ENVIRONMENTAL ENGINEERING LAB

CIVIL ENGINEERING
SUB:CODE-413

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1. ALKALINITY

AIM

To determine the alkalinity of given sample of water in mg/l

PRINCIPLE

Alkalinity is determined by titrating the sample with a standard solution of a strong mineral acid to bicarbonate and carbonic acid equivalence point.Alkalinity is expressed in terms of $CaCO_3$ equivalent.For samples whose P^H is above 8.3, titration is done in two steps. In the first step the P^H is lowered to 8.3,which is indicated by phenolphthalein indicator losing the pink colour and becoming colourless.In the second phase of titration the P^H is lowered to about 4.5,which is indicated by methyl orange indicator changing colour from yellow to orange red

APPARATUS REQUIRED

1.Burette

2.Pipette

3.Erlenmeyer flask

REAGENTS

1.Sulphuric acid 0.02N

2.sodium thiosulphate 0.1

PROCEDURE

1.Take 20 ml of the given sample in Erlenmeyer flask(v)

2.Add 1 drop of 0.1N sodium thiosulphate solution to remove the free chlorine if present

3.Add 2 drops of phenolphthalein indicator.The sample turn pink if the P^H is above 8.3

4.Run down 0.02N standard sulphuric acid till the solution turn to colourless

5.Note down the volume of H_2SO_4added (v_1)

6.Add 2 drops of methyl orange indicator the sample turns yellow

7.Repeat titration till the colour of the solution turns to orange

8.Note down the total volume of H_2SO_4 added (v_2)

OBSERVATIONS AND CALCULATIONS

Sl no.	Sample no.	Volume of sample (v)	Initial burette reading(ml)	Final burette reading(ml)	Volume of H_2SO_4 (ml)	Alkalinity (mg/l)

Phenolphthalein alkalinity expressed as mg/l ($CaCO_3$)

$$P=(V_1X50X1000X0.02N)/\text{vol.of sample used(ml)}$$

Methyl orange alkalinity expressed as mg/l ($CaCO_3$)

$$M=(V_2X50X1000X0.02N)/\text{vol.of sample used(ml)}$$

Total alkalinity expressed as mg/l ($CaCO_3$)

$$T=(V_3X50X1000X0.02N)/\text{vol.of sample used(ml)}$$

RESULT

Phenolphthalein alkalinity expressed as mg/l ($CaCO_3$) =

Methyl orange alkalinity expressed as mg/l ($CaCO_3$) =

Total alkalinity expressed as mg/l ($CaCO_3$) =

2.CHLORIDES

AIM

To determine the chloride content of the given sample by Mohr's method

PRINCIPLE

Chloride ion is determined by Mohr's method,titration with standard silver nitrate solution in which silver chloride is precipitated first.The end of titration is indicated by formation of red silver chromate from excess $AgNO_3$ and potassium chromate used as an indicator in neutral to slightly alkaline solution

$AgNO_3+Cl^- \rightarrow AgCl+NO_3^-$

$2AgNO_3+ K_2CrO_4 \rightarrow Ag_2CrO_4+2KNO_3$(Reddish Brown)

APPARATUS

1.Burette

2.Pipette

3.Erlenmeyer flask

REAGENTS

1.Standard silver Nitrate 0.0141N

2.Sodium Chloride 0.014N

3.Potassium Chromate indicator

PROCEDURE

1.Take 20 ml sample in erlenmeyer flask

2.Adjust its P^H to be between 7.0 and 8.0 either with sulphuric acid or sodium hydroxide solution.Other wise, AgOH is formed at high P^H level or CrO_4^{-2} is converted $Cr_2O_7^{-2}$ at low P^H level

3.Add 1ml of potassium Chromate to get light yellow colour

4.Titrate withStandard silver Nitrate solution till colour change from yellow to brick red

5.Note the volume of silver Nitrate added(A)

6.For better accuracy ,titrate distilled water in the same manner

7.Note the volume of silver Nitrate added for distilled water(B)

