Department of Chemical Engineering, Veer Surendra Sai University of Technology Burla

Environmental Engineering
(Lab Manual)

List of Experiments

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Department of Chemical Engineering, Veer Surendra Sai University of Technology Burla

Experiment No. 1

Aim of the experiment: To determine the alkalinity of a given water sample.

Apparatus Required:

1. Burette
2. Pipette
3. Beaker(100ml)

Chemicals Required:

1. Sulphuric Acid, H2SO4 (0.02N)
2. Phenolphthalein indicator
3. Methyl Orange indicator

Theory:

Alkalinity is defined as the quantity of ions in water that will react to neutralize hydrogen ions. Alkalinity is thus a measure of the ability of water to neutralize acids. Constituents of alkalinity in natural water systems include carbonate, bicarbonate, hydroxide, hyposilicate, hypoborate, hypophosphate, hydrogen sulphide. These compounds result from the dissolution of mineral substances in the soil and atmosphere. Phosphates may also originate from detergents in wastewater discharges and from fertilizers and insecticides from agricultural land. Hydrogen Sulphide may be products of microbial decomposition of organic material. By far the most common constituents of alkalinity are bicarbonates, carbonates, and hydroxide. In addition to their mineral origin, these substances can originate from CO_2, a constituent of the atmosphere and a product of microbial decomposition of organic material.

Alkalinity is measured volumetrically by titration with N/50 or 0.02N H_2SO_4 and is reported in terms of equivalent $CaCO_3$. For samples whose initial pH is above 8.3, the titration made in two steps. In the first step, the titrated is conducted until the pH is lowered to 8.3, the point at which phenolphthalein turns from pink to colorless. The second phase of titration is conducted until the pH is lowered to about 4.5, corresponding to methyl orange end point. When the pH of the sample is less than 8.3, a single titration is made up to pH 4.5.

Significance:

1. The alkalinity of water has little public health significance. Highly alkaline waters are usually unpalatable and consumers tend to seek other supplies.
2. Chemicals used for coagulation of water and wastewater react with water to form hydroxide precipitates. The hydrogen ions released react with the alkalinity of the water. Thus, the alkalinity acts to buffer the water in pH range where the coagulant can be effective. Alkalinity must be present in excess of that destroyed by the acid released by the coagulant for effective and complete coagulation to occur.
3. Alkalinity is a major item that must be considered in calculating the lime and soda ash requirements in softening of water by precipitation methods.
4. Alkalinity is an important parameter involved in corrosion control.
5. Alkalinity measurements are made as a means of evaluating the buffering capacity of waste water and sludge. They can also be used to access the ability of natural water to resist the effects of acid rain.
6. Municipal authorities prohibit the discharge sewers. Alkalinity is an important factor in determining the amenability of waters to biological treatment.

Procedure:

1. 20ml of sample was pipetted into a 100 ml beaker and 2 to 3 drops of phenolphthalein indicator is added to it.

2. The sample was titrated with standard sulphuric acid till the pink colour observed by phenolphthalein indicator just disappears.
3. The volume (A) of standard H_2SO_4 acid solution used was recorded and used to determine the phenolphthalein alkalinity has been determined.
4. 2 to 3 drops of mixed indicator were added to the solution in which the phenolphthalein alkalinity has been determined.
5. The titration was carried out with standard H_2S0_4 to light pink colour. The volume (B) of acid used for this is recorded.

Observation:-

Sl no	Name of the sample	Source of the sample	Alkalinity of the sample	remark

Calculation:

Phenolphthalein alkalinity = $(A \times N \times 5000)/V$ as mg/L of $CaCO_3$.

Total alkalinity = $(A+B)\ N \times 5000/V$ as mg/L of $CaCO_3$.

where,

A = ml of standard H_2SO_4 acid used to titrate upto phenolphthalein end point.

B = ml of standard H_2SO_4 acid used to titrate upto mixed indicator end point.

N = normality of acid used.

V = Volume in ml of water sample taken for the test.

Given,

N = 0.02N (normality of H_2SO_4)

V = 20ml of the given water sample

A and B were noted from the observation table.

