# CHAPTER 5

## SYSTEM : POTASSIUM SULPHATE

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C.V.Suryanarayana and others (1956) studied the conductance of concentrated solutions of strong electrolytes. The new concepts, concentration potential Cp and potential viscosity $\eta_p$ are introduced and the following equation has been formulated.

$\lambda C = As + A\left(1 - \frac{Cp}{\eta_p}\right)$ where $\lambda C$ is the specific conductivity times 1000/cp. "As" is the specific conductivity of solution, Ks x 1000 and A is constant from measurements of viscosity and conductivity of aqueous solution of KCl, $KNO_3$ , $NaNO_3$ and NaCl from 1 molal to saturation at tmperature from $30^o$ to $55^o$c at $5^o$c intervals, it was found that all plots of $\lambda c$ against $\left(1 - \frac{Cp}{\eta_p}\right)$ were linear. A plot of $\lambda c$ against temperature was found to be linear for all solutions except $KNO_3$. The parameter 'A' was a function of temperature.

S.V.Gorbachev and others (1961) studied the electrical conductivity of aqueous potassium salt solutions at elevated temperature. The conductivity of aqueous $KNO_3$ and other salt saturations were determined at $25^o$ - $300^o$c, at $25^o$c interval at concentrations of $5x10^{-2}$M, $1x10^{-1}$M, $2.5x10^{-1}$M, $5x10^{-1}$M, 1 M. Two cells were used. The conductivity at all temperature showed that the order of the conductivity of the anions was I > Br > Cl > $NO_3$. A maximum was obtained in the conductivity for all solutions. The temperature at which this maximum occurred was shifted to a lower temperature as the concentration of the salt was increased. This maximum was due to the lower degree of dissociation of the electrolytes at higher temperature and also due to same increase in the solution viscosity under these conditions.

Zunjurwad, Naidu (1974) studied the conductance and viscosity of potassium chloride at 0, 5 and 10°c at 1 x $10^{-3}$M and 5 x $10^{-4}$M concentrations. A minimum was observed at 60% ethanol. The cause of minimum was attributed to breaking of water structure and clustering in mixed solvents.

Das, N.C., Misra P.P. and others (1978) have studied the conductance of bromates, iodates and sulphates of potassium and sodium in dioxane-water mix at temperature 30 to 45°c. The conductance data obey the Onsager equation for a completely dissociated electrolyte. The ions interact appreciable with solvent in the order $BrO_3^-$ > $IO_3^-$ > $SO_4^{2-}$.

'Aleshko-Ozherskil and others (1979) have determined the temperature and cation radii effect of ion-solvation. The result showed that in the case of alkali metal chloride solutions the increasing temperature affect water in the region of remote (outer-sphere) hydration while an increase in ionic radius affects the immediate vicinity of the ions.

Vasin S.K. and others (1979) have determined the ion association in aqueous solution of alkali metal sulphate (II) in $M_2SO_4$ - $H_2SO_4$ - water system. The study showed that $Li^+$ occurs as simple hydrated ions while $Na^+$, $K^+$, $Rb^+$, $Cs^+$ form solvent separated ion pairs of $M^+ - H_2O - HSO_4^-$ type.

Bamane and Datar (1979) have found that in the case of potassium-chloride and sodium chloride the order in which conductivity values vary in aqueous organic solvents is methanol-water > acetone-water > ethanol-water.

Kenkyu kiyo and others (1980) have determined the electrical conductivity of KCl-dimethyl sulphoxide-water mixtures at 25°c. The results indicate that, the limiting equivalent conductivity shows a minimum at 80% dimethyl sulphoxide. The specific conductivity also shows a minimum at 80% dimethyl sulphoxide. The walden product was constant at $<$ 60 weight percentage dimethyl sulphixide concentration.

Daniel and others (1982) have investigated the formation of complex between sulphate ion and the alkali metal ions ($M^+$ = $Li^+$, $K^+$, $Na^+$, $Rb^+$, or $Cs^+$) at 37°c. The result showed that the order of stability for $\overline{[M(SO_4)]}$ complex is $Li^+$ $Na^+$ $K^+$ $Rb^+$ $Cs^+$.

Abraham Michael H and others (1982) have studied structure making and structure breaking effect of alkali halide ions from electrostatic entropies of solvation. Entropy data indicate that in water the ions $Li^+$, $Na^+$, $Ag^+$, and $F^-$ are structure makers, $K^+$ is on border line and in non-aqueous solvents like methyl-alcohol, formamide, dimethyl formamide all the above ions are structure brakers.

Ivanovo and others (1985) have studied the density, viscosity and x-ray data for $LiHSO_4$, $NaHSO_4$ and $KHSO_4$ solution in $H_2SO_4$ at 298.15°k. The result showed that ion solvating capacities are in the order $K^+ < Na^+ < Li^+$.

Vorob'ev A.V. and others (1989) were determined the solubility of $Na_2SO_4$ and $K_2SO_4$ in dimethyl sulphoxide and aqueous dimethyl sulphoxide solution at 272-313°k. The results showed that at 298°K crystals of $K_2SO_4$ (un solvated) exist in equilibtium with its saturated aqueous dimethyl sulphoxide solution.

At higher water contents and at 298°K, $Na_2SO_4$ crystallises as decahydrates but at higher dimethyl sulphoxide content $Na_2SO_4$ crystallises as the anhydrous salt.

Towarch K.M. and others (1989) have studied the conductance of $Na^+$ , $K^+$, ? $Rb^+$ , $Cs^+$ , with 1, 13-dibenzo-24-crown-8 in acetonitrile at 15, 20, 25, 30 and 35°c. The binding sequence based on the values of log K at 25°c is $Rb > Cs^+ > K^+ > Na^+$ . The enthalpy and entropy values were also reported.

The following systems have been studied at 5, 10, 15, 20, 25, and 30°c.

1) $1x10^{-3}M$ $K_2SO_4$ + X% ethanol
2) $1x10^{-4}M$ $K_2SO_4$ + X% ethanol
3) $5x10^{-5}M$ $K_2SO_4$ + X% ethanol
4) $1x10^{-5}M$ $K_2SO_4$ + X% ethanol
5) $1x10^{-3}M$ $K_2SO_4$ + X% methanol
6) $5x10^{-4}M$ $K_2SO_4$ + X% methanol
7) $1x10^{-4}M$ $K_2SO_4$ + X% methanol
8) $1x10^{-4}M$ $K_2SO_4$ + X% acetone
9) $5x10^{-5}M$ $K_2SO_4$ + X% acetone
10) $1x10^{-5}M$ $K_2SO_4$ + X% acetone.

Turbidity occurred while preparing the following solutions :

1) $1x10^{-2}M$ $K_2SO_4$ + X% ethanol
2) $5x10^{-3}M$ $K_2SO_4$ + X% ethanol
3) $1 x10^{-2}M$ $K_2SO_4$ + X% methanol
4) $5x10^{-3}M$ $K_2SO_4$ + X%methanol
5) $1x10^{-2}M$ $K_2SO_4$ + X% acetone

6) $5x10^{-3}M$ $K_2SO_4$ + X% acetone

7) $1x10^{-3}M$ $K_2SO_4$ + X% acetone

8) $5x10^{-4}M$ $K_2SO_4$ + X% acetone.

and hence the above concentrations could not be studied.

System : ~~$K_2SO_4$~~ $K_2SO_4$

Concentration : $1x10^{-3}M$

Solvent : Ethanol-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.1

| % Ethanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 264.0 | 280.0 | 312.0 | 320.0 | 339.0 | 360.0 |
| 10 | 238.0 | 245.0 | 280.0 | 325.0 | 329.0 | 349.0 |
| 20 | 210.0 | 211.0 | 243.0 | 253.0 | 262.0 | 274.0 |
| 30 | 150.0 | 178.0 | 195.0 | 208.0 | 212.0 | 223.0 |
| 40 | 142.0 | 149.0 | 164.0 | 170.0 | 173.0 | 187.0 |
| 50 | 116.0 | 118.0 | 137.0 | 140.0 | 152.0 | 160.0 |
| 60 | 99.0 | 104.0 | 117.0 | 122.0 | 130.0 | 136.0 |
| 70 | 82.0 | 88.0 | 97.0 | 104.0 | 110.0 | 120.0 |
| 80 | 31.0 | 38.0 | 40.0 | 61.0 | 70.0 | 82.0 |
| 90 | | | | | | |

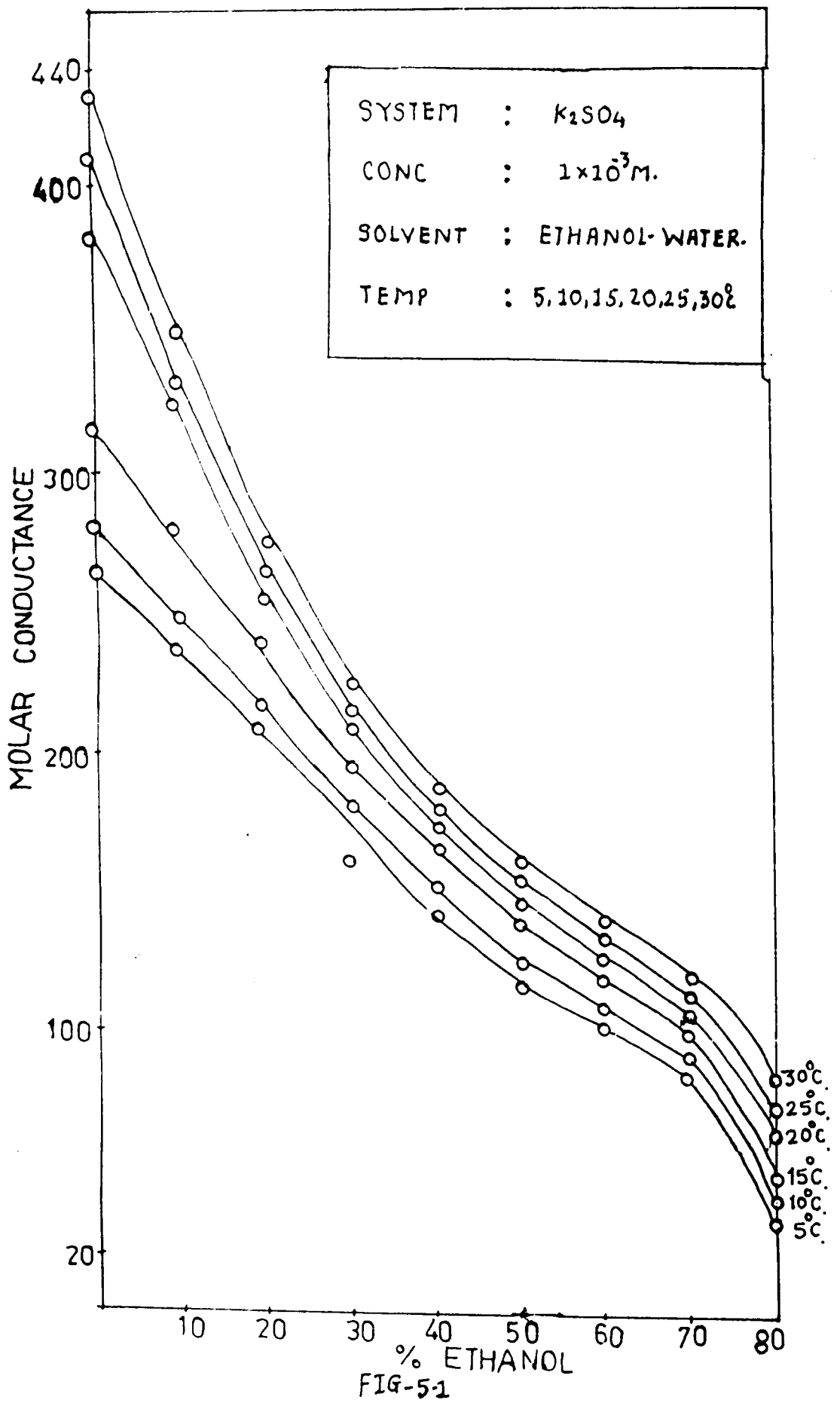

SYSTEM : $K_2SO_4$
CONC : $1\times10^{-3}$M.
SOLVENT : ETHANOL-WATER.
TEMP : 5, 10, 15, 20, 25, 30°C
MOLAR CONDUCTANCE
440
400
300
200
100
20
10
20
30
40
50
60
70
80
% ETHANOL
30°C
25°C
20°C
15°C
10°C
5°C

FIG-5-1

System : $K_2SO_4$

Concentration : $1 \times 10^{-4}M$

Solvent : Ethanol-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.2

| % Ethanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 280.0 | 295.0 | 321.0 | 330.0 | 340.0 | 380.0 |
| 10 | 240.0 | 251.0 | 290.0 | 328.0 | 332.0 | 365.0 |
| 20 | 209.0 | 213.0 | 251.0 | 253.0 | 263.0 | 276.0 |
| 30 | 154.0 | 180.0 | 202.0 | 210.0 | 221.0 | 230.0 |
| 40 | 144.0 | 162.0 | 171.0 | 181.0 | 185.0 | 192.0 |
| 50 | 120.0 | 123.0 | 145.0 | 152.0 | 162.0 | 164.0 |
| 60 | 101.0 | 105.0 | 120.0 | 125.0 | 135.0 | 140.0 |
| 70 | 86.0 | 92.0 | 106.0 | 107.0 | 114.0 | 121.0 |
| 80 | 70.0 | 80.0 | 95.0 | 102.0 | 110.0 | 115.0 |
| 90 | 68.0 | 70.0 | 76.0 | 80.0 | 82.0 | 96.0 |

