



B.V.RAJU COLLEGE

VISHNUPUR, BHIMAVARAM

DEPARTMENT OF UG CHEMISTRY

1.2.3 – ADD ON / CERTIFICATE PROGRAM

ACADEMIC YEAR

2019-2020

B.V.RAJU COLLEGE
VISHNUPUR, BHIMAVARAM
DEPARTMENT OF UG CHEMISTRY

1.2.2 Number of Add on /Certificate programs offered during the year

1.2.3 Total percentage of students enrolled in Add-on/Certificate programs as against the total number of students during the year

Name of Add on /Certificate programs offered	Course Code (if any)	Year of offering	No. of times offered during the same year	Duration of course	Number of students enrolled in the year	Number of Students completing the course in the year
WATER ANALYSIS		09-07-2019	1	3 MONTHS	22 MEMBERS	22 MEMBERS

CONTENTS

- ❖ BROCHURE OF THE PROGRAM
- ❖ SYLLABUS OF THIS ADD ON COURSE
- ❖ MANUAL FOR THE COURSE
- ❖ ADMITTED STUDENTS LIST
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- ❖ CERTIFICATE-ISSUE

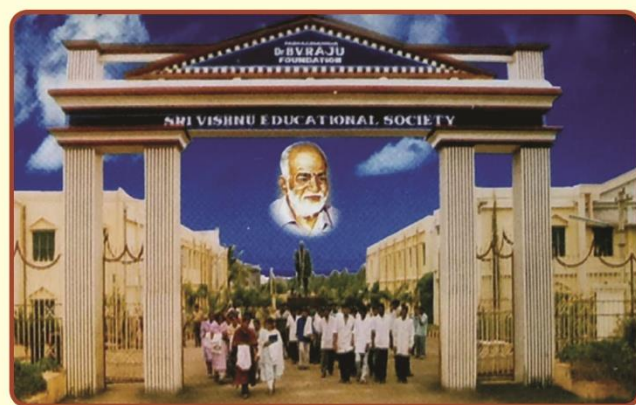
Padmabhushan Dr. B.V.Raju Foundation & Sri Vishnu Educational Society



VISHNU
UNIVERSAL LEARNING

B.V. RAJU COLLEGE

VISHNUPUR - BHIMAVARAM



Our Mission

To Develop A Disciplined Knowledge Society
to Instill Self Confidence and Creativity

COMMENCEMENT OF COURSE:

Normally this 3months course will be offered once in a year which commences from the month of October.

An announcement regarding commencement of course shall be done in every class of III.B.Sc year student prior to two months of the commencement of the course.

Those who are interested can give your names as early as possible to the UG Chemistry department, within the time limit framed from time to time.

ADMISSION CRITERIA:

- * All the III Year B.Sc chemistry stream students.
- * Strength :- Intake of the course is a maximum of 25 Candidates.



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SYLLABUS

Chapter	Title/Method
	Abbreviations
	Scope
I	Physical Parameters
	1. Color
	2. Odour
	3. pH
	4. Total Dissolved Solids
II	General Chemical Parameters
	5. Chloride
	6. Total hardness
	7. Alkalinity
	8. Nitrates
	9. Ammonium

MANUAL

PHYSICAL PARAMETERS

1 COLOUR

Colour is measured by visual comparison of the sample. Colour in water may be due to inorganic ions, such as iron & manganese, humus & peat materials, plankton, weeds and industrial wastes. The term 'colour' is used to mean true colour that is the colour of water from which turbidity has been removed. The term apparent colour includes not only the colour due to substances in solution, but, also that due to suspended matter. Apparent colour is determined on the original sample without filtration or centrifugation.

2 ODOUR

Odour is recognized as a quality factor affecting acceptability of drinking water and food prepared from it, tainting of fish and other aquatic organisms & aesthetes of recreational waters. Most organic and some inorganic chemicals contribute taste or odour. These chemicals may originate from municipal and industrial waste discharges, natural sources, such as decomposition of vegetable matter or from associated microbial activity.

3 pH

pH value is the logarithm of reciprocal of hydrogen ion activity in moles per liter. In water solution, variations in pH value from 7 are mainly due to hydrolysis of salts of strong bases and weak acids or vice versa. Dissolved gases such as carbon dioxide, hydrogen sulphide and ammonia also affect pH value of water. The overall pH value range of natural water is generally between 6 and 8. pH value should preferably be determined at the time of collection of sample. pH metric Method for determination of pH in water. pH Meter with glass with temperature compensation.