Result:

The alkalinity of the given water samples were found to be _____ mg/L of $CaCO_3$.

Experiment No. 2

Aim of the experiment: To determine the acidity of a given water sample.

Apparatus required:

1. Burette
2. Pipette
3. Beaker (100 ml)

Chemicals required:

1. Sodium hydroxide solution, NaOH (0.02N)
2. Methyl orange indicator
3. phenolphthalein indicator

Theory:

Acidity of water is its quantitative capacity to react with a strong base to a designatedpH. It may be defined as the equivalent concentration of hydrogen ion inmg/L. Acidity of neutral water is caused by carbon dioxide or by strong mineral acids, the former being the effective agent in water having pH value greater than 4 and the latter the effective agent in water with pH value less than 4. Natural water and most industrial wastewater that have a pH value below4, contain mineral or methyl orange acidity. Mineral acid are essentially neutralised by the time the pH has been raised to about3.7. Results are reported in terms of methyl orange acidity expressed as$CaCO_3$. Since $CaCO_3$ has an equivalent weight of $50, N/50$ or 0.02N NaOH is used as the titrating agent so that 1mL is equivalent to 1mg of acidity. Titration of a sample to phenolphthalein end point of pH 8.3 measures both mineral acidity plus acidity due to weak acids. This total acidity is also termed as phenolphthalein acidity.

Significance:

1. Acidic waters are of concern because of their corrosive characteristics and the expense involved in removing or controlling the corrosion-producing substance. The corrosive factor in most waters is carbon dioxide, but in many industrial wastewaters, it is mineral acidity.
2. In the development of new public water supplies, the carbon dioxide acidity is an important factor that must be considered in the treatment method and the facilities needed.
3. Many underground supplies require overcoming corrosive characteristics resulting from carbon dioxide. The amount present in an important factor in determining whether removal by aeration or simple neutralization with lime or sodium hydroxide will be chosen as treatment method.
4. The quantities of chemicals, size of chemical feeders, storage space and cost of treatment are determined from the laboratory data base on acidity.
5. When biological processes of treatment are used, the pH must be maintained in between 6 to 8.5. This criterion often requires adjustments of pH to favourable levels and calculation of the amount of chemical needed is based upon acidity values in most cases.

Procedure:

1. 20m'l of sample is pipette into a 100ml beaker and 2 to 3 drops of methyl orange indicator is added to it.

2. The sample is titrated with standard sodium hydroxide solution till the colour changes to faint orange.
3. The volume (A) of standard sodium hydroxide solution used is recorded and used to determine the methyl orange acidity.
4. 2 to3 drops of phenolphthalein indicator are added to the solution in which the methyl orange acidity as been determined.
5. The titration is carried out with standard sodium hydroxide solution to the appearance of faint pink colour. The volume of (B) of sodium hydroxide used for this is recorded.

Observation:-

Sl no	Name of the sample	Source of the sample	Acid value	remark

Calculation

For calculation of acidity of given sample

Acidity of indicator

Methyl orange (indicator acidity) = {(a x n x 50000) ÷v} mg/l of $caco_3$

Total acidity = {(a+b) x n x 50000}/v mg/l of $caco_3$

Where

A -ml of standard NaOH solution used to titrate methyl orange end point

B-ml of standard NaOH solution used to titrate upto phenolphthalein end point

N-normality of sodium hydroxide used

V=volume in ml of sample taken for test

Result

Therefore the acidity of the given sample is found to be _____

Conclusion

Discuss the result obtained above of different samples and arrange the acidity in a particular order.

Experiment – 3

Aim of the experiment: To determine the pH value of the given samples of Water

Apparatus required:

1. Test tube
2. Beaker
3. Electrometric apparatus

Theory:

pH is the term used universally to express the intensity the acidity and alkalinity of a solution. It is a way expressing hydrogen ion concentration or more precisely hydrogen in activity. pH is the negative logarithm of hydrogen ion concentration to base 10.

$pH = -\log_{10} [H^+]$

-Higher pH value means lower H+ ion concentration.