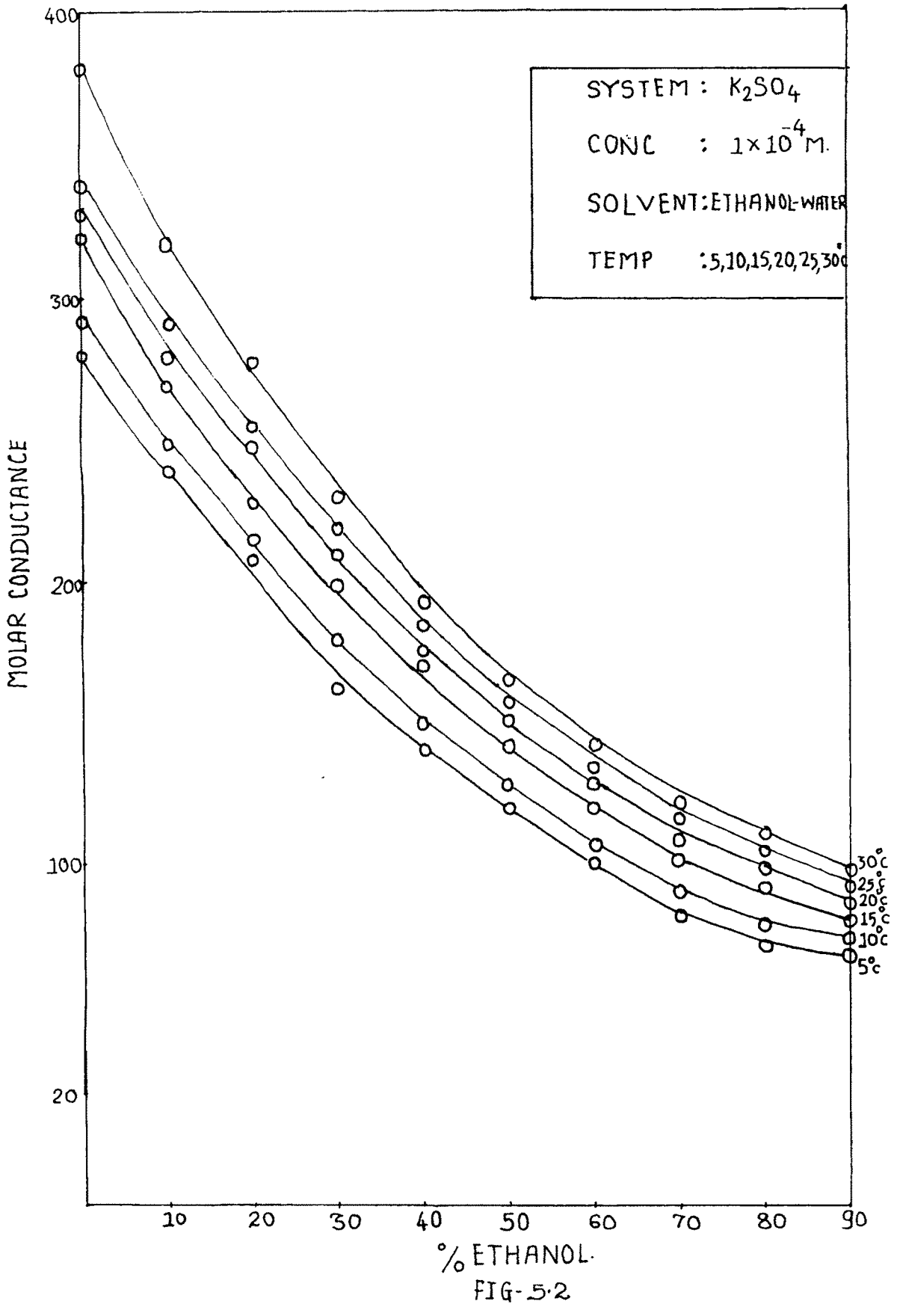

SYSTEM : $K_2SO_4$
CONC : $1 \times 10^{-4}$ M.
SOLVENT: ETHANOL-WATER
TEMP : 5, 10, 15, 20, 25, 30°
MOLAR CONDUCTANCE
400
300
200
100
20
10
20
30
40
50
60
70
80
90
% ETHANOL.
30°C
25°C
20°C
15°C
10°C
5°C

FIG-5.2

System : $K_2SO_4$

Concentration : $5 \times 10^{-5}$ M

Solvent : Ethanol-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.3

| % Ethanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 316.8 | 354.8 | 397.6 | 428.4 | 474.0 | 550.0 |
| 10 | 264.0 | 292.4 | 300.0 | 344.0 | 368.0 | 378.2 |
| 20 | 211.0 | 215.4 | 251.4 | 253.0 | 265.0 | 277.8 |
| 30 | 157.0 | 182.0 | 204.1 | 212.0 | 224.0 | 236.4 |
| 40 | 148.0 | 167.4 | 177.0 | 188.4 | 190.0 | 199.6 |
| 50 | 126.6 | 129.2 | 148.4 | 155.6 | 164.1 | 164.4 |
| 60 | 102.4 | 105.2 | 120.6 | 126.5 | 136.6 | 140.0 |
| 70 | 88.0 | 94.1 | 108.4 | 109.8 | 120.0 | 126.0 |
| 80 | 80.4 | 81.6 | 96.8 | 98.4 | 112.0 | 118.0 |
| 90 | 81.0 | 100.2 | 56.4 | 56.6 | 74.0 | 114.0 |

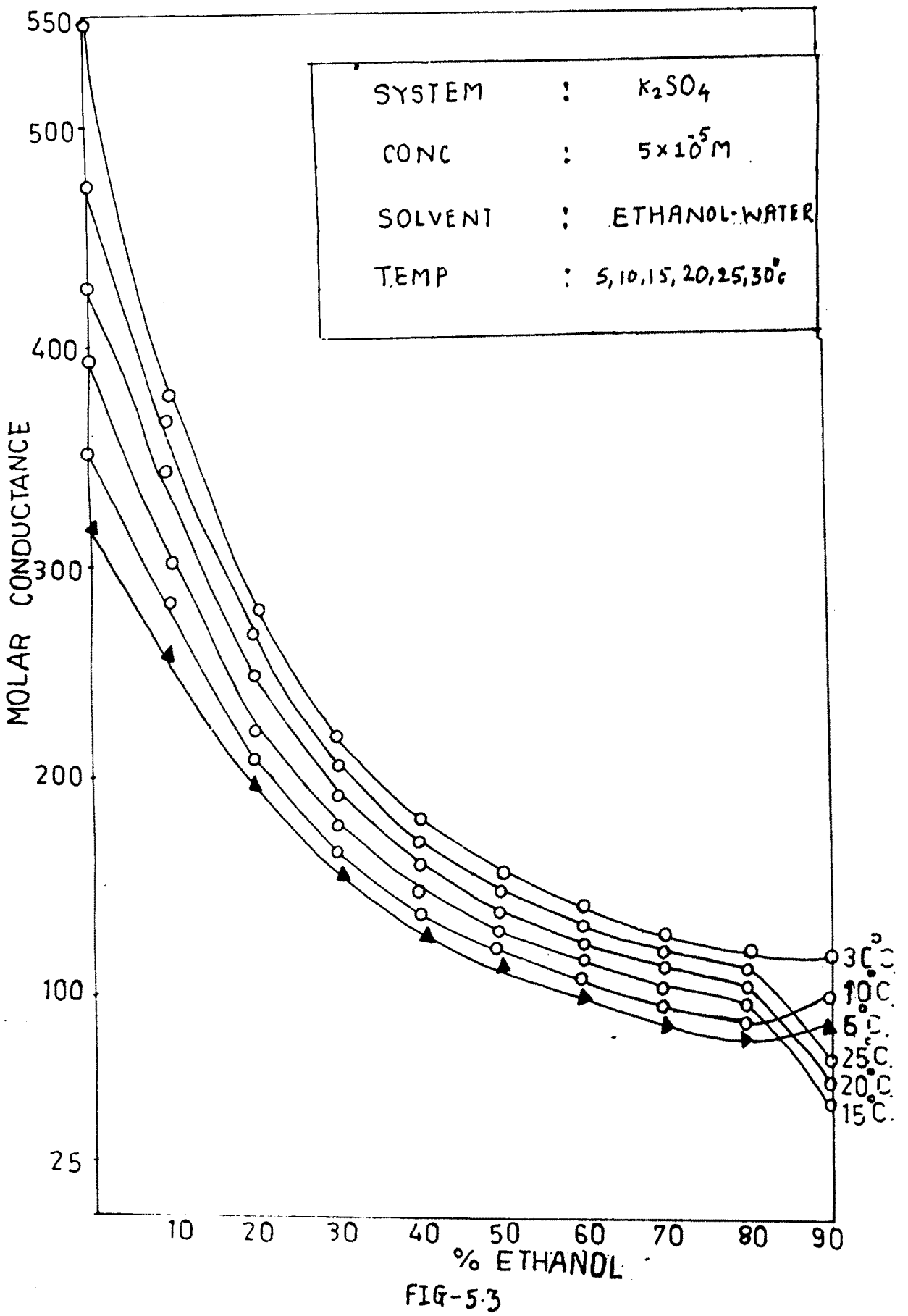

SYSTEM : $K_2SO_4$
CONC : $5 \times 10^{-5}$ M
SOLVENT : ETHANOL-WATER
TEMP : 5, 10, 15, 20, 25, 30°C
MOLAR CONDUCTANCE
550
500
400
300
200
100
25
10 20 30 40 50 60 70 80 90
% ETHANOL
30°C
10°C
5°C
25°C
20°C
15°C

FIG-5.3

| | |
|---|---|
| System | : $K_2SO_4$ |
| Concentration | : $1 \times 10^{-5}$ M |
| Solvent | : Ethanol-water |
| Temperature | : 5, 10, 15, 20, 25 & 30°C |

TABLE 5.4

| % Ethanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 820.0 | 900.0 | 1010.0 | 1070.0 | 1230.0 | 1637.0 |
| 10 | 690.0 | 750.0 | 960.0 | 880.0 | 1100.0 | 1250.0 |
| 20 | 610.0 | 690.0 | 710.0 | 780.0 | 830.0 | 940.0 |
| 30 | 460.0 | 500.0 | 530.0 | 570.0 | 630.0 | 820.0 |
| 40 | 400.0 | 450.0 | 480.0 | 560.0 | 560.0 | 680.0 |
| 50 | 380.0 | 430.0 | 440.0 | 460.0 | 520.0 | 590.0 |
| 60 | 360.0 | 410.0 | 430.0 | 450.0 | 480.0 | 580.0 |
| 70 | 350.0 | 390.0 | 410.0 | 430.0 | 460.0 | 560.0 |
| 80 | 400.0 | 410.0 | 440.0 | 400.0 | 420.0 | 520.0 |
| 90 | 410.0 | 420.0 | 450.0 | 380.0 | 320.0 | 500.0 |

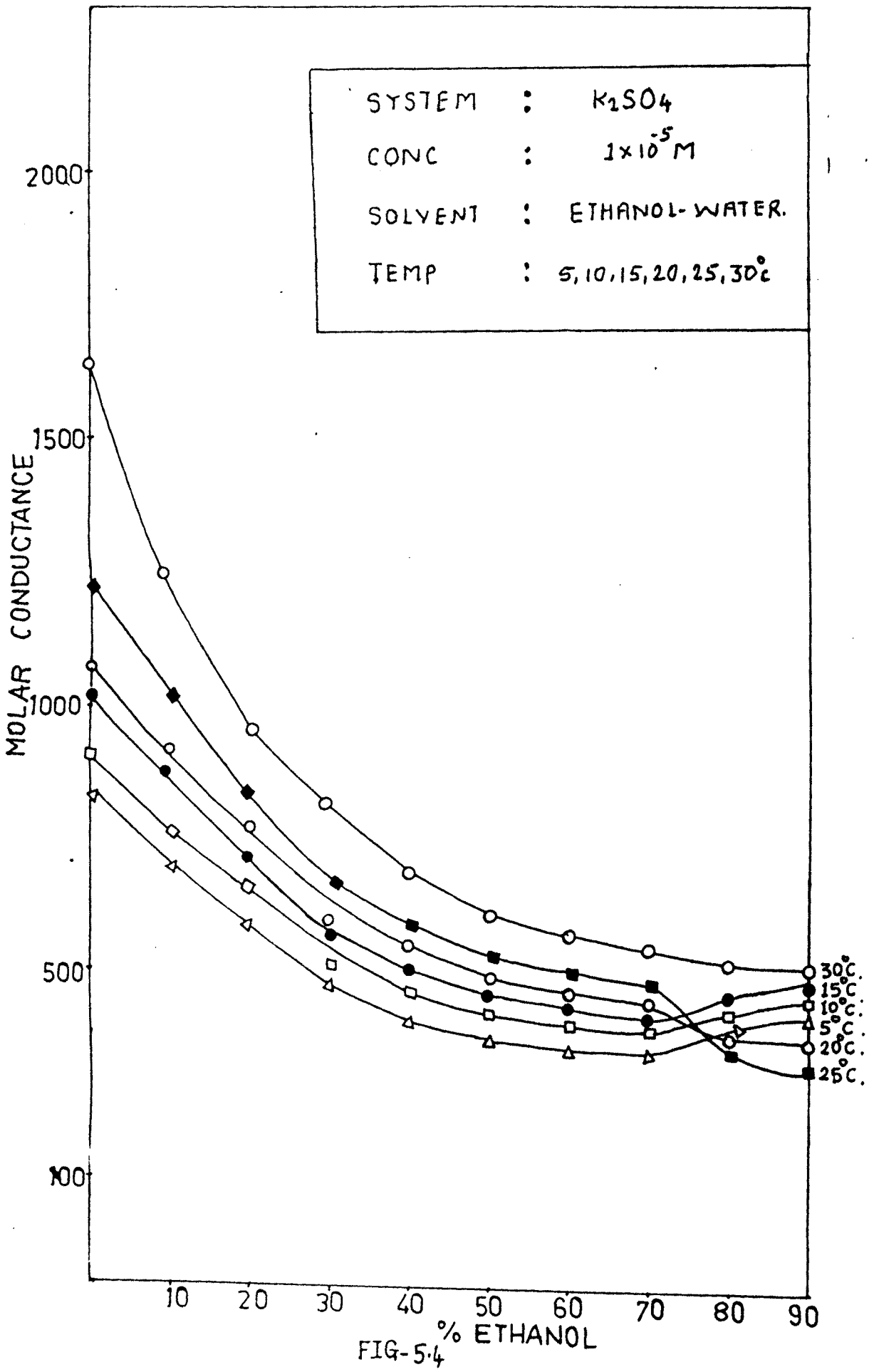

SYSTEM : $K_2SO_4$
CONC : $1 \times 10^{-5}$ M
SOLVENT : ETHANOL-WATER.
TEMP : 5, 10, 15, 20, 25, 30°c
MOLAR CONDUCTANCE
2000
1500
1000
500
100
10
20
30
40
50
60
70
80
90
% ETHANOL
30°C.
15°C.
10°C.
5°C.
20°C.
25°C.