Reagents :-Standard pH buffer solutions be prepared using commercially available tablets.

Procedure :-Follow the manufacturer's instructions for operation of pH meter. After required warm-up period, standardize the instrument with a buffer solution of pH near that of the sample and check electrode against at least one additional buffer of different pH value. Measure the temperature of the water and if temperature compensation is available in the instrument adjust it accordingly. Rinse and gently wipe the electrodes with solution. If field measurements are being made, the electrodes may be immersed directly in the sample stream to an adequate depth and moved in a manner to ensure sufficient sample movement across the electrode, the sensing element as indicated by drift free readings (<0.1 pH unit). If necessary, immerse them into the sample beaker or sample stream and stir at a constant rate to provide homogeneity and suspension of solids. Rate of stirring should minimize the air transfer rate at the air- water interface of the sample. Note and record sample pH and temperature. However, if there is a continuous drift, take a second reading with the fresh aliquot of sample without stirring and report it as the pH value.

4 Total Dissolved Solids :- The method employed for TDS measurement is Gravimetric Method. Principle:-

Procedure:-

The sample is filtered and the filtrate evaporated in a tarred dish on Steam bath. The residue after evaporation is dried to constant mass at $103-105^{\circ}\text{C}$ or $179-181^{\circ}\text{C}$. Heat the clean evaporating dish to 180°C for 1 hr. Cool in the desiccator, Weigh and store in the desiccators until ready for use. Filter a portion of the sample. Select volume of the sample which has residue between 25 and 250mg preferably between 100 to 200mg. This volume may be estimated from values of specific conductance to obtain a measurable residue, successive aliquots of filtered sample may be added to the sample dish. Stir volume of sample with a magnetic stirrer or

shake it vigorously. Pipette this volume to a weighed evaporating dish placed on a steam bath. Evaporation may also be performed in a drying oven. The temperature of drying oven shall be lowered to approximately 98°C to prevent boiling and splattering of the sample. After complete evaporation of water from the residue, transfer this dish to an oven at 103-105°C or 179-181°C and dry to constant mass i.e. till the difference in the successive weighing is less than 0.5 mg. Drying for a long duration (usually 1-2 hr) is done to eliminate necessity of checking for constant mass. The time for drying to constant mass with a given type of sample when a number of samples of nearly same type are to be analyzed has to be determined by trial. Weigh the dish as soon as it has cooled avoiding residue to stay for long time as some residues are hygroscopic and may absorb water form desiccant that is not absolutely dry.

CHEMICAL PARAMETERS

5 CHLORIDE :-

Introduction:- The presence of chloride in natural waters can be attributed to dissolution of salt deposits, discharges of effluents from chemical industries, oil well operations and seawater intrusion in coastal areas. Each of these sources may result in local contamination of both surface water and groundwater. The salty taste produced by chloride depends on the chemical compositions of the water. A concentration of 250 mg/L may be detected in some waters containing sodium ions. On the other hand, the typical salty taste may be absent in water containing 1000mg/L chloride when calcium and magnesium ions are predominant. High chloride content may harm pipes and structures as well as agricultural plants. The method employed for Chloride content measurement is Argentometric Method.

Principle:-

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

Apparatus:-

Reagents :-

Erlenmeyer flask — 250 mL. Burette — 50 mL.

- a) Potassium chromate indicator solution :- Dissolve 50 gm of potassium chromate in a little distilled water. Add silver nitrate solution until a definite red precipitate is formed. Let it stand for 12 hr, filter and dilute to 1 liter with distilled water.
- b) Standard silver nitrate titrant :- 0.0141 N. Dissolve 2.395 gm of silver nitrate in distilled water and dilute to 1 liter. Standardize against 0.0141N sodium chloride solution. 1.00 mL = 500 µg of chloride. Store in a brown bottle.
- c) Standard sodium chloride solution:- 0.0141 N. Dissolve 824.0 mg of sodium chloride (dried at 140°C) in distilled water and dilute to 1 liter.