- Entire concentration of H^+ ions does not correspond to the measurement of pH due to ionic interaction among themselves. Measurement of pH of water relates only to the active portion of the H+ ion concentration .Water is a poor electrolyte and only a small portion of it dissociates as

$$H2O \rightarrow H^+ + OH^-$$

- According to the law of mass action of physical chemistry ionization constant k at equilibrium

Is given by

$$K=[H^+][OH^-] /H_2O$$

- At 25°c value of k is $1.82 * 10^{-16}$ and density of water is 0.997 gm/cm^3.

- Molar concentration of water in 1 liter = 997/18 = 55.39

Moles/Liter $[H +][OH -] =k[H2O]= 1.82*10^{-16} *55.39$

$=1.0*10^{-14}$

-In pure water the concentration of H^+ ion and OH^- ion are equal or $[H^+] = [OH^-]=10^{-7}$ moles/liter i.e. Concentration of H^+ or OH^- per litre of pure water is $1/10^7$ moles.

-But this figure inconvenient for use. Therefore, logarithm of its reciprocal is used for indicating the pH value accordingly, pH of neutral water

$$Log_{10} (1/[H^+])=7$$

- When the pH value is in between 0 to 7, water is acidic and when the pH value is in between 7to 14, water is alkaline

Significance:-

1. In the coagulation process, chemicals used have higher efficiencies within a certain pH value range. Hence determination and adjustment of pH is very important for effective and economic coagulation.
2. In corrosion control, the pH of water should be maintained at appropriate level as water of low pH is highly corrosive and damages the pipe lines and valves etc.
3. In disinfection of water by excessive line treatment.
4. In water softening process by lime soda.
5. In sewage and industrial waste treatment employing biological treatment:
6. The portability of water also depends on pH value

Determination pH by electrometric method:-

Principle:-

The basic principle of electrometric pH measurement is determination of the activity of the hydrogen ion by potentiometric measurement using a standard hydrogen electrode and a reference electrode. It consists of potentiometer, glass, electrode, a reference electrode and a temperature compensating device to complete pH meter.

Procedure:-

1. Before use the electrode was rinsed blot and dried using a soft tissue paper.
2. The instrument was cal liberated with standard buffer solution (7.0 pH).
3. Then the electrode was removed from standard solution to rinsed blot and dry.
4. The electrode was dipped in the sample whose pH was to be measured.
5. The sample was stirred to ensure homogeneity and to minimize CO_2 entrainment.
6. Finally pH was noted from the reading of the pH meter.

Tabulation:-

(pH of the samples are noted at 29.1^0c)

SL.NO	Name of the sample	Source	Ph
01	Sample-1	Industrial Water	6.78

02	Sample-2	Drainage Water	7.13
03	Sample-3	Muddy Water	6.75
04	Sample-4	Tap Water	7.67

Result:-

The pH of laboratory waste was found out to be 6.78 for industrial water, 7.13 for drainage water, 6.75 for muddy water and 7. 67 for tap water at temperature 29.1^0c

Discussion:

1) Is pH of water affected by rise in temperature?

Ans) Temperature plays a significant role on pH measurement. As the temperature rises molecular vibration increases, which result in the ability of water to ionize and form hydrogen ions in the ability of water to ionize and form hydrogen ion . Yes, it does change the pH as a result it drops down.

2) Define pH.

Ans) pH is a scale used to specify how acidic or basic a water-based solution .As it is the negative logarithm of the hydrogen ion concentration.

$$pH = \log_{10} [H^+]$$

3) What do you mean by pOH?

Ans) The ‘p’ means potential and ‘OH’ means hydroxide OH^- in the hydrogen ion. pOH is the inverse log of the concentration hydroxide in a solution.

$$P[OH] = -\log_{10} [OH^-] .$$

Experiment No. 4

Aim of the experiment: To determine the hardness of the given water samples.