FIG-5.4

| | |
|---|---|
| System | : $K_2SO_4$ |
| Concentration | : $1x10^{-3}M$ |
| Solvent | : Methanol-water |
| Temperature | : 5, 10, 15, 20, 25 & 30°C |

TABLE 5.5

| % Methanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 242.0 | 262.0 | 280.0 | 292.0 | 319.0 | 339.0 |
| 10 | 214.0 | 236.0 | 25600 | 266.0 | 272.0 | 289.0 |
| 20 | 183.0 | 196.0 | 217.0 | 225.0 | 229.0 | 246.0 |
| 30 | 156.0 | 166.0 | 187.0 | 198.0 | 209.0 | 215.0 |
| 40 | 134.0 | 147.0 | 163.0 | 172.0 | 186.0 | 193.0 |
| 50 | 130.0 | 140.0 | 155.0 | 164.0 | 170.0 | 178.0 |
| 60 | 119.0 | 137.0 | 146.0 | 150.0 | 163.0 | 168.0 |
| 70 | 117.0 | 133.0 | 134.0 | 144.0 | 154.0 | 159.0 |
| 80 | 102.0 | 118.0 | 128.0 | 132.0 | 134.0 | 142.0 |
| 90 | | | | | | |

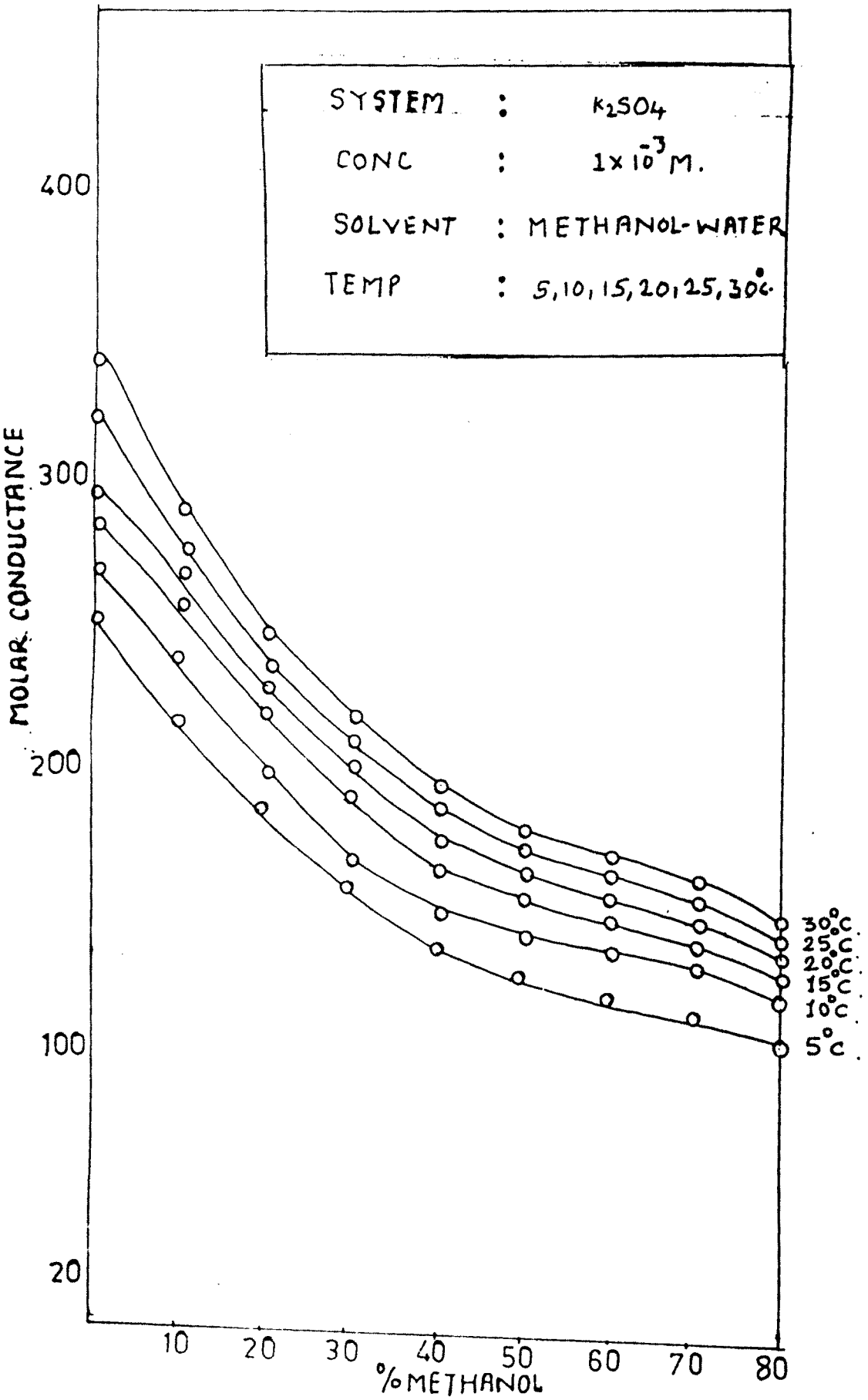

SYSTEM : $K_2SO_4$
CONC : $1 \times 10^{-3}$ M.
SOLVENT : METHANOL-WATER
TEMP : 5, 10, 15, 20, 25, 30°C.
MOLAR CONDUCTANCE
400
300
200
100
20
10
20
30
40
50
60
70
80
% METHANOL
30°C
25°C
20°C
15°C
10°C
5°C

FIG-5.5

System : $K_2SO_4$

Concentration : $5x10^{-4}M$

Solvent : Methanol-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.6

| % Methanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 252.0 | 270.0 | 290.0 | 318.0 | 352.0 | 372.0 |
| 10 | 232.0 | 242.0 | 260.0 | 290.0 | 316.0 | 322.0 |
| 20 | 190.0 | 218.0 | 240.0 | 258.0 | 276.0 | 280.0 |
| 30 | 172.0 | 192.0 | 200.0 | 226.0 | 240.0 | 246.0 |
| 40 | 164.0 | 176.0 | 186.0 | 206.0 | 220.0 | 224.0 |
| 50 | 156.0 | 160.0 | 174.0 | 192.0 | 200.0 | 208.0 |
| 60 | 148.0 | 154.0 | 164.0 | 178.0 | 192.0 | 198.0 |
| 70 | 144.0 | 150.0 | 160.0 | 174.0 | 184.0 | 192.0 |
| 80 | 146.0 | 158.0 | 162.0 | 158.0 | 186.0 | 190.0 |
| 90 | 148.0 | 160.0 | 164.0 | 180.0 | 188.0 | 192.0 |

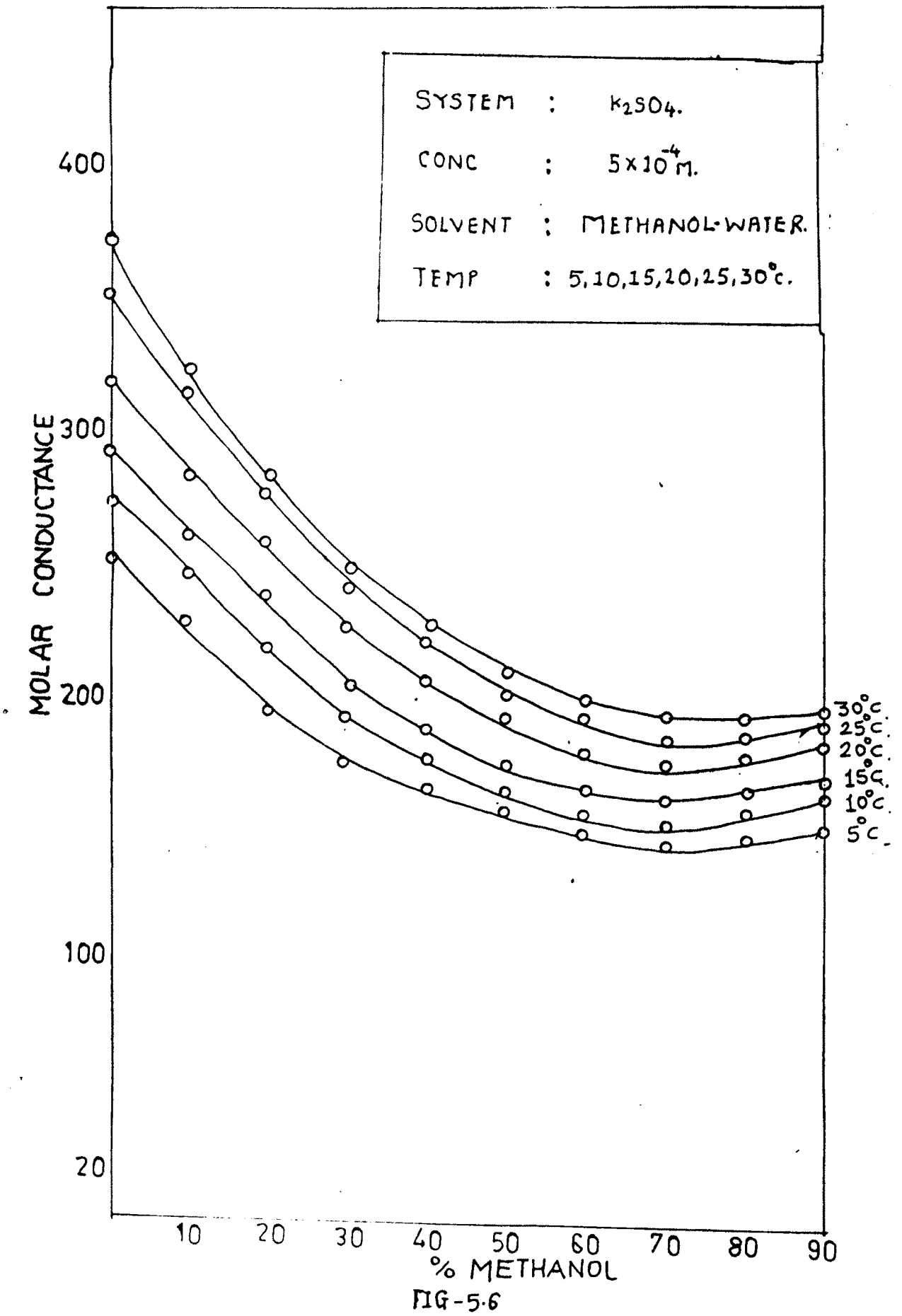

SYSTEM : $K_2SO_4$.
CONC : $5 \times 10^{-4}$ M.
SOLVENT : METHANOL-WATER.
TEMP : 5,10,15,20,25,30°c.
MOLAR CONDUCTANCE
400
300
200
100
20
30°c.
25°c.
20°c.
15°c.
10°c.
5°c.
10
20
30
40
50
60
70
80
90
% METHANOL

FIG-5.6

System : $K_2SO_4$

Concentration : $1x10^{-4}M$

Solvent : Methanol-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.7

| % Methanol | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 282.0 | 304.0 | 332.0 | 353.0 | 387.0 | 432.0 |
| 10 | 243.0 | 260.0 | 298.0 | 338.0 | 348.0 | 382.0 |
| 20 | 212.0 | 232.0 | 263.0 | 285.0 | 301.0 | 342.0 |
| 30 | 198.0 | 214.0 | 232.0 | 247.0 | 268.0 | 314.0 |
| 40 | 182.0 | 193.0 | 215.0 | 220.0 | 236.0 | 282.0 |
| 50 | 161.0 | 168.0 | 196.0 | 208.0 | 225.0 | 263.0 |
| 60 | 149.0 | 155.0 | 183.0 | 192.0 | 216.0 | 253.0 |
| 70 | 142.0 | 146.0 | 179.0 | 190.0 | 206.0 | 248.0 |
| 80 | 155.0 | 159.0 | 192.0 | 202.0 | 220.0 | 254.0 |
| 90 | 160.0 | 164.0 | 199.0 | 210.0 | 226.0 | 258.0 |

