Experiment No. 2: Identification of anions

I Practical Significance

Ionization phenomenon, nature of solution and magnitude of ions plays a vital role in various chemical, catalysis processes, reactions and their products in industries. In chemical and allied engineering processes diploma engineers have to work with different solutions and respective anions. They have to perform sample testing in the industries and also use the data produced from the sample testing. In this experiment students will find the magnitude and types of anions present in the given sample which help in sample testing in industries.

II Relevant Program Outcomes (POs)

PO1 Basic knowledge
PO3 Experiments and practice
PO4 Engineering tools
PO8 Individual and team work
PO9 Communication
PO10 Life-long learning

III Relevant Course Outcomes

D) Apply the catalysis process in industries.

IV Practical Learning Outcome

Identify anion in given ionic solutions.

V Practical Skills

1. Handling glass wares.
2. Handling reagents.
3. Observation.

VI Relevant Affective domain related Outcomes

1. Follow safety practices.
2. Practice good housekeeping.

VII Minimum Theoretical Background

Dissolution of acids, bases and salts in water dissociate it into two types of ions. Positively charged ions are called as cations formed by loss of electrons from the metallic atoms, while anions are formed by gain of electrons from non metallic radicals or group of non metals. Charges present on cations and anions represent the valency of the element, from ion is derived. Total number of charges present on cations are always equal to total number of charges present on anions hence whole solution is electrically neutral.

VIII Circuit diagram / Experimental set-up / Work Situation

(N.A.)

IX Resources required

Sr. No.	Resources	Specification	Quantity	Remark
1.	Test tube	15 ml	6 each	
2.	Test tube holder	Steel with wooden handle	1 each	
3.	Test tube stand	Wooden / Plastic	1 each	
4.	Chemicals	As per requirement		
5.	Beaker	100 ml	1 each	

X Procedure

1. Clean the test tube thoroughly with water.
2. Take 2-3 ml of given solution in test tube with the help of dropper.
3. Add equal amount of relevant reagents according to qualitative analysis chart given below.

Table for qualitative analysis:

A. Identification of anions

Sr. No.	Test	Observation	Inference
1	O.S.+ dil. HNO_3	Effervescence of CO_2 gas which turns lime water milky	CO_3^{--} may be present
2	O.S.+$AgNO_3$	White ppt. insoluble in dil HNO_3	Cl^-, Br^- or I^- may be present
	O.S.+ Chloroform+ Chlorine water	1. Lower chloroform layer colourless	Cl^- may be present
		2. Lower chloroform layer yellow/ brown	Br^- may be present
		3. Lower chloroform layer pink/voilet	I^- May be present
3.	O.S.+ $Ba(NO_3)_2$	1. White ppt. insoluble in dil. HNO_3	SO_4^{--} may be present
		No ppt.	NO_3^- may be present

B. Confirmation of Anions
C.T. for CO_3^{--}

Sr. No.	Test	Observation	Inference
1.	O.S.+$Ba(NO_3)_2$	White ppt.	CO_3^{--} confirmed.
2.	O.S. + Phenolphthalein	Pink colouration	CO_3^{--} confirmed.

C.T. for Cl^-

Sr. No.	Test	Observation	Inference
1.	O.S. + Lead acetate solution	White ppt.	Cl^- confirmed
2.	O.S. + $K_2Cr_2O_7$ + Conc. H_2SO_4	Brown gas evolved when passed through water turns yellow which gives PPT with lead acetate.	Cl^- confirmed
3.	O.S. MnO_2 + Conc. H_2SO_4	Green fumes changes moist blue litmus red and then bleaches.	Cl^- confirmed

C.T. for Br^-

Sr. No.	Test	Observation	Inference
1.	O.S. + Lead acetate solution	Brown ppt.	Br^- confirmed
2.	O.S. + Chloroform + Chlorine water	Chloroform layer yellowish brown	Br^- confirmed
3.	O.S. MnO_2 + Conc. H_2SO_4 (Heat)	Brown fumes	Br^- confirmed

C.T. for I^-

Sr. No.	Test	Observation	Inference
1.	O.S. + Lead acetate solution	Yellow ppt.	I^- confirmed
2.	O.S. + Chloroform + Chlorine water	Chloroform layer pink or violet	I^- confirmed
3.	O.S. + MnO_2 + Conc. H_2SO_4 (Heat)	Violet fumes	I^- confirmed

C.T. for SO_4^{--}

Sr. No.	Test	Observation	Inference
1.	O.S. + Lead acetate solution	White ppt.	SO_4^{--} confirmed
2.	O.S. + $BaCl_2$	White ppt.	SO_4^{--} confirmed
3.	O.S. + $HgNO_3$	Yellow ppt.	SO_4^{--} confirmed