Apparatus Required:

1. Burette,
2. Bottle with stopper and
3. pipette

Chemicals required-

1. Soap Solution (Wanklyn solution)

Theory

Hardness are generally considered to be those water which are required considerable amount of soap to produce a foam as lather. Hardness is caused due to the multivalent metallic cations in the solution. The multivalent metallic ions are most abundant in natural waters are calcium and magnesium. Other may include in the form of fe^{2+}, Sr^{2+}, Mn^{2+} and Al^{3+}. The latter are found in much smaller quantities than calcium and magnesium and for all practicle purposes, hardness may be represented as the sum of the calcium and magnesium ions.

Hardness are classified as carbonate and non-carbonate hardness, depending upon the anions with which it associates. The hardness which is equivalent to alkalinity as termed as carbonate hardness, with any remaining hardness being called as non-carbonate hardness. The temporary hardness or the water containing carbonates and bicarbonates can be simply removed by just adding lime to it or by boiling it. Such hardness is called temporary hardness or carbonate hardness. The Sulphates, chlorides and nitrates of calcium and magnesium by simple boiling and it requires special treatment for softening such hardness is known as permanent hardness or non-carbonate hardness.

Hardness is measured in mg/l of caco3 and depending upon that value, water is classified as follows:-

Classification of water hardness

Soft	0-75
Moderately hard	75-150
Hard	150-300
Very hard	>300

Significance-

1. Soap consumption by hard water represents an economic loss to the water uses.
2. The precipitate by hardness and soap adheres to the surface of the tubs, skins and dishwashs may stain dishes clothing and other items.
3. Residue of hardness of soap may remain in the pores of the clothes so the skin may feel rough and uncomfortable.
4. Boiler scale, the result of carbonate hardness precipitate may cause considerable economic loss through hardness of water heaters and hot water pipes.
5. Food cooked in hard water become tasteless.

SOAP SOLUTION METHOD:

1. 50ml of sample water was taken in a bottle.
2. Wanklyn solution was taken in the burette. It was added to the water sample by 0.5ml at a time.
3. The combination was shaken vigorously and kept for 5 minutes horizontally on the table. When sufficient lather was formed so that the water level is not visible from the top was the end point. The difference between the soap solution consumed and lather factor gives the value of the hardness.

Calculation:

Lather factor=x
Initial burette reading=a
final burette reading=b
so,amount of soap consumed=b-a=c
subtracting lather factor=c-x=d
1ml of soap solution = 1mg of calcium carbonate
d ml of soap solution = d ml of calcium carbonate
50 ml of water contains d mg of calcium carbonate
1000ml of water contains = d*1000/50=e mg of calcium carbonate

Experiment No. 5

Aim of the experiment: To determine the chloride content of a given water sample.

Apparatus Required:

1. Burette
2. Pipette
3. Conical flask

Chemicals Required:

1. Standard silver nitrate solution, AgNO3
2. 5% Potassium chromate solution

Theory:-

Chlorides are generally present in water mainly in the form of sodium chloride, calcium chloride, magnesium chloride and potassium chloride. The chloride content normally increases as the mineral content increases. The presence of chlorides in surface water is due to leaching of marine sedimentary deposits, pollution from sea water and contamination with industrial and domestic wastes. Usual methods for determination of chloride in water are

(1)Mohr's method (2) Villard's method

Mohr's method:-

In Mohr's method, the acidity of the water sample is removed by adding calcium carbonate. Potassium chromate acts as an indicator for titration. Preferential precipitation of white silver chloride over red silver chromate is the principle of this method. The change of colour from white to red indicates the end point. The reactions are:-

$NaCl+AgNO_3 = AgCl + NaNO_3$

(White)

$2AgN0_3+K_2CrO_4=Ag_2CrO_4+2KNO_3$

(Red)

Significance:-

1. Chloride in reasonable concentrations is not harmful to public health. At concentrations above 250 mg/L, it gives a noticeable salty taste in drinking water, which is objectionable.
2. The presence of high quantity of chloride in river or stream waters may indicate pollution of water due to sewage and/or industrial wastes.
3. Increase in chloride level in water increases its corrosiveness.
4. T he chloride content of water used for irrigation is generally controlled along with the total salinity of water.Evapotranspiration tends to increase the chloride and salinity at the root zone of irrigated plants, making it difficult for plants to make up water due to osmotic pressure differences between the water outside the plants and within the plant cells.