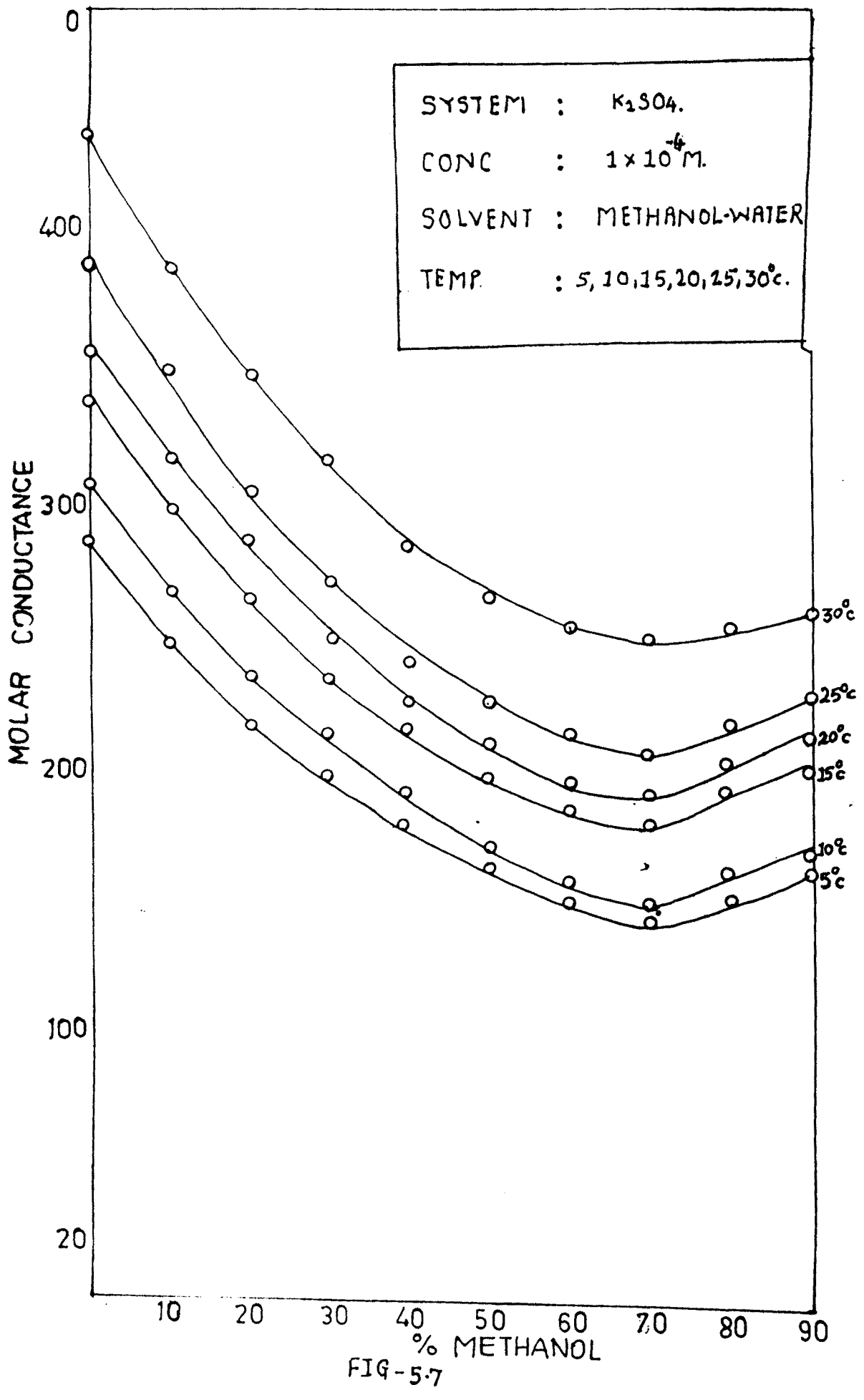

SYSTEM : $K_2SO_4$.
CONC : $1 \times 10^{-4}$ M.
SOLVENT : METHANOL-WATER
TEMP : 5, 10, 15, 20, 25, 30°c.
MOLAR CONDUCTANCE
0
400
300
200
100
20
30°c
25°c
20°c
15°c
10°c
5°c
10
20
30
40
50
60
70
80
90
% METHANOL

FIG-5.7

System : $K_2SO_4$

Concentration : $1x10^{-4}M$

Solvent : Acetone-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.8

| % Acetone | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 287.0 | 312.0 | 333.0 | 359.0 | 395.0 | 453.0 |
| 10 | 271.0 | 286.0 | 312.0 | 350.0 | 358.0 | 404.0 |
| 20 | 238.0 | 248.0 | 285.0 | 304.0 | 310.0 | 346.0 |
| 30 | 212.0 | 226.0 | 244.0 | 297.0 | 305.0 | 322.0 |
| 40 | 180.0 | 198.0 | 220.0 | 256.0 | 272.0 | 290.0 |
| 50 | 166.0 | 178.0 | 213.0 | 212.0 | 241.0 | 283.0 |
| 60 | 144.0 | 167.0 | 192.0 | 201.0 | 220.0 | 262.0 |
| 70 | 142.0 | 152.0 | 188.0 | 198.0 | 209.0 | 258.0 |
| 80 | 139.0 | 149.0 | 153.0 | 157.0 | 164.0 | 204.0 |
| 90 | 72.0 | 76.0 | 86.0 | 110.0 | 120.0 | 151.0 |

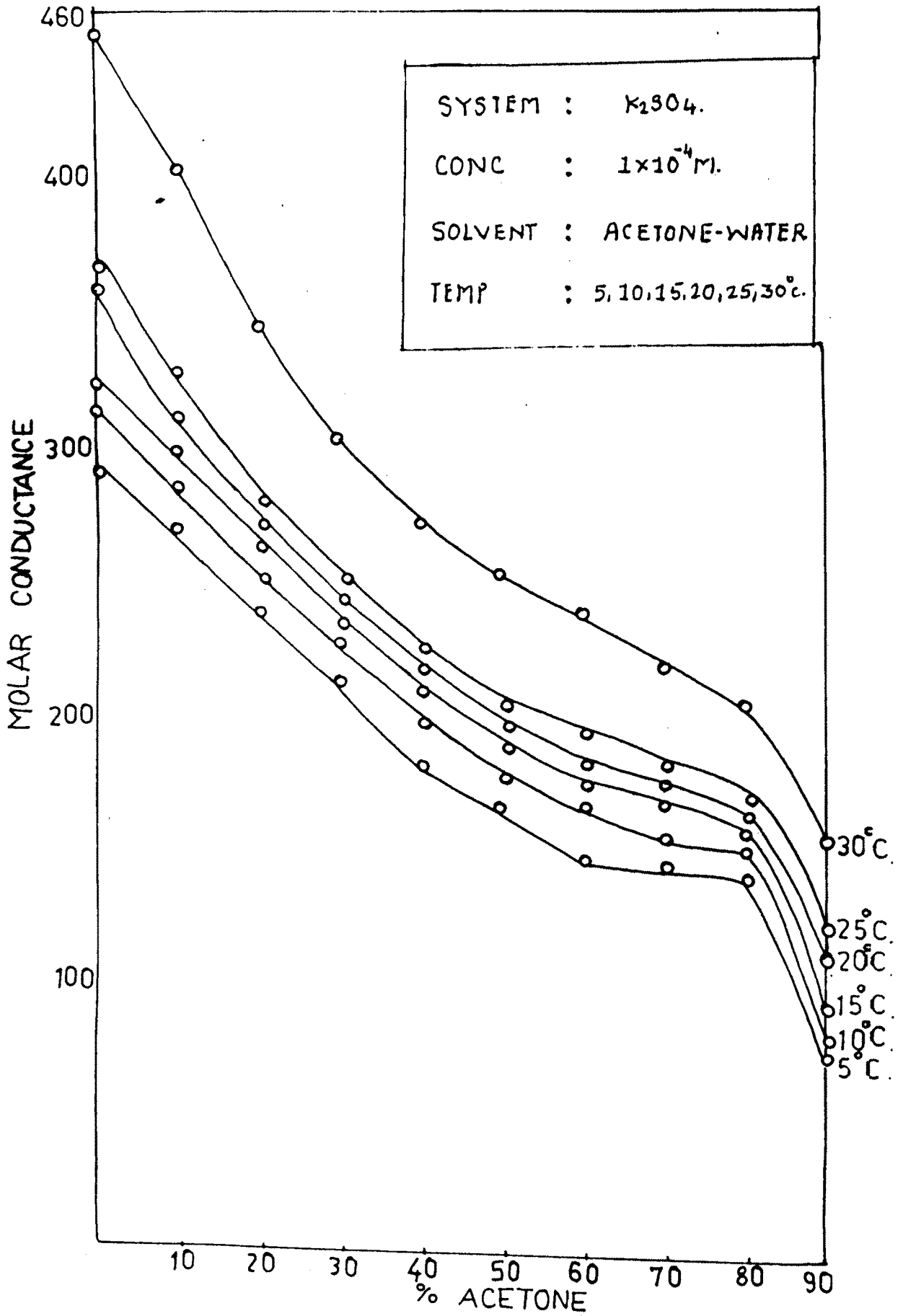

460
400
300
200
100
MOLAR CONDUCTANCE
SYSTEM : K2SO4.
CONC : 1×10⁻⁴M.
SOLVENT : ACETONE-WATER
TEMP : 5, 10, 15, 20, 25, 30°c.
30°C.
25°C.
20°C.
15°C.
10°C.
5°C.
10
20
30
40
50
60
70
80
90
% ACETONE

FIG-5.8

System : $K_2SO_4$

Concentration : $5x10^{-5}M$

Solvent : Acetone-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.9

| % Acetone | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 336.0 | 344.0 | 402.0 | 420.0 | 484.0 | 566.0 |
| 10 | 300.0 | 310.0 | 342.0 | 370.0 | 420.0 | 454.0 |
| 20 | 262.0 | 272.0 | 294.0 | 322.0 | 378.0 | 410.0 |
| 30 | 232.0 | 238.0 | 250.0 | 284.0 | 330.0 | 368.0 |
| 40 | 216.0 | 220.0 | 222.0 | 252.0 | 308.0 | 332.0 |
| 50 | 190.0 | 202.0 | 212.0 | 220.0 | 274.0 | 292.0 |
| 60 | 184.0 | 186.0 | 188.0 | 208.0 | 248.0 | 278.0 |
| 70 | 180.0 | 182.0 | 184.0 | 194.0 | 242.0 | 253.0 |
| 80 | 182.0 | 184.0 | 194.0 | 196.0 | 248.0 | 240.0 |
| 90 | 184.0 | 186.0 | 200.0 | 200.0 | 250.0 | 242.0 |

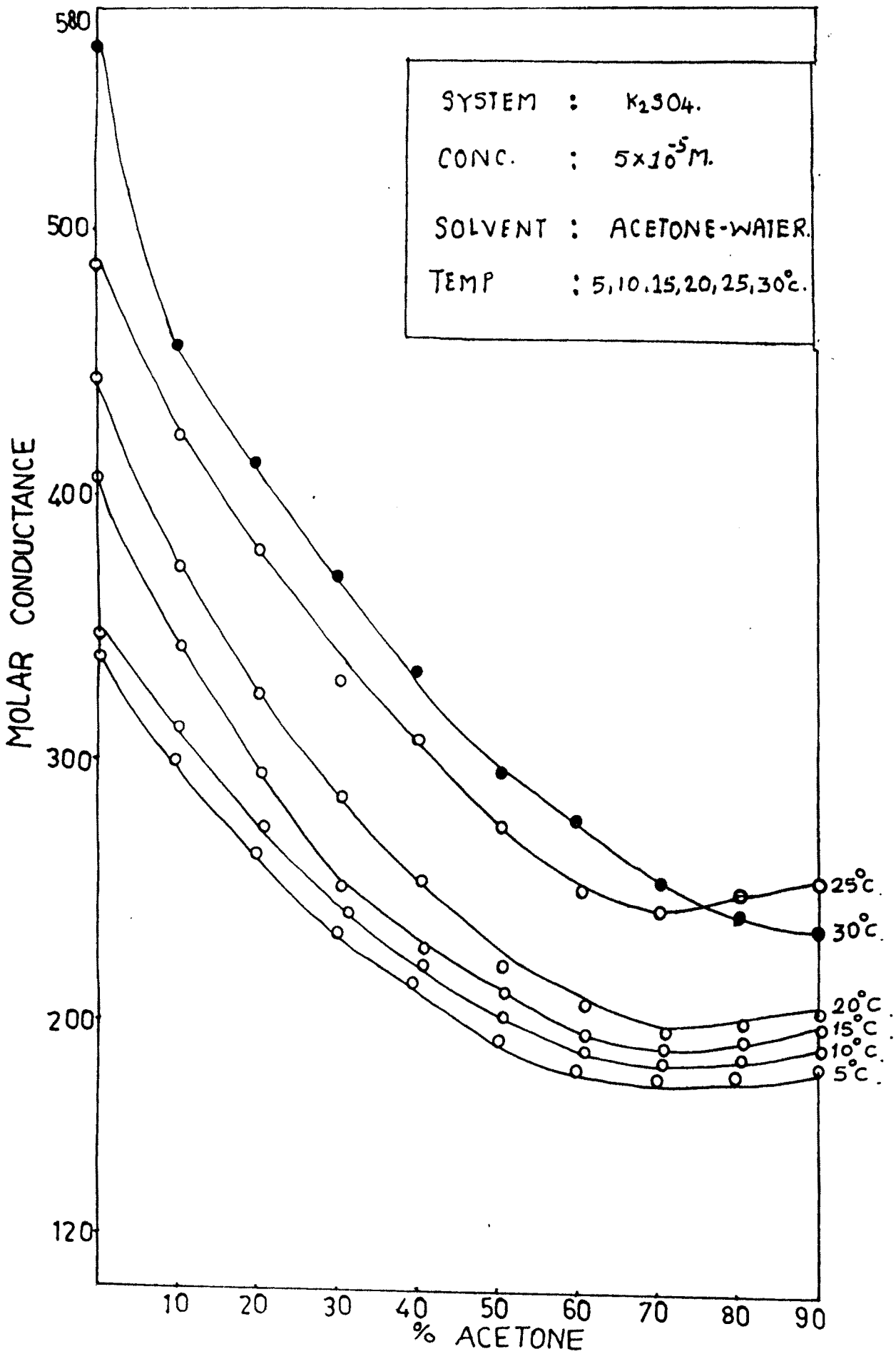

SYSTEM : $K_2SO_4$.
CONC. : $5\times10^{-5}$M.
SOLVENT : ACETONE-WATER.
TEMP : 5,10.15,20,25,30°c.
MOLAR CONDUCTANCE
580
500
400
300
200
120
10
20
30
40
50
60
70
80
90
% ACETONE
25°C
30°C
20°C
15°C
10°C
5°C