Procedure:-

- 1) Use 100 mL sample or a suitable portion diluted to 100 mL. If the sample is highly colored, add 3 mL of aluminium hydroxide suspension, mix, let settle and filter.
- 2) If sulphide, sulphite or thiosulphate is present, add 1 mL of hydrogen peroxide and stir for 1 minute. Directly titrate the samples in the pH range 7 to 10.
- 3) Adjust sample pH to 7-10 with sulphuric acid or sodium hydroxide if it is not in the range.
- 4) Add 1.0 mL of potassium chromate indicator solution.
- 5) Titrate with standard silver nitrate solution to a pinkish yellow end point. Standardize silver nitrate solution and establish reagent blank value by titration method.

Calculation :-

$$\text{Chloride, mg/L} = \frac{(v_1 - v_2) \times N \times 35450}{V_3}$$

Where V_1 = Volume in mL of silver nitrate used by the sample.

V_2 = Volume in mL of Silver nitrate used in the blank titration .

V_3 = volume in mL of sample taken for titration.

N = Normality of silver nitrate solution.

TOTAL HARDNESS :-

Introduction:- Water hardness is a traditional measure of the capacity of water to precipitate soap. Hardness of water is not a specific constituent but is a variable and complex mixture of cations and anions. It is caused by dissolved polyvalent metallic ions. In fresh water, the principal hardness causing ions are calcium and magnesium which precipitate soap. Other polyvalent cations also may precipitate soap, but often are in complex form, frequently with organic constituents, and their role in water hardness may be minimal and difficult to define. Total hardness is defined as the sum of the calcium and magnesium concentration both expressed as CaCO_3 in mg/L. The degree of hardness of drinking water has been classified in terms of the equivalent CaCO_3 concentration as follows:

Soft	0-60 mg/L
Medium	60-120 mg/L
Hard	120-180 mg/L
Very Hard	>180 mg/L

Although hardness is caused by cation, it may also be discussed in terms of carbonate (temporary) and non-carbonate (permanent) hardness. Carbonate hardness refers to the amount of carbonates and bicarbonates in solution that can be removed or precipitated by boiling. This type of hardness is responsible for the deposition of scale in hot water pipes and kettles. When total hardness is numerically greater than that of total alkalinity expressed as CaCO_3 the amount of hardness is numerically equal to less than total alkalinity is called carbonate hardness. When the hardness is numerically equal to less than total alkalinity, all hardness is carbonate hardness. The amount of hardness in excess of total alkalinity expressed as CaCO_3 is non-carbonate hardness. Non-carbonate hardness is caused by the association of the hardness-causing cation with sulphate, chloride or nitrate and is referred to the "permanent hardness". This type of hardness cannot be removed by boiling. Public acceptability of the degree may vary considerably from community depending on local conditions, and the association. The taste threshold for magnesium is less than that for calcium.

Methods for determination of total hardness in water are prescribed:-

- Titrimetric Method
- Method based on Analytical Data

Principle:-

Titrimetric Method (EDTA method for determination of total hardness) :-

It depends on ability of ethylenediamine tetra acetic acid ($\text{C}_{10}\text{H}_{16}\text{O}_8\text{N}_2$) or its disodium salt to form stable complexes with calcium and magnesium ions. When the dye eriochrome black T (EBT) ($\text{C}_{20}\text{H}_{13}\text{N}_3\text{O}_7\text{S}$) is added to solution containing calcium and magnesium ions at pH 10.0, a wine red complex is formed, this solution is titrated with standard solution of disodium salt of EDTA, which extracts calcium and magnesium from the dye complex and the dye is changed back to its original blue colour. Eriochrome black T is used to indicate the end point for the titration of calcium and magnesium together.

Apparatus:-

Reagents :-

Purity of the reagents. Unless specified otherwise only pure chemicals and tannin free distilled water shall be used in tests.

