Shri Vile Parle Kelavani Mandal's

DWARKADAS J. SANGHVI COLLEGE OF ENGINEERING

(Autonomous College Affiliated to the University of Mumbai)

NAAC Accredited with "A" Grade (CGPA : 3.18)

CERTIFICATE

This is to certify Mr./~~Ms.~~ Ayush Jain has performed and completed the below mentioned experiments satisfactorily as part of the term-work prescribed by the Dwarkadas J Sanghvi College of Engineering Autonomous, during the academic year 2020-21.

Program: Computer Engineering SAP ID: 60004200132

Course: Engineering Chemistry - I Course Code: DJ19FEC103

Class: F.E. Division: I1 Semester: I

Sr. No.	Title of the Experiment	Course Outcome	Date of		Marks	Signature of the teacher
			Expt.	Subm.		
1	Determination of total hardness of water	CO-4	9/3/21	9/3/21		
2	Determination of chloride content	CO-4	9/3/21	9/3/21		
3	Determination of chemical oxygen Demand (COD)	CO-4	23/3/21	23/3/21		
4	Preparation of urea-formaldehyde resins	CO-3	23/3/21	23/3/21		
5	Determination of percentage of Iron in plain carbon steel.	CO-2	6/4/21	6/4/21		

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Signature of the Teacher Head of the Department Principal

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EXPERIMENT NO. : 1 **DATE** : 09/03/2021

DIVISION/ BATCH : J 1 **SAP ID** : 60004200132

COURSE : Engineering Chemistry 1 **COURSE CODE** : DJ19FEC103

NAME : Ayush Shailesh Jain

COURSE OUTCOME : Analyze the quality of water and suggest suitable method for treatment.

AIM : To determine the total, permanent and temporary hardness of water sample.

REAGENTS : EDTA, Buffer solution, EBT, Standard hard water and hard water sample.

GLASSWARE : Burette, Pipette, conical flask, measuring cylinder, etc.

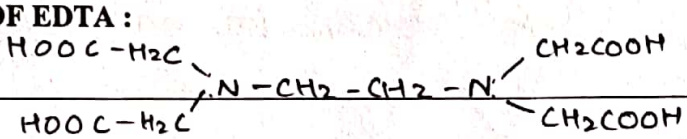
PRINCIPLE:

EDTA forms stable complex with metal ions at PH 10 to 11.

TYPE OF TITRATION :

Complexometric.

STRUCTURE OF EDTA :



CHEMICAL REACTIONS : M^{n+} + EBT $\xrightarrow{PH=10}$ M^{n+} - EBT

(blue) (wine red)

M^{n+} - EBT + EDTA $\xrightarrow{PH=10}$ MN^{+} - EDTA + EBT

(wine red) (blue)

PROCEDURE : (A) Standarisation of EDTA

1) Pipette out 10 ml of given Standard hard water (SHW) sample. 2) Add 1ml of the buffer solution. 3) Add 3-4 drops of EBT indicator. The solution acquires wine red colour. 4) Titrate with EDTA solution from the burette till the solution acquires blue colour. 5) Note the reading and repeat the procedure till you obtain concurrent readings. 6) Use the data for standardisation of EDTA. 7) $N_1V_1 = N_2V_2$

(B) Determination of Total Hardness

1) 10 ml of unknown water sample (UWS) is taken in a conical flask. 2) Follow the same procedure as in part 1. 3) Note the reading and repeat the procedure till you obtain concurrent readings. 4) Calculate the total hardness of water.

(C) Determination of Permanent Hardness

i) Pipette out the 10 ml of given water sample (after boiling and filtering) is taken in a conical flask. 2) Follow the same part as in I. 3) Note the reading and repeat the procedure till you obtain concurrent readings.
4) Calculate the permanent hardness of water.

OBSERVATIONS :

TABLE 1 : STANDARDISATION OF EDTA SOLUTION

Volume of standard hard water for each determination = 10 ml

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	10.2	10.2	10.2
Volume of EDTA Solution	10.2	10.2	10.2

CBR 1 (X) = 10.2 ml

TABLE 2 : DETERMINATION OF TOTAL HARDNESS

Volume of water sample for each determination = 10 ml

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	7.1	7.1	7.1
Volume of EDTA Solution	7.1	7.1	7.1

CBR 2 (Y) = 7.1 ml

TABLE 3 : DETERMINATION OF PERMANENT HARDNESS

Volume of boiled water sample for each determination = 10 ml

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	3.1	3.1	3.1
Volume of EDTA Solution	3.1	3.1	3.1

CBR 3 (Z) = 3.1 ml

CALCULATIONS : Strength of standard hard water = 1 mg $CaCO_3$ per ml.