FIG-5.9

System : $K_2SO_4$

Concentration : $1x10^{-5}M$

Solvent : Acetone-water

Temperature : 5, 10, 15, 20, 25 & 30°C

TABLE 5.10

| % Acetone | MOLAR CONDUCTANCE | | | | | |
|---|---|---|---|---|---|---|
| | 5°C | 10°C | 15°C | 20°C | 25°C | 30°C |
| 00 | 660.0 | 690.0 | 1050.0 | 1110.0 | 1220.0 | 1780.0 |
| 10 | 640.0 | 660.0 | 870.0 | 950.0 | 1040.0 | 1600.0 |
| 20 | 590.0 | 610.0 | 640.0 | 750.0 | 820.0 | 1430.0 |
| 30 | 550.0 | 570.0 | 600.0 | 620.0 | 720.0 | 1240.0 |
| 40 | 450.0 | 500.0 | 520.0 | 540.0 | 610.0 | 1150.0 |
| 50 | 430.0 | 440.0 | 460.0 | 470.0 | 540.0 | 980.0 |
| 60 | 390.0 | 410.0 | 430.0 | 450.0 | 500.0 | 920.0 |
| 70 | 350.0 | 400.0 | 420.0 | 430.0 | 480.0 | 850.0 |
| 80 | 380.0 | 430.0 | 440.0 | 500.0 | 460.0 | 800.0 |
| 90 | 390.0 | 450.0 | 450.0 | 510.0 | 480.0 | 820.0 |

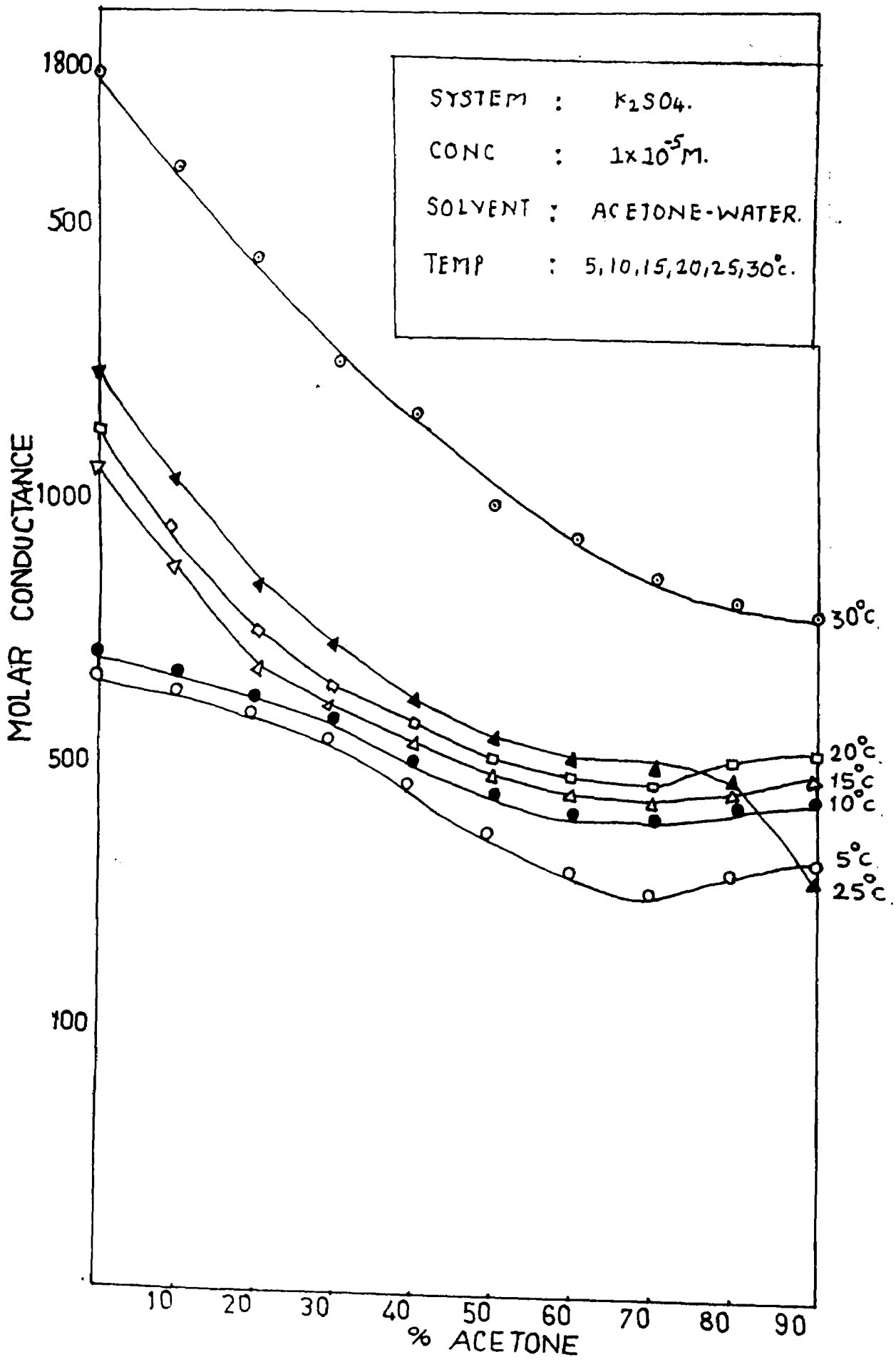

SYSTEM : $K_2SO_4$.
CONC : $1 \times 10^{-5}$M.
SOLVENT : ACETONE-WATER.
TEMP : 5,10,15,20,25,30°c.
MOLAR CONDUCTANCE
1800
500
1000
500
100
30°c
20°c
15°c
10°c
5°c
25°c
10
20
30
40
50
60
70
80
90
% ACETONE

FIG-5.10

## DISCUSSION

It has been observed that the molar conductance of potassium sulphate decreases very suddenly for the concentrations of $1x10^{-3}M$ and $1x10^{-4}M$ in ethanol-water systems for the temperatures 5, 10, 15, 20, 25, $30^{o}c$.

While a minima is obtained at 80% ethanol in ethanol-mixed solvents at 5 and $10^{o}c$ only for the concentration of $5x10^{-5}M$ and there is no minima for the above concentration at the temperatures 15, 20, 25 and $30^{o}c$. There is also a minima obtained at 70% ethanol for the temperature 5 and $10^{o}c$. and for the concentration $1 x10^{-5}M$.

For the methanol-water system, there is no minima for $1x10^{-3}M$ concentration and for all the temperature studied.

A minima is obtained at 70% methanol in methanol-water system for the concentration $5x10^{-4}M$ and $1x10^{-4}M$ and for the temperature 5, 10, 15, 20, 25 and $30^{o}c$.

For the acetone-water system, the molar conductance decrease abruptly above 80% acetone and the concentration is $1x10^{-4}M$. Minimum in molar conductance has been observed at all temperatures at 5 and 10, 15, 20, 25 and $30^{o}c$ for acetone-water system and for the concentration $5x10^{-5}M$ and $1x10^{-5}M$. This minima is at 70% acetone for both the concentrations.

It seems that this is due the structure breaking of water and establishment of new hydrogen bonds to form methanol-water and acetone-water clusters at all temperatures from 5 to $30^{o}c$, where as in case of ethanol-water system, ethanol-water clustering is favoured only at lower temperature upto $10^{o}c$ and not above.

The summary graphs show that the conductivity of potassium sulphate varies linearly with temperature from 5 to 30°c.

It has been found from the study of conductivity of potassium sulphate in mixed aqueous organic solvents (ethanol, methanol and acetone) that the conductivity values are in the order : acetone-water > methanol-water > ethanol-water upto 70% of non-aqueous solvent. Beyond 70%, the order changes as methanol-water acetone-water > ethanol-water.

Comparison of molar Conductances of Potassium sulphate in mixed solvents at $5^{o}c$ and at $1 \times 10^{-4}$ M concentration

TABLE 5.11

| % Non aqueous solvent | $1 \times 10^{-4}$M | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 280.0 | 282.0 | 287.0 |
| 10 | 240.0 | 243.0 | 271.0 |
| 20 | 209.0 | 212.0 | 238.0 |
| 30 | 154.0 | 198.0 | 212.0 |
| 40 | 144.0 | 182.0 | 184.0 |
| 50 | 120.0 | 161.0 | 166.00 |
| 60 | 101.0 | 149.0 | 154.0 |
| 70 | 86.0 | 142.0 | 146.0 |
| 80 | 70.0 | 155.0 | 139.0 |
| 90 | 68.0 | 160.0 | 72.0 |

Comparison of molar Conductances of potassium sulphate in mixed solvents at $10^{o}c$ and at $1x10^{-4}M$ concentration.

TABLE 5.12

| % Non aqueous solvent | $1x10^{-4}M$ | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 295.0 | 304.0 | 312.0 |
| 10 | 251.0 | 260.0 | 286.0 |
| 20 | 213.0 | 232.0 | 248.0 |
| 30 | 180.0 | 214.0 | 226.0 |
| 40 | 162.0 | 193.0 | 198.0 |
| 50 | 123.0 | 168.0 | 176.0 |
| 60 | 105.0 | 155.0 | 167.0 |
| 70 | 92.0 | 146.0 | 152.0 |
| 80 | 80.0 | 159.0 | 149.0 |
| 90 | 70.0 | 164.0 | 76.0 |

Comparison of molar Conductances of potassium sulphate in mixed solvents at $15^{o}c$ and at $1x10^{-4}M$ concentration..

TABLE 5.13

| % Non aqueous solvent | $1x10^{-4}M$ | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 321.0 | 332.0 | 333.00 |
| 10 | 290.0 | 298.0 | 312.0 |
| 20 | 251.0 | 263.0 | 285.0 |
| 30 | 202.0 | 232.0 | 244.0 |
| 40 | 171.0 | 215.0 | 220.0 |
| 50 | 145.0 | 196.0 | 213.0 |
| 60 | 120.0 | 183.0 | 192.0 |
| 70 | 106.0 | 179.0 | 188.0 |
| 80 | 95.0 | 192.0 | 153.0 |
| 90 | 76.0 | 199.0 | 86.0 |

Comparison of molar Conductances of Potassium sulphate in mixed solvents at $20^{o}c$ and at $1x10^{-4}M$ concentration

TABLE 5.14

| % Non aqueous solvent | $1 \times 10^{-4}M$ | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 330.0 | 353.0 | 359.0 |
| 10 | 328.0 | 338.0 | 350.00 |
| 20 | 253.0 | 283.0 | 304.0 |
| 30 | 210.0 | 247.0 | 297.0 |
| 40 | 181.0 | 219.0 | 256.0 |
| 50 | 152.0 | 208.0 | 212.0 |
| 60 | 125.0 | 192.0 | 201.0 |
| 70 | 105.0 | 190.0 | 198.0 |
| 80 | 102.0 | 202.0 | 157.0 |
| 90 | 80.0 | 210.0 | 110.0 |

Comparison of molar Conductances of potassium sulphate in mixed solvents at $25^{o}c$ and at $1x10^{-4}_{M}$ concentration

TABLE 5.15

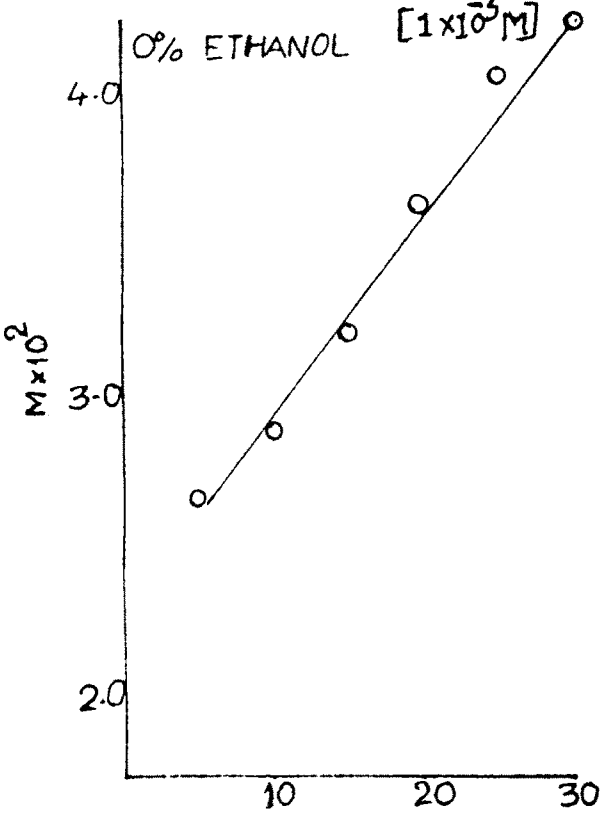
| % Non aqueous solvent | $1 \times 10^{-4}_{M}$ | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 340.0 | 387.0 | 395.0 |
| 10 | 332.0 | 348.0 | 359.0 |
| 20 | 263.0 | 301.0 | 312.0 |
| 30 | 221.0 | 268.0 | 304.0 |
| 40 | 185.0 | 235.0 | 271.0 |
| 50 | 162.0 | 223.0 | 241.0 |
| 60 | 135.0 | 216.0 | 220.0 |
| 70 | 114.0 | 205.0 | 209.0 |
| 80 | 110.0 | 220.0 | 164.0 |
| 90 | 82.0 | 226.0 | 120.0 |