Procedure:-

1. 50 ml of the given water sample is pipette in a conical flask.
2. Two drops of potassium chromate is added to the sample.
3. The whole solution is titrated against standard silver nitrate solution from the burette with constant stirring. The red colour appearing at this stage doesn't persist and disappears on shaking.
4. The titration is carried out till faint red colour persists.
5. The procedure is repeated till three concordant readings are obtained.

Calculation:-

Initial burette reading=X ml, Final Burette reading=Y ml

Total volume of $AgNO_3$=X-Y=V ml, Strength of $AgNO_3$ solution=y (N/50)

1000ml of 1N $AgNO_3$ solution=35.5 g of chloride

Vml of y (N/50) $AgNO_3$ solution= (35.5*V*y*1000)/50*1000)=0.71Vy mg of chloride

50ml of supplied water sample contains0.71 Vy mg of chloride

1000ml of supplied water sample contains (0.71 Vy*1000)/50mg of chloride=14.2 Vy mg of chloride

Concentration of chloride in given water sample=14.2Vy mg/L

Result:-

The chloride concentration of the given water sample is found to be_____.

Experiment No. 6

Aim of the experiment: To determine the residual chlorine of given water sample.

Apparatus Required:

1. Comparator box or chloroscope

Chemicals Required:

1. Orthotolidine Solution

Theory: The prime purpose of disinfecting public water supplies and waste effluents is to prevent the spread of waterborne diseases. The applications of chlorine for disinfection of drinking water go far back as the nineteenth century. Chlorine is used in the form of free chlorine or hypochlorite .In either form, it acts as a protein oxidizing agent and often dissipates itself in side reactions so rapidly that little disinfection is accomplished until amounts in excess of the chlorine demand have been added.

Residual chlorine is the chlorine left in the water after the required contact period. Residual chlorine ensures complete killing of bacteria and oxidation organic matters. When filtered water is chlorinated, it is consumed initially for killing microorganisms and then for oxidizing organic matter. When oxidation is complete and break point is reached, whatever chlorine is added appears as residual chlorine .For satisfactory care of future contamination of water usually free chlorine residual of 0.2 to 0.3mg/L is sufficient for a contact period of 10-20 minutes.

Procedure:

Residual chlorine can be tested by three methods:

1. Orthotolidene Test

2. Starch iodide Test

3. DPD Test

1. Orthotolidine test:-

- First take 10 ml of water sample in a test tube.
- Then 0.01 gm of bleaching powder is added to the sample.
- Kept the mixture for 15 min without any disturbing.
- After that to this chlorinated water we have to add 2-3 drops of orthotolidine solution.
- The yellow colour indicates that the residual chlorine is present in the sample.
- Then note down the residual chlorine present in diff. types of samples.

Observation:-

SL NO.	NAME OF THE SAMPLE	SOURCE OF THE SAMPLE	RESIDUAL CHLORINE	REMARK

Result:

From the above experiment we have calculate the residual chlorine of the diff samples like_____ and the value is_____.

Experiment No. 7

Aim of the experiment: To determine the total solids of a given sample of water.

Apparatus Required:

1. Beaker
2. Measuring cylinder
3. Weighing machine
4. Heater

Theory:-

The total solids in water comprises of both suspended solids and dissolved solids. Solids suspended in water may consist of inorganic and organic particles or of immiscible liquids. Dissolved substances may be organic or inorganic in nature.

The total solids present in water can be determined by evaporating the water sample at 105 ˚c and weighing the dry residue left. The suspended solids can be found by filtering the water sample and weighing the residue left on the filter paper. The difference between the total solids and the suspended solids will represent the dissolved solids.