10 ml of standard hard water = 10 mg $CaCO_3$ equivalent.

10 ml of Standard hard water = 10.2 ml of EDTA

∴ 1 ml of EDTA = 0.9803 mg of $CaCO_3$ equivalent.

10 ml of hard water sample = 7.1 ml of EDTA

∴ 10 ml of sample hard water = 7.1 x 0.9803

= 6.96013 mg of $CaCO_3$.

∴ 1000 ml of sample hard water = 6.96013 x 100

Total hardness = 696.013 mg of $CaCO_3$ Eq.

10 ml of boiled water sample = 3.1 ml EDTA

10 ml of boiled water sample = 3.1 x 0.9803

= 3.03893 mg of $CaCO_3$

∴ 1000 ml of boiled water sample = 3.03893 x 100 mg

= 303.893 mg of $CaCO_3$

∴ Permanent hardness = 303.893 ppM.

∴ Temporary hardness = Total hardness - Permanent hardness

= 696.013 − 303.893

= 392.12 ppm

RESULT : The total hardness of the given water sample is 696.013 ppm

The total permanent of the given water sample is 303.893 ppm

The total temporary of the given water sample is 392.12 ppm

D.J.S.C.E. (Chemistry)		
Journal		
(Lab Ethics)	5	
(Performance)	5	
(Documentation)	5	
(Knowledge)	5	
(Punctuality)	5	
Total	25	

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EXPERIMENT NO. : 2 **DATE** : 09/03/2021

DIVISION/ BATCH : J1 **SAP ID** : 60004200132

COURSE : Engineering Chemistry-1 **COURSE CODE** : DJ19FEC103

NAME : Ayush Shailesh Jain.

COURSE OUTCOME : Analyze the quality of water and suggest suitable methods of treatment.

AIM : To determine the Chloride content of water by Mohr's method.

REAGENTS : 0.01N NaCl, $AgNO_3$ solution, K_2CrO_4, unknown water sample.

GLASSWARE : Burette, pipette, conical flask, dropper, funnel, etc.

CHEMICAL REACTIONS :

$AgNO_3 + NaCl \longrightarrow AgCl \downarrow + NaNO_3$ (white ppt)

$2\,AgNO_3 + K_2CrO_4 \longrightarrow Ag_2CrO_4 \downarrow + KNO_3$ (Brick red ppt)

PROCEDURE : Part 1: Standardisation of $AgNO_3$.

1) Pipette out 10 ml of given 0.01N standard sodium chloride (NaCl) solution. 2) Add 2 drops of Potassium

Chromate (K_2CrO_4) indicator. 3) Add slowly silver nitrate Solution ($AgNO_3$) from a burette while stirring the solution. 4) Continue the titration until solution acquires faint black red colour. 5) Note the end point. 6) Repeat the steps 1-4, till you obtain constant readings.

Part II : Determination of Chloride Content.

1) Similarly, titrate the given water sample as mentioned in part - 1. 2) Calculate the concentration of chloride (in ppm) in the given unknown water sample.

OBSERVATIONS :

TABLE 1 : STANDARDISATION OF $AgNO_3$ SOLUTION

Volume of standard sodium chloride for each determination = 10 ml

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	11.2	11.2	11.2
Volume of $AgNO_3$ Solution	11.2	11.2	11.2

CBR (X) = 11.2 ml

TABLE 2 : DETERMINATION OF CHLORIDE CONTENT OF WATER SAMPLE

Volume of water sample for each determination = 10 ml

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	7.2	7.2	7.2
Volume of $AgNO_3$ Solution	7.2	7.2	7.2

CBR (Y) = 7.2 ml

CALCULATIONS :

1) Normality of NaCl solution = 0.01 N

2) Normality of $AgNO_3$ solution

$$N_1V_1\ (AgNO_3) = N_2V_2\ (NaCl)$$

$$N_1 \times X = 0.01 \times 10$$

$$N_1 = \frac{0.01 \times 10}{X} = \frac{0.01 \times 10}{11.2} = 0.0089\ N$$

3) Chloride content of the sample:

