



SATHYABAMA

INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)

INTERNSHIP REPORT

HIYOSHI INDIA ECOLOGICAL SERVICE PRIVATE LIMITED AT
THARAMANI, CHENNAI



Submitted to partial fulfilment of requirements

For the award of degree of

MASTER OF SCIENCE

In

CHEMISTRY

Submitted by

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Reg.no:42910014

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DEPARTMENT OF CHEMISTRY

ACKNOWLEDGEMENT

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SL NO	SYLLABUS
1.	Laboratory tour (Equipment, Glassware & Chemicals, etc), pH at 25°C, Electrical conductivity etc
2.	Total Dissolved Solids & Total Suspended Solids
3.	MLSS & Total Solids
4.	Phosphorous
5.	Ammoniacal Nitrogen
6.	Chemical Oxygen Demand
7.	Biochemical Oxygen Demand
8.	Chloride
9.	Sulphate
10.	Biochemical Oxygen Demand

INTRODUCTION

The water treatment process is a series of steps that purify water to make it safe for drinking and other uses. It involves processes like coagulation, sedimentation, filtration, and disinfection. Each step helps remove impurities and harmful substances, ensuring clean and safe water for everyone. It's an important process to protect public health and the environment.

INSTRUMENTS

- ❖ PH METER
- ❖ CONDUCTIVITY METER
- ❖ TURBIDITY METER
- ❖ ANALYTICAL BALANCE
- ❖ DESSICATOR
- ❖ UV VIS SPECTROPHOTOMETER
- ❖ HOT AIR OVEN
- ❖ FUME EXHAUST HOOD
- ❖ BOD INCUBATOR
- ❖ COD DIGESTOR

1. pH

pH value of water indicates the hydrogen ion concentration in water. pH is expressed as the logarithm of the reciprocal of the hydrogen ion concentration in moles/ litre at a given temperature. The pH scale extends from 0 (very acidic) to 14 (very alkaline) with 7 corresponding to exact neutrality at 25°C.

The temperature interference the pH, so it should be at 25.C as per IS 3025.

Procedure:

Calibrate the instrument using Certified reference Material (CRM). A sample of Ph was taken and test was conducted.

Note that electrode cleaning is must after every test using water and tissue.

Electrical conductivity

Electrical conductivity is a measurement of water's ability to conduct electricity. EC is related to water temperature and the total concentration, mobility, valence and relative concentration of ions. Higher EC means more electrolytes in the water. So that, high amount of impurities are present which will lead to a higher conductivity. Before going for UV VIS Spectrophotometer, get some rough idea with the value of EC.

2. TDS (Total Dissolved solids)

Filterable residue (TDS). Total dissolved solids (TDS) are the amount of organic and inorganic materials, such as metals, minerals, salts, and ions, dissolved in a particular volume of water. TDS are essentially a measure of anything dissolved in water. This method is applicable to all type of water and waste water.

Principle:

The sample is filtered and the filtrate evaporated in a tared dish on steam-bath. The X residue after evaporation is dried to constant mass at 103-105°C.

Procedure:

First heat the evaporating dish to 180.C for 1 hr. Then cool it in desiccator, weigh and store in desiccator for use. Filter the sample, pipette the volume required to the weighed evaporating dish placed in steam bath. Leave some time after complete evaporation of water from residue transfer the dish to oven and dry it. Weigh the dish as soon as it has cooled.

Calculation:

Filterable residue, mg/l = 1000 M/V

3. TSS (Total Suspended Solids)

TSS is the dry-weight of suspended particles, that are not dissolved in a sample of water that can be trapped by a filter that is analysed by Filtration. A filter paper pore is 1.2 microns.

Principle:

The sample is evaporated in a weighed dish on a steam-bath and is dried to a constant mass in hot air oven either at 103-105°C or 179-181°C. Cool in desiccator. Total residue is calculated from increase in mass (usually mg/l).

Calculation:

$$\text{TSS} = (w_2 - w_1) / \text{volume} \times 1000 \times 1000$$

4. MLSS (Mixed Liquor suspended solids)

The overall concentration of solids in an aeration tank is measured by Mixed Liquor Suspended Solids (MLSS) in wastewater treatment. Non-biodegradable suspended particles, organic materials, and microbes are all included.

