**Experiment No: 01**

To determine the equilibrium constant (K) for the formation of complex by spectrophotometric method.

**Apparatus:**

Spectrophotometer, beakers, cuvettes, pipette, sucker etc.

**Chemicals Required:**

0.3 M Fe (NO3)3 solution, 0.005M KSCN solution, 1:1 solution i-e 1M NaNO3 and 1M HNO3 to form 0.5M solution.

**Theory/Principle:**

Fe3+ + SCN1-  Fe(SCN)]2+

K=

According to beer lambert’s Law:

A= C ἐ b

If we know ἐ then

C= A/E ἐ d.

C= Conc. Of

a= i-e total concentration of Fe Including complex.

b= Total concentration of thiocyanate ion including complex

= b-A/Ed

K=

K=

K=

A= K[a(bEd-A)]

A = K[abed-aA]

KabEd-kaA = A

K.a.b.Ed = A+K.a.A

K.a.b.Ed = A(1+Ka)

Dividing both sides by (1+Ka)

=

=

+=

+=

=.+

y= x.m+c

(this eq correctly written in folder in form of piks

**Procedure:**

* Apparatus was taken, washed and dried.
* Standard solutions were prepared.
* graduated flask was taken and different compositions were prepared according to table.
* First concentration was taken and absorbance was measured at 350-700nm in Uv-vis region.
* Graph was plotted between absorbance and maximum wavelength was calculated.
* Absorbance of each mixture/composition was recorded at maximum wavelength.
* Then graph was plotted between1/A along y- axis and 1/a (concentration of iron) along x-axis and value of equilibrium constant K was calculated.

**Observations and calculations:**

Preparation of solution

**For Fe (NO3)3 in 25ml**

Mass in grams = 0.3x242g/mlx0.025ml

=1.815g

**For KSCN in 1000ml**

Mass in grams = 0.005m x 97g/mol x1

=0.4g

**For NaNO3 in 100ml**

Mass in grams = 1 x 85g/mol x 0.1ml

=8.5g

**Dilution for 15.8 M HNo3**

M1V1 = M2V2

15.8 x v1 = 1 x 200

V1 = 12.65ml

Table 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sr. No | Fe(NO3)3 | KSCN |  | Electrolyte  NaNO3+HNO3 | Total Volume |
| 1 | 2 | 1 | 0.0 | 22 | 25 |
| 2 | 1 | 1 | 1.0 | 22 | 25 |
| 3 | 0.8 | 1 | 1.2 | 22 | 25 |
| 4 | 0.6 | 1 | 1.4 | 22 | 25 |
| 5 | 0.4 | 1 | 1.6 | 22 | 25 |
| 6 | 0.3 | 1 | 1.7 | 22 | 25 |
| 7 | 0.25 | 1 | 1.75 | 22 | 25 |
| 8 | 0.2 | 1 | 1.8 | 22 | 25 |

Table 2

|  |  |  |  |
| --- | --- | --- | --- |
| Concentration of Fe (a) mol/ | 1/a  /mol | Absorbance  (A) |  |
|  |
|  | 41.66 | 0.89 | 1.1235 |
|  | 83.33 | 0.47 | 2.127 |
|  | 104.16 | 0.44 | 2.272 |
|  | 138.88 | 0.30 | 3.333 |
|  | 208.33 | 0.28 | 3.5714 |
|  | 277.22 | 0.22 | 4.5454 |
|  | 333.33 | 0.21 | 4.7619 |
|  | 416.66 | 0.20 | 5 |

Slope=Y2-Y1 / X2 –X1

= 1 /K b E d =0.0101

Intercept= 1/b E d

= 1.3111

Slope/intercept= 1/K

1/K= 0.0101/1.3111

=7.703\*10-3

K= 1.298\*10-4M-1s-1