C.T. for NO_3^-

Sr. No.	Test	Observation	Inference
1.	O.S. + Copper fillings + Conc. H_2SO_4 (Heat)	Evolution of brown fumes, leaving blue coloured solution	NO_3^- confirmed
2.	O.S. + Conc. H_2SO_4 + freshly prepared $FeSO_4$ solution (Add slowly from the side of the test tube without disturbing the solution in the test tube)	A brown ring appears at the junction of the two solutions.	NO_3^- confirmed

XI Precautions:

1. Use test tube holder.
2. Use funnel for transfer of solution and reagents.
3. Wear apron and shoes.
4. Turn off the gas burners after use.

XII Actual procedure followed

Procedure followed by using for qualitative analysis chart.

XIII Resources used (with major specifications)

Test tube, Test tube holder, Test tube stand chemical, beaker.

XIV Precautions followed

1) Use test tube holder, 2) Use funel transfer of solution and reagents, 3) wear apron

XV Observations

A. Identification of Anion

Sample Solution 1.

Sr. No.	Test	Observation	Inference
1.	O.S + chloroform + chlorine water	lower chloroform layer colour-less	Cl^- may be present

B. Confirmatory Test (C.T.) for anion.....Cl^-.....

Sr. No.	Test	Observation	Inference
1	0.S + Leadcetate Sodium	White ppt	Cl + confirmed
2	0.S + $K_2Cr_2O_7$ + Conc. H_2SO_4	Brown gas Vdved when passed through water forms which lead accelerate	Cl^- confirmed

A. Sample Solution 2.

Sr. No.	Test	Observation	Inference
1.	0.S + $Ba(NO_3)_2$	White ppt in dilute HNO_3	SO_4 -- may be present

B. Confirmatory Test (C.T.) for anion.....SO_4^-.....

Sr. No.	Test	Observation	Inference
1.	0.S + lead asetable Solution	White ppt	SO_4^- confirmed
2.	0.S + $BaCl_2$	White ppt	SO_4^- confirmed
3.	0.S + $HgNO_3$	White ppt	SO_4^- confirmed

XVI Results

1. Anion identified in sample solution 1 is Cl^-, that can be obtained by dissolving chloroform + chlorine water salt in water.
2. Anion identified in sample solution 2 is SO_4^-, that can be obtained by dissolving lead acetate solution salt in water.

XVII Interpretation of results

A group of radical present in the given sample solution B Group radical present in the sample solution.

XVIII Conclusions and Recommendations

Give sample solution 1 contains Cl^- given sample 2 contains SO_4^-

XIX Practical Related Questions

1. Identify acidic radical present in the given solution, 'A' which gives effervescences of CO_2 gas with dil. HNO_3.
2. Explain the separation test for halides in the sample solution.
3. Identify anion in solution 'X' when mixed with barium nitrate which gives white ppt.

XX References / Suggestions for further Reading

Sr. No.	Title of Book	Author	Publication
1.	Experiments in general chemistry Principles and modern applications	Thomas G. Greco; Lyman H. Richard; Gerald S. Weiss	Pearson, 2011 ISBN 13:978-0131493919
2.	Inorganic qualitative analysis	Vogel	Prentice Hall, 2013 ISBN 13: 9780582218666
3.	Chemistry: Inorganic Qualitative Analysis in the Laboratory	Clyde Metz	Elsevier, 2015 ISBN: 978-0-12-503354-1

XXI Assessment Scheme

Process related assessment scheme

Sr. No.	Process related	Weightage(60%)
1.	Process for detection of anion 1	15%
2.	Process for detection of anion 2	15%
3.	Confirmatory test for anion 1	15%
4.	Confirmatory test for anion 2	15%

Product related assessment scheme

Sr. No.	Product related	Weightage(40%)
	Identification of anion 1	10%
	Identification of anion 2	10%
	Answer to sample questions	10%
	Submission of report in time	10%

Marks Obtained			Dated Signature of Teacher
Process Related (15)	Product Related (10)	Total (25)	
14	09	23	

[Space to Write Answers]

Q1 ——— ?

When solution A is given white ppt with lead acetate solution then Cl^- acidic radical is present is solution that is Cl^- acidic radical.

Q.2 ——— ?

When a original solution NaCl added lead acetate solution then white ppt form they group A may be present that is Cl^- then go for Cl^- original solution it gives white ppt Cl^- is confirmed.

Q.3 ——— ?

When solution B gives white ppt then go for Cl test is 0.5 + lead accetate solution it gives white ppt Cl^- confirmed.