Procedure:

Take the MLSS grab sample and filter it. The filter was ignited for around 15-20 mins in a muffle furnace. When the filter has cooled, the residue was transferred to a desiccator for chilling purpose. Finally weigh the residue that we got on the filter paper.

5. TS (Total Solids)

Total solids are dissolved solids, suspended solids and settleable solids in water. In stream water, dissolved solids consist of calcium, chlorides, nitrate, phosphorus, iron, sulphur, and other ions particles that will pass through a filtration.

UV-Vis Spectrophotometer:

It works on the principle of Beer-Lamberts law which says the amount of light passed or absorbed is directly proportional to the concentration and the path length of the material/absorbent.

$$I \propto b c$$

- Absorbance- light absorbed like 0.123, 0.056 etc...

- Transmittance- Light transmitted

$$A = 1/T$$

6. Phosphorous

It works on the principle of phosphorous reacts with ammonium molybdate and stannous chloride. The molybdo-phosphoric acid formed is reduced to an intensely coloured complex molybdenum blue by stannous chloride.

Procedure:

Prepare 100ml of 0.1, 0.5, 1.0, 1.5, 2.0ppm from 100ppm.

$$100 \times V_1 = 0.1 \times 100 \quad V_1$$

$$= 10/100 \quad = 0.1\text{ml}$$

Like this prepare std for other concentration. Make the above ml of phosphorous in 100ml std flask for blank use distilled water and in another take the sample to be analysed. Add 4 ml of ammonium molybdate. To that add 0.5ml or 10drops of stannous chloride. We can observe blue colours of solution. Now measure the absorbance in UV -vis spectrophotometer. Spectrophotometer- suitable range for phosphorous is 690nm. The graph obtained will give the unknown concentration from which calculation can be done

Calculation:

Phosphorus, mg/l = mg of phosphorus corresponding to control standard x 1000 / volume of sample in ml.

7. Ammoniacal Nitrogen

Principle:

The sample is buffered and distilled. The ammonia in the distillate or in the sample is treated with Nessler's reagent and the colour developed is matched with that of a series of standard ammonia solutions or measured absorbance at 410 nm.

Nessler's Reagent: Hgl + KI in basic medium i.e. NaOH need to be added.

Rochelle's salt: Potassium sodium tartrate in water, but it is used for removing interference like Ca, Mg, Fe as well as other ions.

Procedure:

Remove any interference of other ions by adding few drops of Rochelle's salt. After that add 1ml of Nessler's reagent where it will form brown coloured complex and then measured the absorbance at 410nm. For blank 0, and other conc. Like 0.5, 1.0, 1.5, 2.0, 2.5 ppm of ammoniacal nitrogen is made up in 100ml std flask. For std no need Rochelle's reagent because we are using only distilled water. But for sample we must use it. After mixing all, keep the Solution for 10 mins incubation, this depends on parameter. Now check the absorbance in UV spectrophotometer. The reaction and result depends on the procedure and temperature of environment.

8. COD (Chemical Oxygen Demand)

It is a test that measures the amount of oxygen required to chemically for organic material and inorganic nutrients, such as Ammonia or Nitrate, present in water. This undergoes a reverse titration.

Digestion:

To remove all unsaturated materials and reduce the material to its simplest form. In other word, all organic and other wastes will be removed/oxidised.

Principle:

Most of the organic matters are-destroyed when boiled with mixture of potassium bichromate and sulphuric acid producing carbon dioxide and water. A sample is refluxed with a known amount of potassium bichromate in sulphuric acid medium and the excess of bichromate is titrated against ferrous ammonium sulphate. The amount bichromate consumed is proportional to the oxygen required to oxidize organic matter. It is a reverse titration, blank titrate value will occur more than the sample value. Here we calculate the leftover oxygen present in the sample, So FAS consumes less than the blank.

Reagents:

Mercuric sulphate, Std Potassium dichromate, Silver sulphate in the presence of H_2SO_4 , Std Ferrous ammonium sulphate, Indicator- Ferroin.

Procedure:

20ml or adequate of sample made up to 20ml will be added in COD tube. To this add half spatula of Mercuric sulphate. Now add 10ml of potassium dichromate followed by 30ml of silver H₂SO₄. Keep it for 2 hours digestion. Cool it and titrate against 0.1N ferrous ammonium sulphate using ferroin indicator. The end point is the colour change sharply from green to wine red.