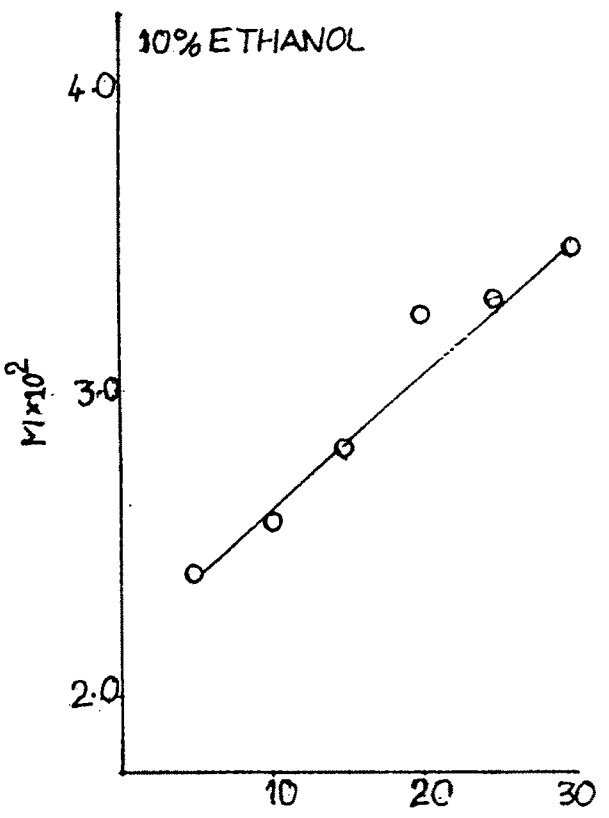
Comparison of molar Conductances of potassium sulphate in mixed solvents at $30^{o}c$ and at $1x10^{-4}M$ concentration

TABLE 5.16

| % Non aqueous solvent | $1 \times 10^{-4}M$ | | |
|---|---|---|---|
| | Ethanol-water | Methanol-water | Acetone-water |
| 00 | 380.0 | 432.0 | 453.0 |
| 10 | 365.0 | 383.0 | 404.0 |
| 20 | 276.0 | 342.0 | 346.0 |
| 30 | 230.0 | 314.0 | 322.0 |
| 40 | 192.0 | 282.0 | 290.0 |
| 50 | 164.0 | 263.0 | 284.0 |
| 60 | 140.0 | 254.0 | 262.0 |
| 70 | 121.0 | 248.0 | 259.0 |
| 80 | 115.0 | 254.0 | 204.0 |
| 90 | 96.0 | 258.0 | 152.0 |

SYSTEM: $K_2SO_4$ (0·001 M), SOLVENT: ETHANOL-WATER.



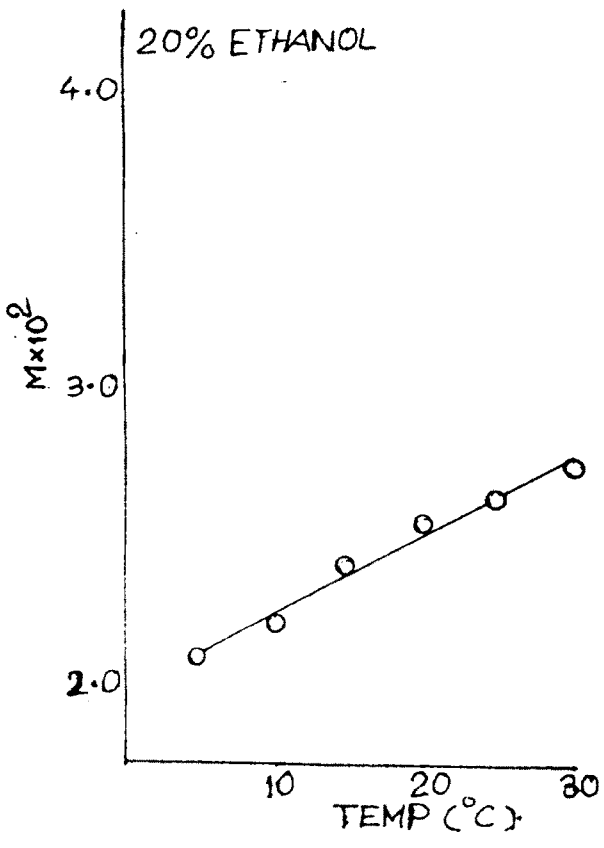
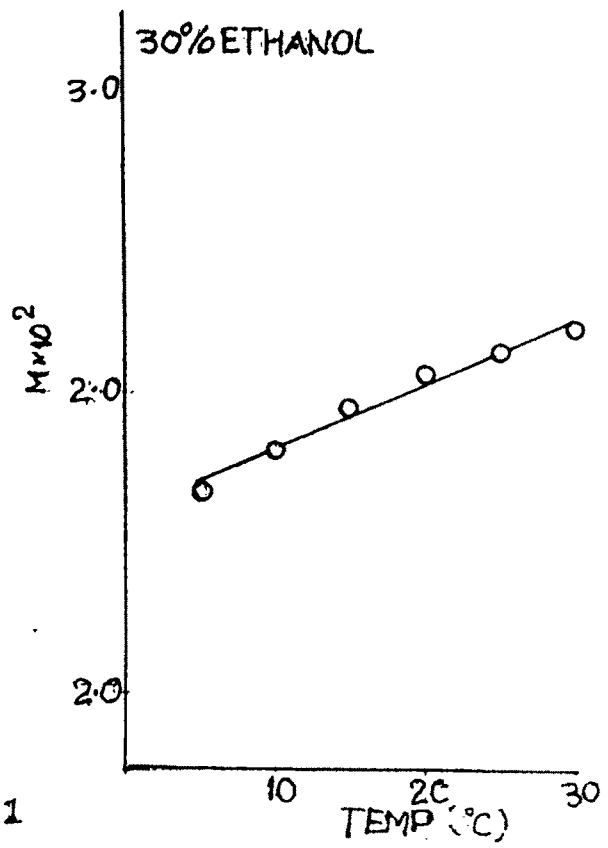
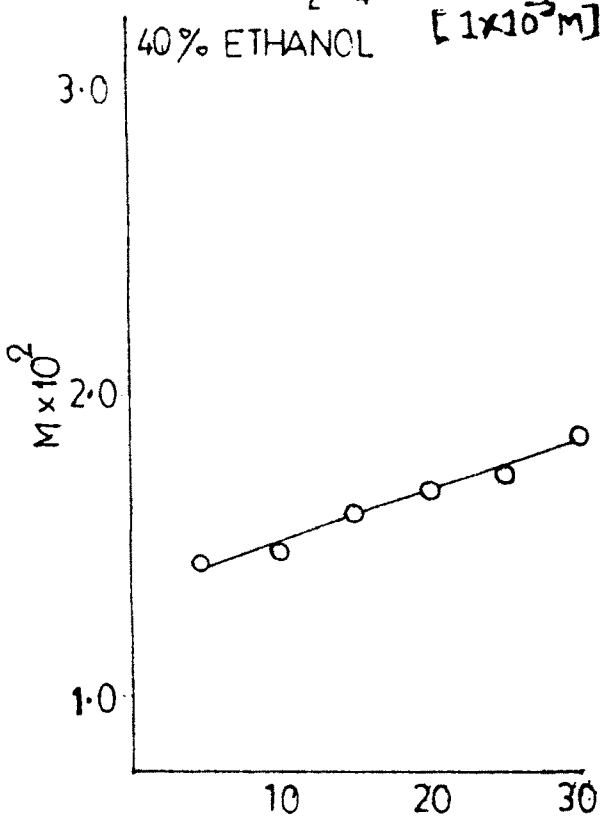
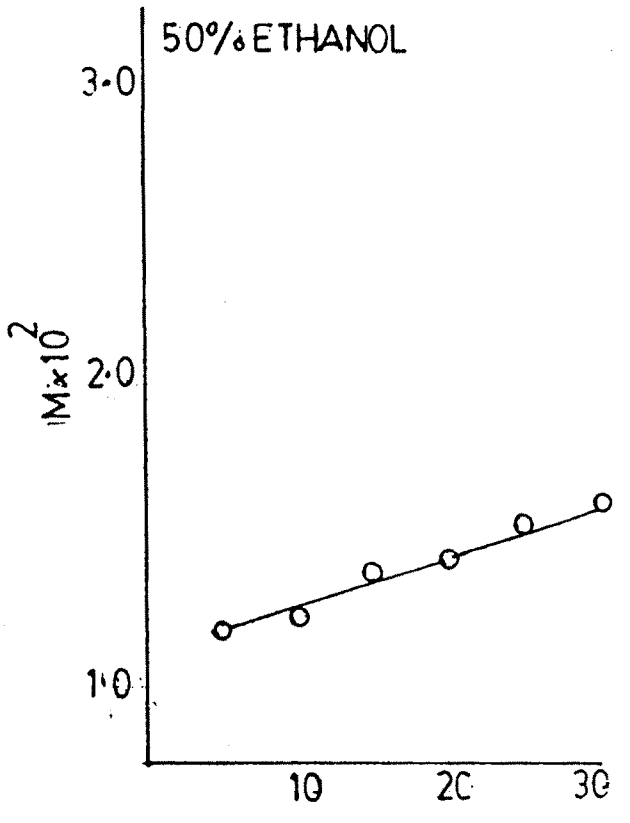




FIG-5.11



SYSTEM : $K_2SO_4$ (0·001M), SOLVENT: ETHANOL-WATER [$1\times10^{-3}$M]



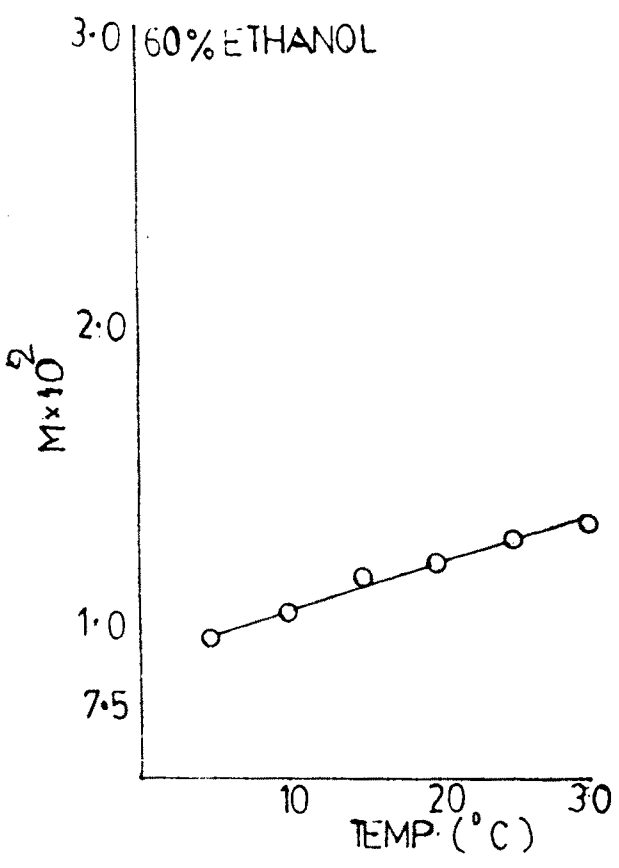
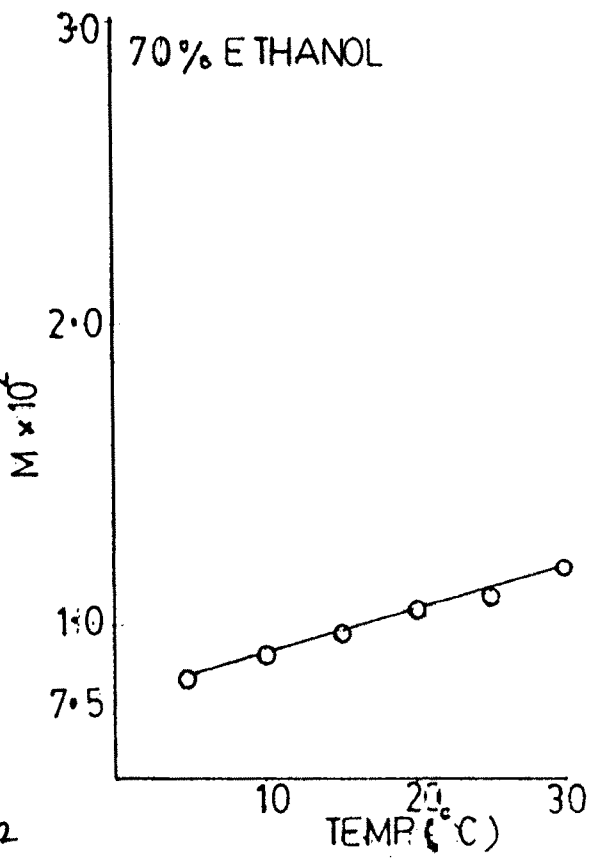