1 ml of 1N AgNO3 solution = 35.5 mg of Cl^-

7.2 ml of 0.0089 N AgNO3 = $7.2 \times 0.0089 \times 35.5$

= 2.27 mg of Cl^-

10 ml of water sample contains 2.27 mg of Cl^-

∴ 1 L of water sample contains 227 mg of Cl^-/L

RESULT : The concentration of chloride in given water sample is 227 ppm

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Journal		
(Lab Ethics)	5	
(Performance)	5	
(Documentation)	5	
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Total	25	

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EXPERIMENT NO. : 3 **DATE** : 23/03/2021

DIVISION/ BATCH : I1 **SAP ID** : 60004200132

COURSE : Engineering Chemistry I **COURSE CODE** : DJ19FEC103

NAME : Ayush Shailesh Jain

COURSE OUTCOME : Analyze the quality of water and suggest suitable methods of treatment.

AIM : To determine the chemical oxygen demand (COD) in a waste water sample.

REAGENTS : 0.1N $K_2Cr_2O_7$, 0.1N FAS, Ferroin indicator, Sulphuric acid

APPARATUS : Burette, pipette, conical flask, measuring cylinder

REACTIONS : $C_xH_yO_z + (x + y/4 - z/2)O_2 \rightarrow CO_2 + y/2\ H_2O$

$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{+3} + 7H_2O$

$6Fe^{+2} \rightarrow 6Fe^{+3} + 6e^-$, $Cr_2O_7^{2-} + 14H^+ + 6Fe^{+2} \rightarrow 2Cr^{+3} + 7H_2O + 6Fe^{+3}$

PROCEDURE : Part I: Determination of Blank Titration:

Pipette out 10 ml of 0.1N $K_2Cr_2O_7$, add 15 ml H_2SO_4 and titrate against 0.1N FAS solution using ferroin indicator. Note the blank reading ("10.5") ml.

Part II: Determination of COD.

1) Take 10 ml of conc. sample in a conical flask. Shake the flask

well several times to make the solution homogeneous. 2) Add few drops of ferroin indicator. 3) Titrate the unreacted $K_2Cr_2O_7$ with 0.1N FAS sol. in the conical flask charges from green to wine red. 4) Repeat the titration till you get constant burette readings. 5) Note down this burette reading as 'b' ml i.e. amount of $K_2Cr_2O_7$ not consumed. 6) (a-b) ml gives the amount of $K_2Cr_2O_7$ consumed by the 20 ml of water sample.

OBSERVATIONS :

TABLE 1 : DETERMINATION OF BLANK TITRATION

Burette : 0.1N Ferrous Ammonium sulphate solution	**Conical flask :** 10 ml of 0.1N $K_2Cr_2O_7$ solution + 15 ml of H_2SO_4
Indicator : Ferroin	**End point :** Blue green to wine red

Reading (ml)	Trial 1 (ml)	Trial 2 (ml)	Trial 3 (ml)
Initial Reading	0.0	0.0	0.0
Final Reading	10.5	10.5	10.5
Volume of FAS Solution	10.5	10.5	10.5

CBR 1 (a) = 10.5 **ml**

TABLE 2 : DETERMINATION OF COD

Burette : 0.1N Ferrous Ammonium sulphate solution	**Conical flask :** 10 ml of Concentrated solution + 15 ml of H_2SO_4
Indicator : Ferroin	**End point :** Blue green to wine red

Reading (ml)	Trial 1 (ml)	Trial 2 (ml)	Trial 3 (ml)
Initial Reading	0.0	0.0	0.0
Final Reading	5.3	5.3	5.3
Volume of FAS Solution	5.3	5.3	5.3

CBR 1 (b) = 5.3 **ml**

CALCULATIONS : Normality of FAS solution = 0.1 N

Volume of water sample = 20 ml

COD of water sample = $\frac{(A-B) \times 8000 \times N}{\text{Volume of waste water}}$

$= \frac{5.2 \times 0.1 \times 8000}{20} = 208$ mg/L

RESULT : The COD of the given sample = 208 mg/L

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(Knowledge)	5	
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Total	**25**	

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EXPERIMENT NO. : 4 **DATE** : 23/03/2021