Calculation:

Normality of FAS = $10 \times 0.25 / V$

Where V = volume of Fe (NH₄)₂ (SO₄)₂ required for titration, in ml.

COD, mg/l = $(V_1 - V_2) N \times 8000 / \text{Volume}$

9. BOD (Biochemical Oxygen Demand)

It represents the amount of oxygen consumed by bacteria and other microorganisms while they decompose organic matter under aerobic (oxygen is present) conditions at a specified temperature.

Principle:

The biochemical oxygen demand test is based on mainly bio-assay procedure which measures the dissolved oxygen consumed by microorganisms while assimilating and oxidizing the organic matter under aerobic conditions. The standard test condition includes incubating the sample in an air tight bottle, in dark at a specified temperature for specific times.

Eutrophication:

It is the process in which a water body becomes overly enriched with nutrients, leading to the plentiful growth of simple plant life. The excessive growth (or bloom) of algae and plankton in a water body are indicators of this process.

Seeding method:

It is necessary to have present in each BOD bottle a population of microorganisms capable of oxidizing the biodegradable organic matter in the sample. Sometimes only Cod will present, in that case it should contain some BOD. So that we are using seeding method.

Apparatus:

Incubation bottle - 300 ml capacity narrow neck special BOD bottles with planed mouth with ground glass stoppers.

Reagent:

Phosphate buffer, Magnesium sulphate, Calcium chloride, Ferric chloride, acid and alkali Solution, Starch indicator, alkaline iodide, sulphuric acid, Std sodium Thio sulphate soln.

Dissolved oxygen

I₂O – measure from brown precipitate

Procedure:

Take sample in two 300ml bottle one for BOD day1 and Other for Day 3. To that add 2ml MnSO₄ +2ml alkaline iodide solution which turns into a brown ppt. shake nicely and keep it to settle. Day one bottle add the following and keep the day 3 bottle inside BOD incubator. After that dissolve ppt by adding 5ml H₂SO₄. From that take 200ml in conical flask. Titrate against 0.25N sodium Thio sulphate till pale yellow. Add starch as indicator and blue colour formed. The end point is the blue to colourless.

10. Chloride

The Argentometric method is suitable for use in relatively clear waters when 0-1.5 to 10 mg of chloride is present in the portion titrated. This involves the direct titration.

Principle:

In a neutral or slightly alkaline solution, potassium chromate can indicate the end point of the silver nitrate titration of chloride. Silver chloride is precipitated before red silver chromate is formed.

Reagents:

Std silver nitrate (0.0141 N), std sodium chloride, potassium chromate as indicator.

Procedure:

Take 20 ml of NaCl in conical flask add potassium chromate as indicator and titrate against silver nitrate. The end point is the brick red colour. This is done to find the give the normality of silver nitrate soln. Now follow the sample procedure for blank and sample solutions. Note the reading and calculate to find the amount of chlorine present in sample.

Calculation:

Chloride, mg/l = $(V1-V2) \times N \times 35450 / V3$

V1= volume in ml of silver nitrate used by the sample,

V2 = volume in ml of silver nitrate used in the blank titration, V3 = volume in ml of sample taken for titration, and

N =normality of silver nitrate solution.

11. Sulphate

To determine the amount of sulphate present in the given samples. Sulphate is widely distributed in nature. Sulphates are considerable concern because they are indirectly responsible for two serious problems often associated with the handling and treatment of wastewater.

Principle:

The turbidimetric method of measuring sulphate is based upon the fact that barium sulphate tends to precipitate in a colloidal form and that this tendency is enhanced in presence of a sodium chloride-hydrochloric acid. The absorbance(420nm) of the barium sulphate solution is measured by UV vis spectrometer and the sulphate iron concentration, determined by comparison of the reading with a standard curve.

Buffer solution which resists any changes in pH due to atmospheric conditions. pH is inversely proportional to Temperature.

Reagents:

Barium chloride, Acidic buffer solution, Standard sulphate solution.