FIG-5.12



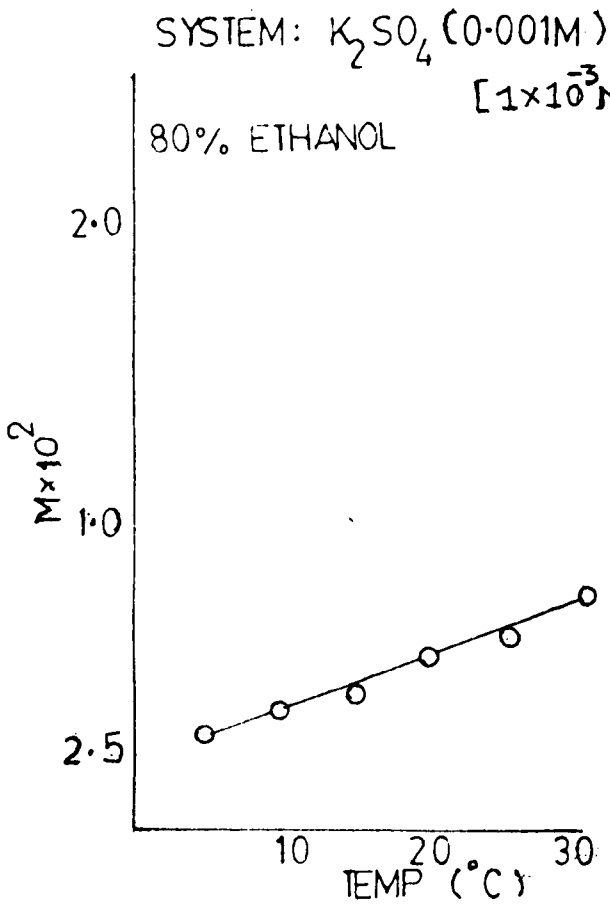



FIG-5·13

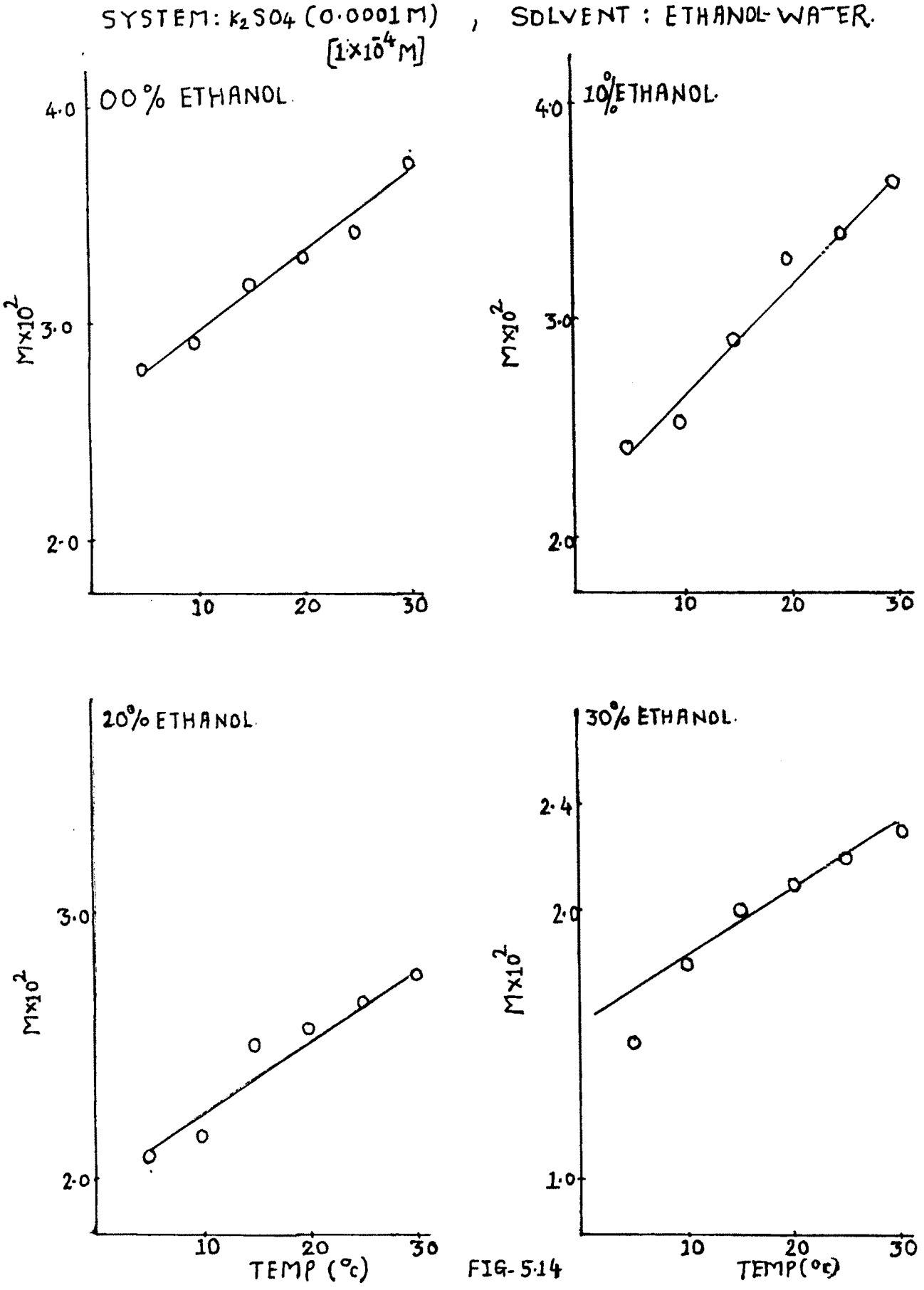
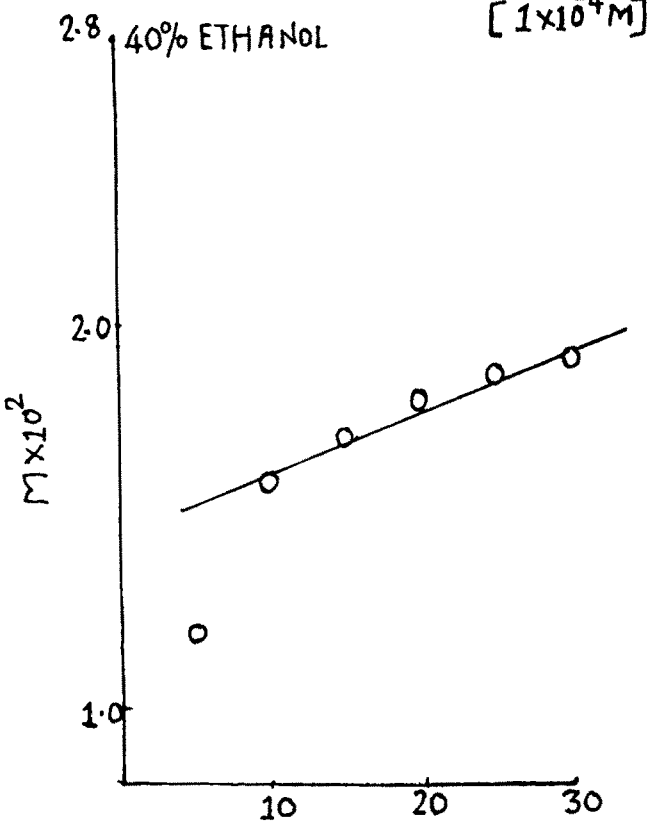
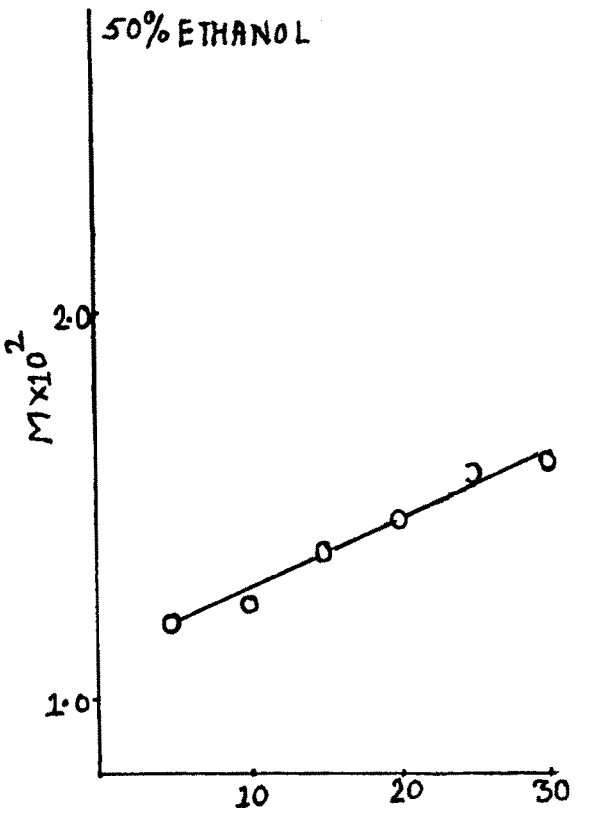
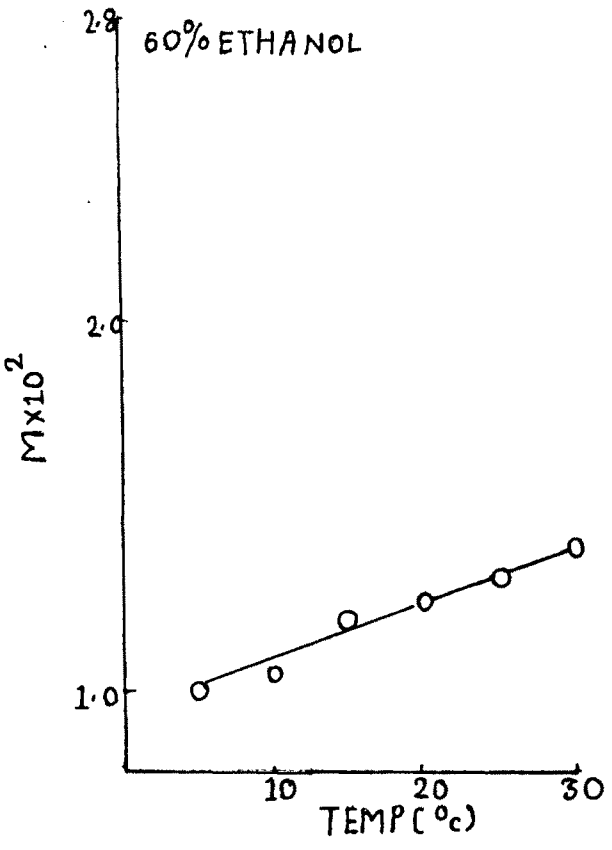

SYSTEM: $K_2SO_4$ (0.0001 M) , SOLVENT : ETHANOL-WATER.
$[1\times10^{-4}M]$
00% ETHANOL
10% ETHANOL
20% ETHANOL
30% ETHANOL
$M\times10^2$
4.0
3.0
2.0
2.4
1.0
10
20
30
TEMP (°c)

FIG-5.14

SYSTEM : $K_2SO_4$ (0.0001M) [$1\times10^{-4}$M] , SOLVENT: ETHANOL-WATER.



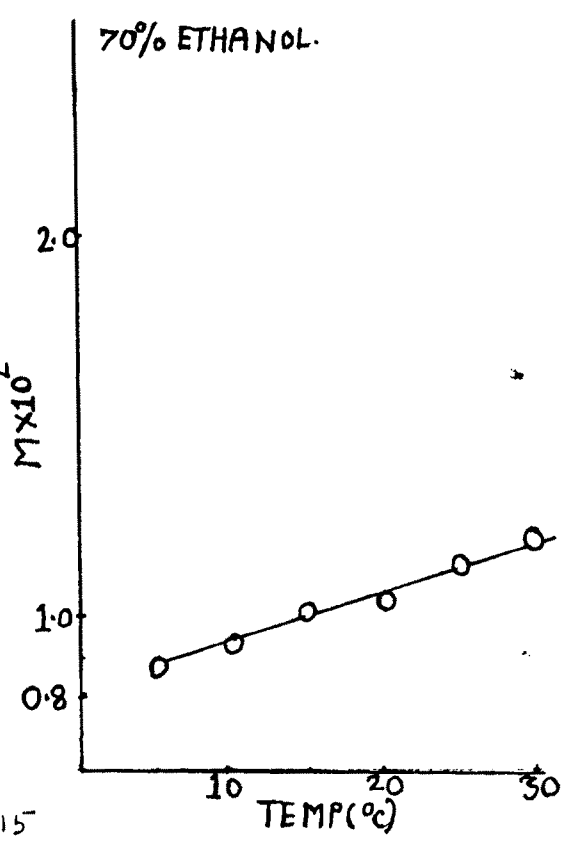
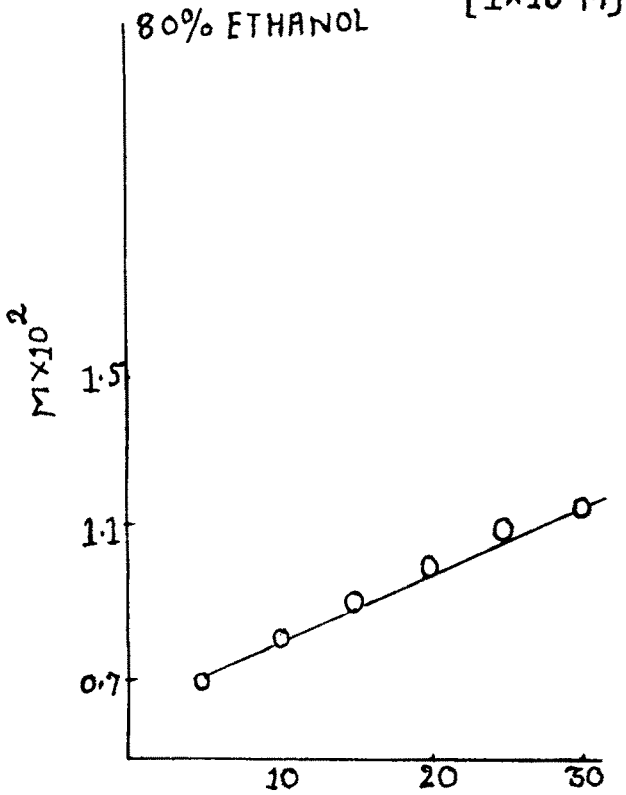