- Buffer solution:** Dissolve 16.9 gm ammonium chloride in 143 mL concentrated ammonium hydroxide, add 1.25 gm of magnesium salt of EDTA and dilute to 250 mL with distilled water. Store the solution in a polyethylene bottle tightly stoppered to prevent loss of ammonia or pick up of carbon dioxide for no longer than 1 month. Dilute 10 mL of the solution to 100 mL with distilled water and check that the pH value is 10.0 ± 0.1 . In the absence of magnesium salt of EDTA dissolve 1.179 gm disodium salt of EDTA and 780 mg magnesium sulphate or 644 mg magnesium chloride in 50 mL of distilled water. Add this solution to 16.9 gm ammonium chloride and 143 mL concentrated ammonium hydroxide with mixing and dilute to 250 mL with distilled water. To attain the highest accuracy adjust to exact equivalence through appropriate addition of a small amount of EDTA or magnesium sulphate or chloride the exact amount can be determined by taking an appropriate aliquot of buffer and titrate it with disodium salt of EDTA as above. Keep the solutions tightly stoppered to prevent loss of ammonia or absorbance of carbon dioxide and do not store for more than a month. Dilute 10 mL of the solution to 100 mL with distilled water and check that the pH value is 10.0 ± 0.1 .

- b) **Eriochrome black T indicator solution:** Dissolve 0.40 gm Eriochrome black T and 4.5 gm hydroxylamine hydrochloride in 100mL 95% ethanol.
- c) **Standard EDTA solution:** Dissolve 3.723gm EDTA which has been dried overnight in sulphuric acid desiccators, in demineralized water and dilute to 1000mL. The reagent is stable for several weeks and large volume is usually prepared. Check the reagent by titrating 25 mL of standard calcium solution as described above. Store in polyethylene bottles.

Procedure:-

- 1) **Standardization:** Pipette 25 mL of standard calcium solution in a porcelain basin and adjust the volume to 50 mL with distilled water. Add 1 mL buffer solution, add 1 to 2 drops of indicator, titrate slowly with continuous stirring until the reddish tinge disappears. adding last few drops at 3 to 5 second interval. At the end point the color is sky blue.
- 2) Pipette an aliquot of water sample maximum 50 mL in a porcelain dish or 150 mL beaker and adjust the volume to approximately 50 mL. Add 1 mL hydroxylamine hydrochloride solution.
- 3) Add 1 to 2 mL buffer solution so as to achieve pH of 10.0 to 10.1.
- 4) Add 2 mL Eriochrome black T indicator solution.
- 5) Titrate with standard EDTA solution stirring rapidly in the beginning and slowly towards the end till end point is reached when all the traces of red and purple color disappear and solution is clear sky blue in color. Blank titration carried out in a same way as that for sample may be used for comparison.

Calculation :-

Calculate the hardness as follows

$$\text{Total hardness as (CaCO}_3\text{), mg/L} = [1000(V_1 - V_2)/V_3] \times \text{CF}$$

Where V_1 = volume in mL of the EDTA standard solution used in the titration for the sample

V_2 = volume in mL of the EDTA solution used in the titration for blank.

V_3 = volume in mL of the sample taken for the test

CF = X_1/X_2 correction factor for standardization of EDTA.

X_1 = volume in mL of standard calcium solution taken for standardization

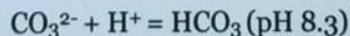
X_2 = volume of mL of EDTA solution used in the titration.

7 **ALKALINITY :-**

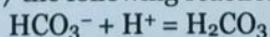
Introduction:- Alkalinity of sample can be estimated by titrating with standard sulphuric acid (0.02N) at room temperature using phenolphthalein and methyl orange indicator. Titration to decolourisation of phenolphthalein indicator will indicate complete neutralization of OH^- and $\frac{1}{2}$ of CO_3^{2-} while sharp change from yellow to orange of methyl orange indicator total alkalinity (complete neutralization of OH^- , CO_3^{2-} , HCO_3^-)

Principle:-

Alkalinity of water is the capacity of the water to accept protons. It may be defined as the quantitative capacity of an aqueous medium to react with hydrogen ions to pH 8.3 (phenolphthalein alkalinity) and then to pH 3.7 (total alkalinity or methyl orange alkalinity). The equation in its simplest form is as follows:



From pH 8.3 to 3.7 the following reaction may occur:



Apparatus:-
Reagents :-

a) **Distilled Water** – Distilled water used should have pH not less than 6.0. If the water has pH less than 6.0, it shall be freshly boiled for 15 minutes and cooled to room temperature. Deionized water may be used provided that it has a conductance of less than 2 $\mu\text{s/cm}$ and a pH more than 6.0.

b) **Sulphuric Acid** - Dilute 5.6 mL of concentrated sulphuric acid (relative density 1.84) to 1 liter with distilled water.

c) Standard solution of sulphuric acid - 0.02N

d) **Phenolphthalein indicator** - Dissolve 0.5 gm of phenolphthalein in 100mL, 1:1 (v/v) alcohol water mixture.

f) **Mixed indicator solution:** Dissolve 0.02gm methyl red and 0.01gm bromocresol green in 100mL, 95 percent, ethyl or isopropyl alcohol.