OBSERVATIONS AND CALCULATIONS

Sl no.	Sample no.	Volume of sample (v)	Initial burette reading(ml)	Final burette reading(ml)	Volume of $AgNO_3$ (ml)	Chlorides (mg/l)

Chloride (mg/l) =[(A-B)X35.450X0.0141X1000]/Volume of sample(ml)

Where

A=Volume of Silver Nitrate solution consumed in water sample(ml)

B= Volume of Silver Nitrate solution consumed in distilled water sample(ml)

RESULT

Chloride value of sample =

3.HARDNESS

AIM

To determine the hardness of the given sample by EDTA Titrimetric method

PRINCIPLE

EDTA and its sodium salt form a compound when added to a solution of certain metal cations.If a small amount of dye such as Eriochrome black T is added to an aqueous solution containing small calcium and magnesium ions at a P^H of a 10±0.50 the solution become wine red.If EDTA is added then Ca and Mg will be complexed .When all these two ions are completed the solution will turn blue. This is the end point of titration. The higher the P^H sharper the end point,however above P^H10 ,there is a danger of precipitation of calcium carbonate and magnesium hydroxide.Hence the P^H is fixed at 10±0.50.

APPARATUS

1.Burette

2.Pipette

3.Erlenmeyer flask

REAGENTS

EDTA Solution 0.01M

PROCEDURE

1.Take 20 ml well mixed sample in erlenmeyer flask

2.Add 1 to 2 ml buffer solution so as to bring the P^H to 10+0.50 or 10-0.50

3.Add 2 drops Eriochrome black T indicator solution.The solution turns wine red in colour

4.Titrate against standard EDTA till wine red colour just turns blue.Note down the volume (v)

OBSERVATIONS AND CALCULATIONS

Sl no.	Sample no.	Volume of sample (v)	Initial burette reading(ml)	Final burette reading(ml)	Volume of EDTA (ml)	Hardness (mg/l)

Hardness as $CaCO_3$ =($v_1$xsx1000)/V mg/l

Where v_1= ml of titrant used

S=mg of $CaCO_3$ equivalent to 1ml of EDTA solution=1mg $CaCO_3$

V=volume of sample

RESULT

1.Hardness as $CaCO_3$ =

4. P^H OF WATER

AIM

To determine the P^H of given sample using P^H–paper and digital P^H meter

PRINCIPLE

P^H refers to the hydrogen ion activity.It is expressed as the negative logarithm of the reciprocal of the hydrogen ion activity in moles per litre. It can be measured by P^H paper or electrometrically by measuring of hydrogen ion by potentiometric measurement using a standard hydrogen electrode and a reference electrode

APPARATUS REQUIRED

P^H meter along with electrodes

Buffer solution

Thermometer

P^H paper

REAGENT

STANDARD BUFFER SOLUTION:preparation of buffer solution :standard solution can be prepared freshly by dissolving the standard buffer tablets or powders(P^H 4 and 7.2)

PROCEDURE

USING P^H METERS:

Take the liquid sample which the P^H is to be determined in a glass beaker.

Note the sample temperature.Rinse the electrode thoroughly with distilled water and carefully wipe with a tissue paper.dip the electrode in to the sample solution

USING P^H METERS:

Dip the P^H paper strip in to the solution.compare the colour given on the wrapper of the P^H paper book. Note down the P^H of the sample along with temperature.

RESULT

P^H value of sample using P^H paper =

P^H value of sample using P^H meter =

5. RESIDUAL CHLORINE

AIM

to determine the amount of total residual chlorine present in the given sample of chlorinated water by starch Iodide method

PRINCIPLE

Chlorine will liberate free Iodine from Potassium Iodide solution at P^H 8.0 or less.The liberated Iodine is titrated against standard sodium thiosulphate with starch as indicator

APPARATUS REQUIRED

1.Burette

2.Pipette

3.Erlenmeyer flask

REAGENTS

1.Concentrated Acetic acid

2.Potassium Iodide

3.Sodium Thiosulphate (0.025N)