DIVISION/ BATCH : J1 **SAP ID** : 60004200132

COURSE : Engineering chemistry **COURSE CODE** : DJ19FEC013

NAME : Ayush Shailesh Jain

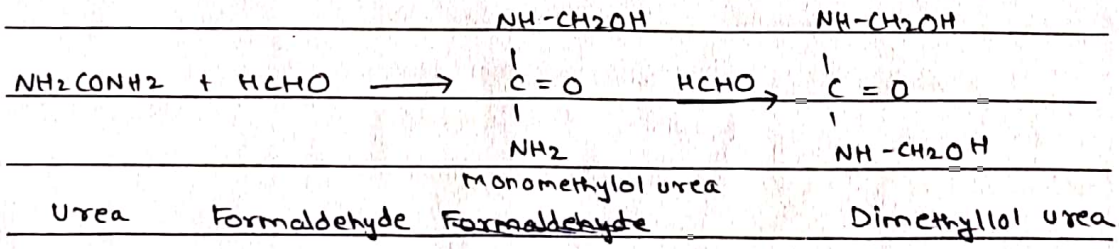
COURSE OUTCOME : Apply the knowledge of polymers, fabrication method, conducting polymers in various industrial fields.

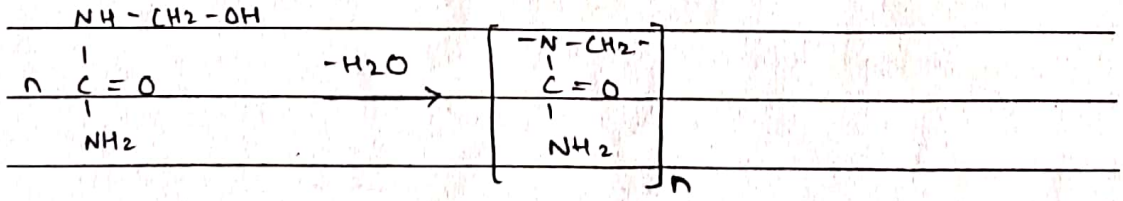
AIM : To prepare urea formaldehyde resin.

REAGENTS : Urea, formaldehyde solution, concenterated H_2SO_4.

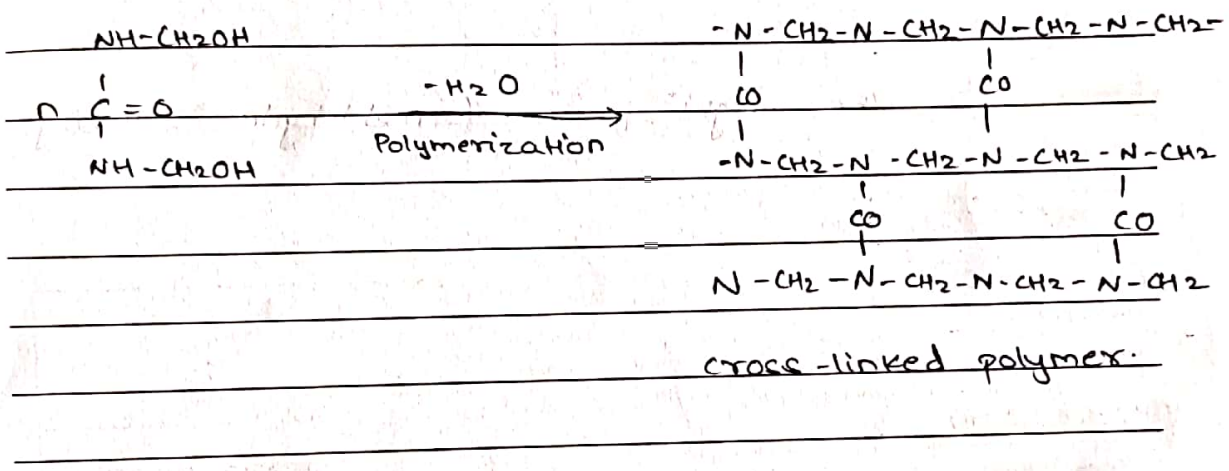
APPARATUS : Weighing Balance, beaker, glass rod, funnel and filter paper.

CHEMICAL REACTIONS :





Monomethylol urea Linear polymer.



cross-linked polymer.

PROCEDURE : 1) Add 1.5 g urea in a pre-weight 100 ml beaker.

2) Place about 3 ml of 40% formaldehyde solution on it.

3) Stir it constantly till saturated solution is obtained.

4) Add conc. H_2SO_4 dropwise, with constant stirring.

5) A voluminous white solid mass appears in the beaker.

6) Keep stirring till it turns into powder.

7) Wash the white solid with water and dry it in the folds of filter paper.

8) Keep it in over four half an hour.

9) Put it in a desiccator for 10 minutes and weigh the yield of the product.