Procedure:-

- 1) Pipette 20 mL or a suitable aliquot of sample into 100 mL beaker.
- 2) If the pH of the sample is over 8.3 then add 2 to 3 phenolphthalein indicator and titrate with standard sulphuric acid solution till the pink color observed by indicator just disappears (equivalence of pH 8.3).
- 3) Record the volume of standard sulphuric acid solution used. Add 2 to 3 drops of mixed indicator to the solution in which the phenolphthalein alkalinity has been determined.
- 4) Titrate with the standard acid to light pink color (equivalence of pH 3.7). Record the volume of standard acid used after phenolphthalein alkalinity.

Calculation :-

Calculate the alkalinity in the sample as follows

$$\text{Phenolphthalein alkalinity (as mg/L of CaCO}_3\text{)} = \frac{A \times N \times 50000}{V}$$

$$\text{Total alkalinity (as mg/L CaCO}_3\text{)} = \frac{(A+B) \times N \times 50000}{V}$$

Where

A= mL of standard sulphuric acid used to titrate to pH 8.3

B= mL of standard Sulphuric acid used to titrate from pH 8.3 - 3.7

N= normality of acid Used

V= volume in mL of sample taken for test.

ADMITTED STUDENTS LIST

The following is the list of students who opted "WATER ANALYSIS".

<u>S.NO</u>	<u>REGISTER NUMBER</u>	<u>NAME OF THE STUDENT</u>
1	173117101003	B.UMESWARI
2	173117101006	B.GOWTHAMI
3	173117101007	B.NEELIMA
4	173117101010	D.NAVEEN KUMAR
5	173117101013	G.M.S.VIJAY CHARAN
6	173117101017	I.SYAM
7	173117101019	K.NITEESH
8	173117101026	K.PRABHU DEVA
9	173117101028	M.VENKATESH
10	173117101032	N.NAVYA BHASKARA
11	173117101036	P.LAKSHMI SUKQANYA
12	173117101038	P.JYOTHI
13	173117101040	PNV VARAKUMAR
14	173117101043	R.LOKESH SAI MANIKANTA
15	173117101045	R.SWETHA APARNA
16	173117101046	R.LAKSHMI KANTHAM
17	173117101050	T.PRAMEELA
18	173117101051	T.PAVAN
19	173117101052	U.MANOJ VARMA
20	173117101053	U.SUPRIYA
21	173117101054	U.RAMBABU
22	173117101056	V.DAYANA

EXECUTION PROCESS

“Students have to submit a single Project report collectively”

DATE OF COLLECTION OF SAMPLE :- 14.10.2019
DATE OF ANALYSIS OF SAMPLE :- 14.10.2019

S.NO	VARIOUS PARAMETERS							Ca ²⁺	Mg ²⁺
	HARDNESS	pH	ALKALINITY	ACIDITY	CHLORIDES	NITRATES	CALCIUM	MAGNESIUM	
PERMITTED LEVELS	<80 PPM	6.5-7.8	<50 PPM	< 10 PPM	<20 PPM	< 20 PPM	< 40ppm	< 40 PPM	
RAW WATER	40	6.5	25	NIL	8.5	4	20	20	
PRODUCT WATER	35	6.8	20	NIL	4.5	2	25	10	

ANALYSED BY

brilaf
14.10.2019

Principal
PRINCIPAL

SAMPLE
COPY

CERTIFICATE

“Certificate will be given to Students on Letter Head”




B.V. Raju College

(Formerly Dr. B.V. Raju Institute of Computer Education)
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This is to certify that Mr. /Ms. B. NEELIMA
of III B.Sc with Group M.P.C, has been duly completed “Water analysis”
Add-on Certificate Course commenced on 2019-2020
Academic Year.


HOD


Vice-Principal


PRINCIPAL
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Vishnupur, BHIMAVARAM-534 202



SAMPLE
COPY