4.Starch solution

5.Iodine solution (0.025N)

PROCEDURE

1.Take 25 ml of sample in an Erlenmeyer flask

2.Add 5ml of Acetic acid to bring P^H 3.0 to 4.0

3.Add 1gm of potassium iodide and mix thoroughly.Yellow colour is obtained

4.Titrate against standard sodium thiosulphate solution in the burette until a pale yellow colour is obtained

5.At these stages add 1ml of starch indicator and continue the titration till the blue colour disappears.Note down the volume(vV1)

RESULT

Turbidity of sample =

6. TOTAL SOLIDS

AIM

To determine the total suspended solids,total dissolved solids and total solids of given sample

PRINCIPLE

Determination of total solids is made by evaporating and drying of a measured sample in an oven at 105^0C for a period of 1 hour.Since water for potable use contains small amount of suspended mater,it is usual to filter a sample of water and determine solids in filtrate by the fore going method. The difference between total solids in unfiltered and filtered samples are taken as measure of the suspended solids is also classified as volatile or organic solids and fixed or inorganic solid

APPARATUS

1.Standard beaker

2.Conical Flask

3.Filter paper

4.Digital balance

5.Oven

6.Water quality analyzer

PROCEDURE

SUSPENDED SOLIDS

1.Take 25 ml of sample in beaker

2.Note the weight of properly dried filter paper (W_1)

3.Properly fold and place the filter paper on the Erlenmeyer flask

4.Pour the sample trough the filter paper and filter it completely

5.Transfer the filter paper to an oven at105^0C for one hour

6.Note the weight of dried filter paper (W_2)

7.The difference between the above two weight gives the suspended solids(W_3)

DISSOLVED SOLIDS

1.Take suitable quantity of sample in a beaker

2.Switch on the water quality analyzer and dip the concerned electrode in the sample

3.After few minuts note the digital reading,which gives the amount of dissolved solids in mg/l (W_4)

TOTAL SOLIDS

1.Add suspended solids (w_3) and dissolved solids(w_4) which gives total solids

RESULTS

1.Total suspended solids in the sample =

2.Total dissolved solids in the sample =

3.Total solids in the sample =

TURBIDITY

AIM

to determine the turbidity of the given sample using nephelometer in N.T.U

PRINCIPLE

Turbidity can be measured either by its effects on the transmission of light which is termed as turbidimetry or its effects on the scattering of light which termed as Nephelometry.Turbidimetry can be used for sample with moderate turbidity and Nephelometer for sample with low turbidity.Higher the intensity of scattered light higher the turbidity.

APPARATUS REQUIRED

Nephelometric turbidimeter

Cuvettes ti take the samples for measurements

REAGENTS

- Solution (1) dissolve 1 g hydrazine sulphate in distilled water and dilute to 100 ml in volumetric flask
- Solution (2) dissolve 10g hexamine LR grade in distilled water and dilute to 100ml in volumetric flask
- In 100ml volumetric flask ,mix 12.5 ml solution (1)and 12.5 ml solution(2) .let them stand for 24 hours at 25^0 dilute to mark and mix.the turbidity of the suspension is 1000 NTU

PROCEDURE

CALIBERATION:

- Switch on the instrument and keep it on for some time
- Select appropriate range depending upon the expected turbidity of the sample.
- Set zero of the instrument with turbidity free water using a blank solution and adjust 000 with set zero knob.
- Now in another test tube take standard suspension just prepared as above for 0 – 200 NTU solution as standard.
- Take its measurements and set the the display to the value of the standard suspension with the caliberate knob.

MEASUREMENTS:

To determine the turbidity of water sample place the sample in the cuvette and note the displayed reading .if water has high turbidity it can be suitably diluted and must be shaken before determination.

CALCULATION:

Turbidity = A (B + C) / C

A = NTU found in diluted sample

B = volume of dilution water

C = sample of volume taken for dilution

RESULT

Turbidity of sample =