Size classification of solids in water

(i)Dissolved solids: 10^{-5} -10^{-3} μm

(ii)Colloidal solids: 10^{-3}-1μm

(iii)Suspended solids: 1-100μm

Significance:-

1. The total permissible limit of solids in water is 500mg/L, although higher amounts up to 1000mg/L are sometimes permitted, but are likely to produce certain psychological effects on human.
2. Suspended materials are aesthetically displeasing and provide adsorption sites for chemical and biological agents.
3. Suspended organic solids may be degraded biologically, resulting in objectionable by products.
4. Biologically active suspended solids may include disease causing organisms as well as organisms such as toxin producing strains of algae.
5. Quite often, two or more dissolved substances, especially organic substances and members of halogen group will combine to form a compound whose characteristics are more objectionable than those of either of the organic materials.

Procedure:-

i) The beaker is properly cleaned and dried and its weight is taken.
ii) 100ml of water is taken in the beaker and dried in the oven such that all the water evaporated.
iii) After cooling, the weight of the beaker is recorded.
iv) Total solids are determined by subtracting the initial weight from final weight of the beaker.

Calculation:-

Weight of the empty beaker=X mg
Weight of the beaker dry total solids=Y mg
Weight of total solids present in 100 ml of water=Y-X mg
Concentration of total solids=(Y-X)*1000/100 mg/l

Result:-

The total solids concentration of the given water sample is found to be ……

Discussion:-

Discuss the result obtained for the above experiment.

Experiment No. 8

Aim of the experiment: To determine the turbidity of a given water sample

Apparatus Required:

1. Standard turbidity tubes of various units

Theory:

The turbidity of the sample is the reduction of transparency due to the presence of particular matter such as day or silk, finely divided organic matter, plankton or other microscopic organism.these particular manner cause light to be scattered and absorbed rather than being transmitted in straight lines thought sample

Pescribes neohelometric method for the measurement of turbidity of water. this is applicable to all types of water .it is based on the comparision f the intensity of light scatterd by the sample under defined condition with the intensity of light scattered by a standard reference suspension under the same condition.

Principle:

The standard method for the determination of turbidity is based on Jackson candle turbidimeter and the lowest turbidity value that can be measured in this can be measured in this instrument is 25 units .as turbidity of treated water is usually in the range of 0-5 units, turbiment based on nephelometric principle is used to determine the turbidity in NTU(nephelometric turbidity unit) scale.

In Jackson candle turbidimeter , measurement of turbidity is based on the interference of light path through the suspension which just cases the image of the flames of the standard candle to dis-appear I e to become indistingushing against the general background illumination, when the flame is viewed through the suspension. The greater Is the light path, the lower is the turbidity.

Significance:

1. Turbid water is not essential acceptable to the consumer. So it is required to know the turbidity.
2. Turbidity indicates the pollution, which may be responsible for water borne diseases.
3. It determine the the type of water treatment to be adopted.
4. Turbidity interferes with the process of disinfection, specially chlorination ad application of ozone. Turbidity adheres to the pathogenic organisms without proper contact with disinfectant.
5. Turbidity interfers with the water purification process, particularly oin filtration by frequently clogging the filters and consequently the filters and consequently reducing the filter run .

Procedure:

By comparison with standard bottles:

1. The standard samples are kept in bottles of diameter and same type with enough empty space at the top of each bottles to allow adequate shaking before each reading.
2. The samples are takes in similar bottles and turbidity is determined by comparing them with the standard bottles. The comparison is done by viewing though the sample and standard bottles simultaneously.
3. The turbidity of the sample is matched as that of the standard bottles, which produces the visual effect most closely as that of that of the sample.

Observation:

Sl. No.	Sample No.	Turbidity (NTU)	Remark
1	Sample-1		
2	Sample-2		

Result:

By comparison with standard bottles, the turbidity of given water sample is found to be ……NTU.

Discussion:

Discuss about the potability of water and mention if any treatment required based on the result obtained.

Experiment No. 9

Aim of the experiment: To determine the colour of the given water sample.

Apparatus Required:

Nussle's tubes containing standard colours.

