl then the excess Ag^+ ions react with potassium chromate (K_2CrO_4) indicator and forms silver chromate (Ag_2CrO_4) which gives brick-red colour which is the end point of titration. This reaction occurs in neutral pH.

$$\mathbf{NaCl + AgNO_3 \dashrightarrow AgCl\downarrow + NaNO_3}$$

$$\mathbf{2\ AgNO_3 + K_2CrO_4 \dashrightarrow Ag_2CrO_4\downarrow + 2\ KNO_3}$$

(Brick-red ppt)

Limitations of Mohr's method:

1. In acidic medium silver nitrate gets dissolved so add base ($CaCO_3$, $NaHCO_3$) to make the solution neutral.
2. In basic medium there is a formation of Ag(OH) by degradation of $AgNO_3$ so add acids (CH_3COOH) to make the solution neutral.

PROCEDURE: Pipette out 10 ml of the sample water **(V_2)** into a clean conical flask and add two drops of K_2CrO_4 solution as indicator which gives yellow colour. Titrate this against 0.005N $AgNO_3$ solution **(N_1)** taken in the burette. End point is yellow to brick-red. Note the amount of $AgNO_3$ rundown **(V_1)**. Repeat the titration for concordant values.

RESULT: The amount of the salt in sample A = ---------gms/ltr.

The amount of the salt in sample B = ---------gms/ltr.

DISCUSSION: Several species of crabs have blood which is hypertonic to sea water. They always face the problem of entry of water and loss of salts through outward diffusion. In this condition the animal world either swell or lose so much salt that their internal body fluids would not support the proper functioning of the body cells.

Salinity of water acts as an important limiting factor for the distribution of a number of species of plants and animals. Certain animals such as spider crab can tolerate only narrow fluctuation of salinity of water, are known as stenohaline. Mytilus, Aplysia etc can withstand wider ranges of salinity are known as euryhaline animals. There are certain animals like salmon are both stenohaline and euryhaline.

The study of salinity gives an insight to the method of osmoregulation in organisms. For most of the fresh water individuals excess intake of water remains a problem, as they have their body fluid, concentration higher than that of surrounding water, consequently there is a tendency to lose salts by diffusion and gain water by endosmosis. They maintain hyper tonicity by secreting water and checking salt loss by gills and kidney tubules. In marine animal salt intake remains a problem, so secretion by gill epithelium regulates hyper tonicity in marine animals.

From the experiment we can conclude that:

a. Salinity differs from one medium to another medium. Therefore salinity of tap water is different from salinity of distilled water. Salinity of marine water is constant about 3.5%. the salinity of the fresh water varies greatly from 0.065 to 197.51 gms / lt.

b. Chlorinity and salinity of tap water is greater than that of distilled water.

SAMPLE B.

TRIALS	**I**	**II**	**III**
Final burette reading			
Initial burette reading			
Volume of $AgNO_3$ rundown			

Volume of $AgNO_3$ rundown = ----------ml.

$$N_1V_{1\ (AgNO_3)} = N_2V_{2\ (sample)}.$$

$$N_2 = \frac{N_1V_1}{V_2}$$

Chlorinity = N_2 X Equivalent weight of chlorine (35.5).

Salinity = (Chlorinity X 1.805) + 0.03 grams / ltr.