OBSERVATIONS : Weight of urea = 1.5g

Weight of watch glass + filter paper = W_1 = 21.93 g

Weight of watch glass + filter paper + urea formaldehyde = W_2 = 26.21g

∴ Weight of urea formaldehyde = 26.21 - 21.93 = 4.28 g

RESULT : The weight of urea formaldehyde is 4.28 g.

D.J.S.C.E. (Chemistry)		
Journal		
(Lab Ethics)	5	
(Performance)	5	
(Documentation)	5	
(Knowledge)	5	
(Punctuality)	5	
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EXPERIMENT NO. : 5 **DATE** : 06/04/2021

DIVISION/ BATCH : J1 **SAP ID** : 60004200132

COURSE : Engineering Chemistry **COURSE CODE** : DJ19FEC103 ~~DJ19FEC103~~

NAME : Ayush Shailesh Jain

COURSE OUTCOME : Rationalize various phase transformation using thermodynamics.

AIM : To determine the percentage of iron in the given solution of plain carbon steel.

REAGENTS : 0.1 N FAS solution, KMnO4 solution, dil. H_2SO_4, Steel alloy sollution.

GLASSWARE : Conical flask, pipette, burette, beaker, dropper, measuring cylinder

PRINCIPLE : Steel is an alloy of iron and carbon. To determine the amount of iron in steel, it is titrated with standard KMnO4 solution.

CHEMICAL REACTIONS : $2KMnO_4 + 8H_2SO_4 + 10FeSO_4 \longrightarrow K_2SO_4 + 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$

PROCEDURE : Part I: Standerdization of KMnO4 solution.

1) Pipette out 0.1 N 10 ml of standard $Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$ solution into a 100 ml conical flask. 2) Add 5.6 ml of dil. H_2SO_4. 3) Titrate this solution slowly with the KMnO4 solution from the burette until a faint but permonet pink colour persists in the solution.
4) Repeat titration until constant (CBR-1) results are obtained.

5) Calculate the normality of KMnO4 sol. using $N_1V_1 = N_2V_2$.

Part II - Estimation of Iron.

1) Pipette out 10 ml of the steel solution into a 100 ml conical flask. 2) Add 5-6 ml dil. H_2SO_4. 3) Titrate the solution with KMnO4 solution taken in burette. 4) The apperance of a faint but permanent pink colour marks the end point.

5) Repeat the titration with fresh 10 ml portion of the sample until constant (CBR-2) readings are obtained (4) ml.

OBSERVATIONS : Weight of Steel alloy = 3 g/L

TABLE 1 : Standardisation of KMnO4 solution.

Volume of FAS = 10 ml

Solution pipetted out

Reading (ml)	Trial 1 (ml)	Trial 2 (ml)	Trial 3 (ml)
Initial Reading	0.0	0.0	0.0
Final Reading	10.1	10.1	10.1
Volume of KMnO4 Solution	10.1	10.1	10.1

CBR 1 = 10.1 ml

TABLE 2 : Estimation of iron in plain carbon steel

Volume of Steel solution = 10 ml

Solution pipetted out

Reading (ml)	Trial 1	Trial 2	Trial 3
Initial Reading	0.0	0.0	0.0
Final Reading	5.0	5.0	5.0
Volume of KMnO4 Solution	5.0	5.0	5.0

CBR 2 = 5.0 ml

CALCULATIONS : $KMnO_4$ = FAS .

$N_1V_1 = N_2V_2$

$N_1 = \frac{N_2V_2}{V_1} = \frac{0.1 \times 10}{10.1}$ $\therefore N_1 = 0.099\ N$

1000 ml of 1N $KMnO_4$ = 55.85 g of Fe

5ml of 0.099N $KMnO_4$ = $\frac{55.85 \times 5 \times 0.099}{1000}$

= 0.02764 gm of Fe / 10 ml of solution

10 ml of steel contains = 0.02764 gm of Iron.

∴ 1000 ml of steel contains = 2.764 gm

∴ 3 gm of steel alloy contains 2.764 gm Iron

∴ 100 gm of steel contains = $\frac{100 \times 2.764}{3}$ = 92.133 %

RESULT : The given plain carbon steel alloy contains 92.133 % of iron.

D.J.S.C.E. (Chemistry)		
Journal		
(Lab Ethics)	5	
(Performance)	5	
(Documentation)	5	
(Knowledge)	5	
(Punctuality)	5	
Total	25	

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