Theory: -

Pure water is colorless, but water in nature is often colored by foreign substances. The coloring materials many of which are humic substances, reduces from contact of waters with organic debris. Such as leaves, needles of conifers and wood all in various stages of decomposition. Iron is sometimes present in ferric humets and produce color of high potency. Surface water may be colored due to presence of high colored waste water, colored suspended matter.

Colour caused by suspended matter is referred as apparent color and is differentiated colour due to vegetable and organic extracts that are called as true colors.

Water containing natural color is yellow, brownish in appearance. Solutions of potassium chloroplatinate titrated with small amount of cobalt chloride yields colors those are very much like the neutral colors.

The shading of the colors can be varied to match neutral very closely by increasing or decreasing the amount of cobalt chloride. The chloride produced by 1mg/liter of platinum is taken as the standard unit colour. The usual procedure is to prepare stock solutions of k_2phtCl_6 that contains 500 mg/litre of Platinum cobalt chloride is added to provide the proper

Tint. The stock solution has a colour of 500 units and a series of working standards may be prepared from it by dilution. A matched set of color comparison tubes, commonly called Nessler tubes are usually used to contain the standard. The maximum permissible color at domestic supplies is color units.

Significance:-

1. Water containing coloring matter derived from natural substances undergoing delay in swamps and forests are not generally considered to process harmful or toxic properties and are not objectionable from health point of view, but colored waters are objectionable from aesthetic and psychological point of view, since people may not like to drink colored water.
2. Colored water may spoil the color of the clothes if washed in such waters.
3. Disinfections by chlorination of waters containing natural organic substances results in the formations of chloroform, and other methane's and a range of other chlorinated organics, leading to problem of much current concern.

Procedure :-

- 10ml of Nessler tube is filled up to the mark with the water to be tested. If the turbidity is high, it should be removed by centrifuging.
- The color is compared with that of standard colored Nessler tube (containing known tube value of standard color intensity of platinum cobalt) by looking vertically down through two tubes at a white surface in good light.
- If the color of the sample is greater than chosen standards the sample water should be diluted with Distilled water until the required matching is obtained
- The color intensity of the standard color matching
  With the sample may be noted down to represent the color of given water sample.

Observation table: -

SL.NO.	Sample no.	Colour(platinum cobalt nitrate)	Remark
1	Sample -1		
2	Sample -2		

Result: -

By comparison with standard bottles, the turbidity of given water sample is found to be ……..NTU.

Discussion: -

Discuss about the portability of water and mention if any treatment required based on the result obtained.

Experiment No. 10

Aim of the experiment: To determine the odour of a given water sample.

Apparatus Required:

1. Osmoscope
   The instrument used for measuring odour is known as osmoscope. It consists of two open ended glass tubes, each of 10mm diameter and 300mm long. The loose plain ends of the tubes are held slightly above the water surface and the upper leveled ends are inserted in the nostrils of our nose to smell the odour.

Theory-

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Odour in water is caused by the presence of algae, leaves, decaying vegetables or contamination from sewage and industrial waste. The odour of a given sample of water is determined at a temperature of 24°C to 25°C.

Significance-

- Consumers find odour aesthetically displeasing for obvious reasons because water is thought as tasteless and odourless. The consumer associates odour with contamination and may prefer to use a tasteless and odourless water that might actually pose more of a health threat.
- Odours produced by organic substances may pose more than a problem of simple aesthetic, since some of those substances may be carcinogenic.

Procedure-

1. The given water was mixed with odour free water in different proportion such as 1 in 2 , 1 in 4, 1 in 6, 1 in 8and 1 in 10 etc. to prepare different mixture samples(each of 200ml)to be tested for odour.
2. The mixture of greatest dilution(such as 1 in10)was first tested and then the samples were tested one by one in the odour lf decreasing dilution . An assembled panel of five to ten noses was used to determine the mixture in which the odour is just barely detectable to the sense of smell.
3. The threshold odour no.(TON) of the sample was then calculated using the formula TON =(A+B)/A, where A is the volume of given water sample (in ml) and B is the volume of odour free water required to produce a 200ml mixture.

Conclusion-

From the above study experiment, we got to know about the odour of various given samples.