Procedure:

Take 5ml,10ml,15ml etc of std sulphate solution in 100ml std flasks. Likewise make up the blank and sample also. Transfer this to the beaker and add 10ml of buffer Solution containing 30g MgCl₂, 5g CH₃COONa, 1g

KNO₃ and 20ml CH₃COOH in 1 litre. Add a spoonful of barium chloride crystals and begin timing immediately. Stir at constant speed exactly for one minute. After stirring pour some of the solution into the absorption cell of the photometer. Absorbance versus sulphate concentration is plotted and a curve is obtained. Finding the absorbance for a given sample, the concentration of sulphates in the solution is determined with the help of calibration curve.

12. BOD (Biochemical oxygen demand)

The BOD test is among the most important method in sanitary analysis to determine the polluting power, or strength of sewage, industrial wastes or polluted water. The test consists in taking the given sample in suitable concentrations in dilute water in BOD bottles. Two bottles are taken for each concentration and three concentrations are used for each sample. One set of bottles is incubated in a BOD incubator for 3 days at 20°C; the dissolved oxygen (initial) content (D₁) in the other set of bottles will be determined immediately. At the end of 3 days, the dissolved oxygen content (D₂) in the incubated set of bottles is determined.

Procedure:

Place the set of bottles to be incubated in a BOD incubator for 3 days at 20°C. Care should be taken to maintain the water seal over the bottles throughout the period of incubation. Determine the initial dissolved oxygen contents in the other set of bottles and note down the results. Determine the dissolved oxygen content in the incubated bottles at the end of 3 days and note down the results. Proceed as like titration done in BOD day 1 and note down the titre value. Calculate the BOD of the given sample.

Calculation:

1. COD = 2 to 3 times of BOD

$BOD = COD/3 = \text{expected BOD in mg/l}$

$\text{Total volume required for BOD} = 3/\text{expected BOD} \times 300$

2. $DO = \frac{\text{Burette Reading} \times \text{Normality of Na}_2\text{S}_2\text{O}_3 \times 8000}{200}$

$$\text{BOD} = \text{DO1} - \text{DO3} / \text{Sample volume} \times 300$$

CONCLUSION

In a nutshell, I would like to conclude that this internship was a whole new opening of knowledge. From the first day to the last day of training was an addition of acquiring new information, the work from theoretical to demo all was done in a way which was easy to grab it. The workings of the laboratories from the planning to its operation was also known, in which NABL (National Accreditation Board for Testing and Calibration Laboratories) was the utmost importance. Education is the Key to unlock the world as popular saying, In this internship period I have learned many new things that was out of my core and is well satisfied with the outcome.



HIYOSHI india

Ecological Services Pvt. Ltd.

Certificate of Training

This is to certify that

Ms. R. Nirubama

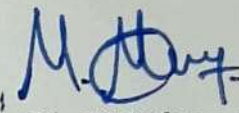
Of

*Sathyabama Institute of Science and Technology (Deemed to
be University), Jeppiaar Nagar, Rajiv Gandhi Salai (OMR),
Sholinganallur, Chennai - 600 119, Tamilnadu, India*

*Successfully completed the "Internship" in the field of Water
and Wastewater analysis at Hiyoshi India Ecological
Services Pvt. Ltd., Chennai - 600 113, Tamilnadu, India*

From 11th to 26th September 2023.




Dr. M. MAYILSAM Y
Director

Serial No: HIES/Sep-2023/01



NPTEL Online Certification

(Funded by the MoE, Govt. of India)



This certificate is awarded to

NIRUBAMA R

for successfully completing the course

Basics in Inorganic Chemistry

with a consolidated score of **57** %

Online Assignments	22.5/25	Proctored Exam	34.37/75
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Total number of candidates certified in this course: **450**

Jan-Feb 2023

(4 week course)

Prof. Sridhar Iyer
Head CDEEP & NPTEL Coordinator
IIT Bombay



Indian Institute of Technology Bombay



Roll No: NPTEL23CY02S34343713

To validate the certificate



No. of credits recommended: 1 or 2



Elite

NPTEL Online Certification

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This certificate is awarded to

NIRUBAMA R

for successfully completing the course

Metals in Biology

with a consolidated score of **68** %

Online Assignments	21.25/25	Proctored Exam	46.5/75
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Total number of candidates certified in this course: **314**

Jul-Sep 2023

(8 week course)

Prof. Sridhar Iyer
Head CDEEP & NPTEL Coordinator
IIT Bombay



Indian Institute of Technology Bombay



Roll No: NPTEL23CY51S45335472

To verify the certificate



No. of credits recommended: 2 or 3