FIG-5.15

SYSTEM : $K_2SO_4$ (0.0001M) , SOLVENT : ETHANOL-WATER
[$1\times10^{-4}$M]



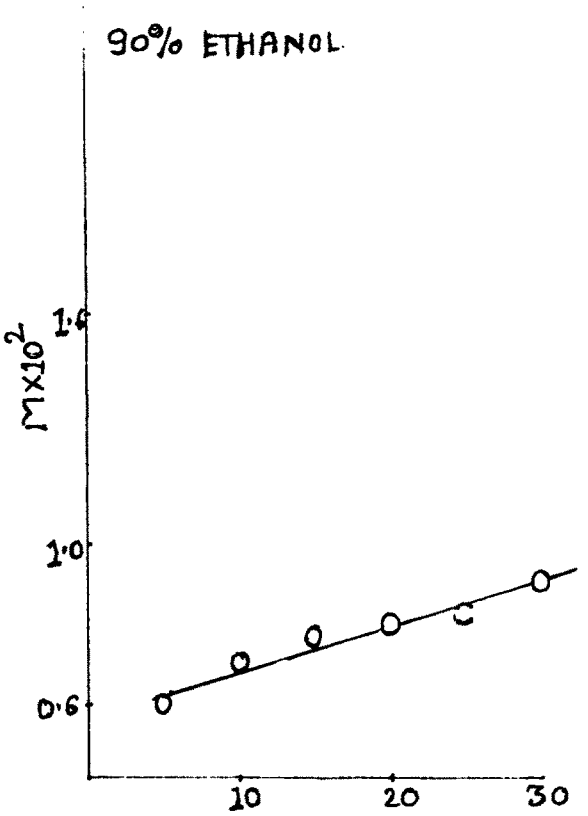




FIG-5.16

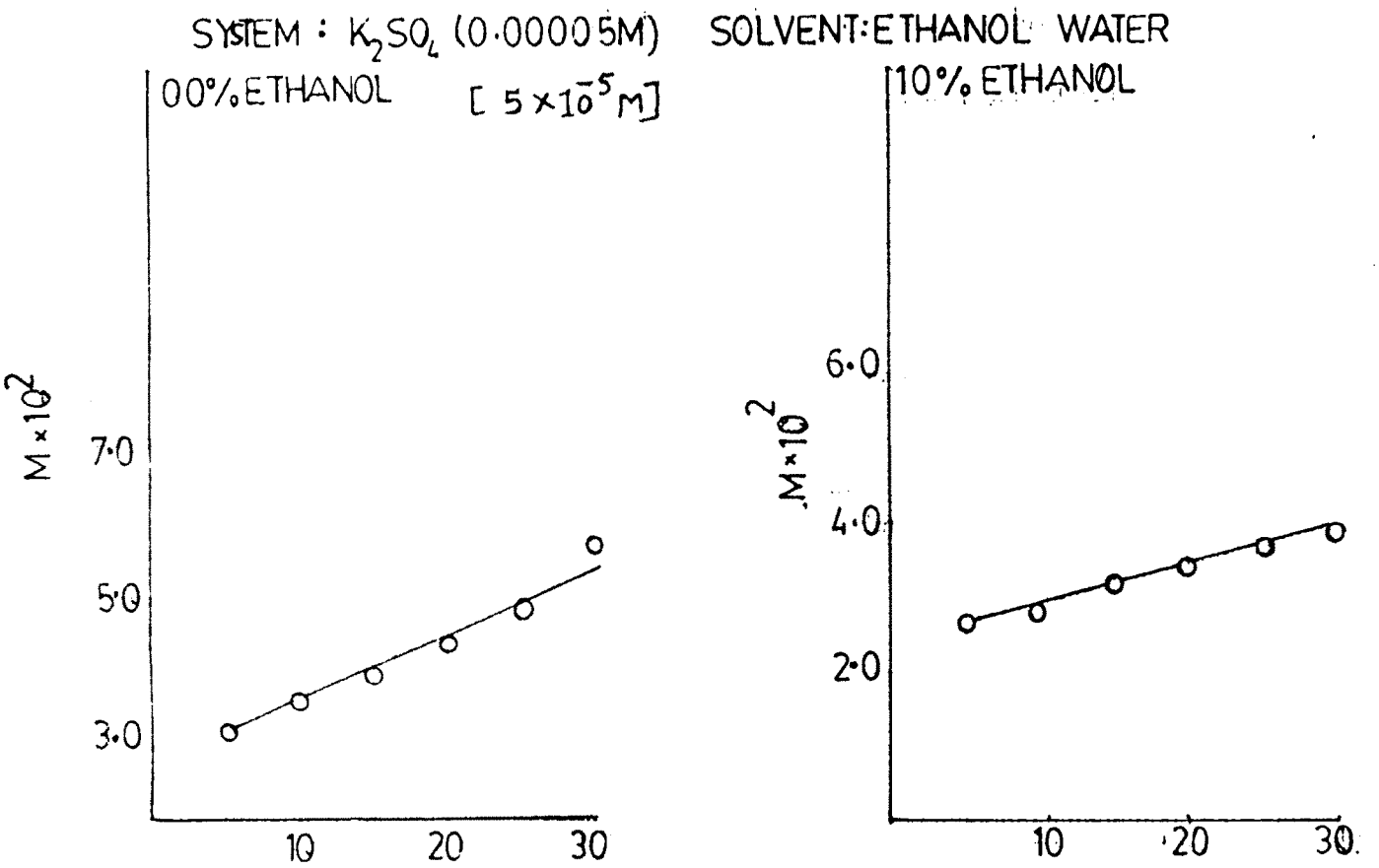
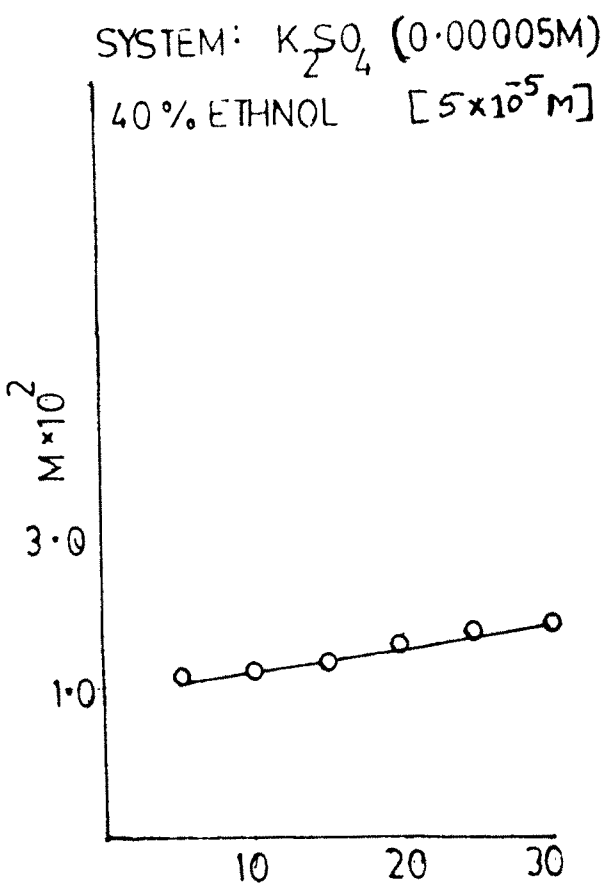
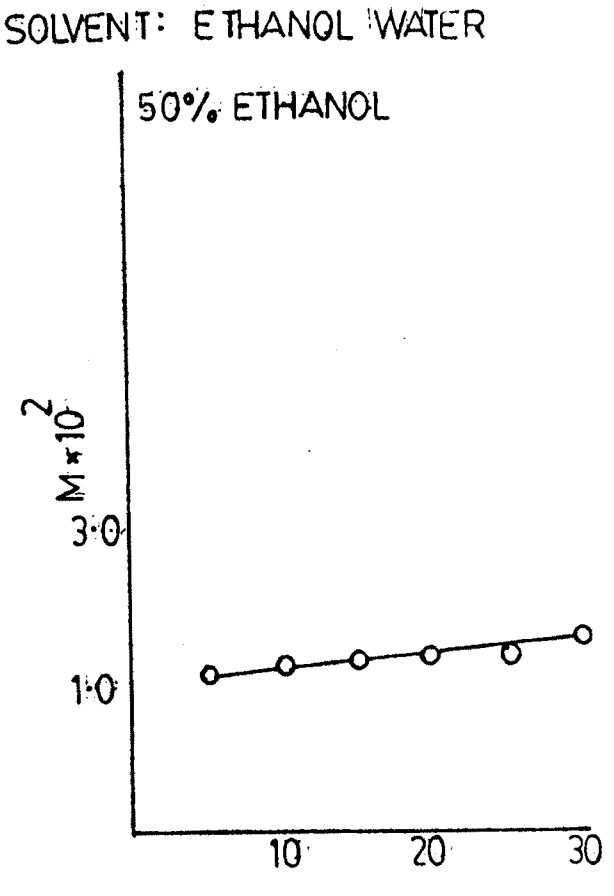

SYSTEM : $K_2SO_4$ (0·00005M)
SOLVENT: ETHANOL WATER
00% ETHANOL
[ $5 \times 10^{-5}$ M]
10% ETHANOL
20% ETHANOL
30% ETHANOL
M × $10^2$
7·0
5·0
3·0
6·0
4·0
2·0
1·0
10
20
30
TEMP (°C)

FIG-S·17


SYSTEM: $K_2SO_4$ (0·00005M),
40 % ETHNOL [$5\times10^{-5}$ M]
$M\times10^2$
3·0
1·0
10
20
30


SOLVENT: ETHANOL WATER
50% ETHANOL
$M\times10^2$
3·0
1·0
10
20
30

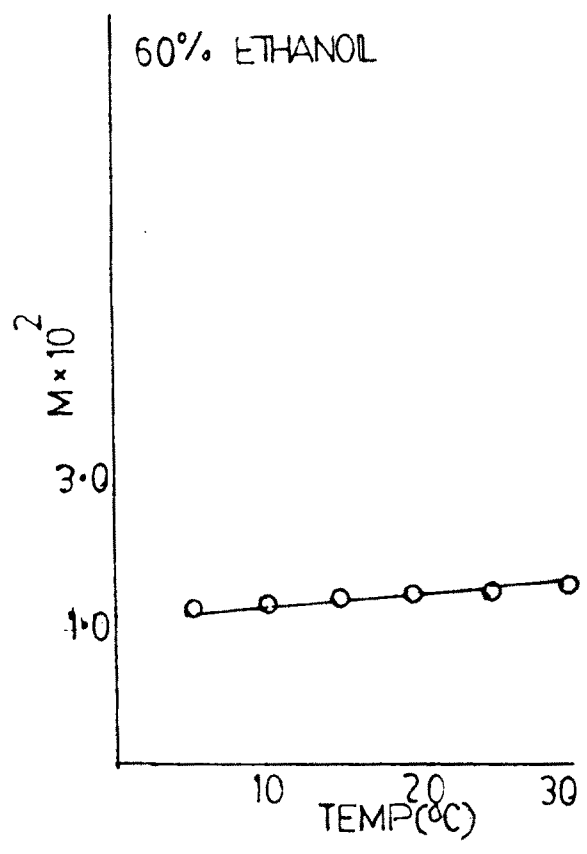
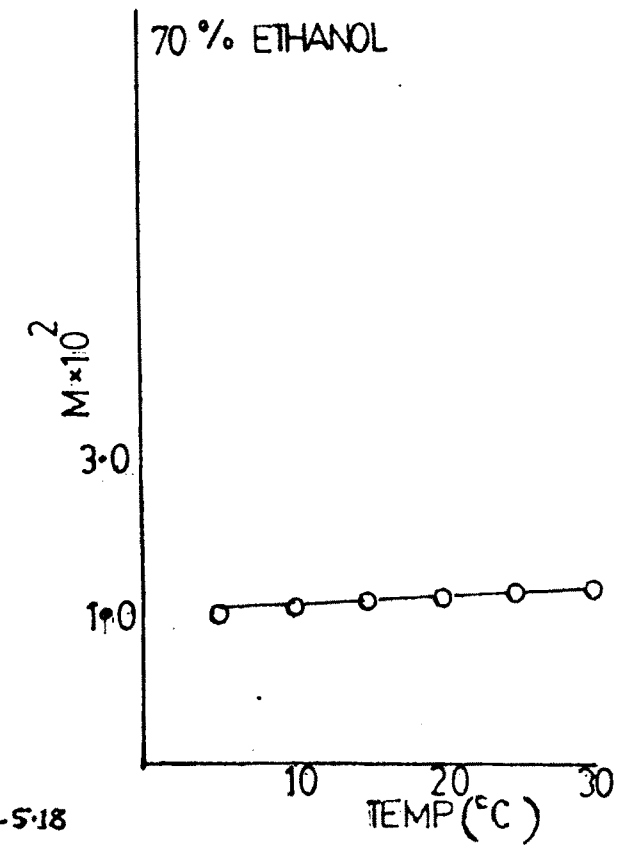
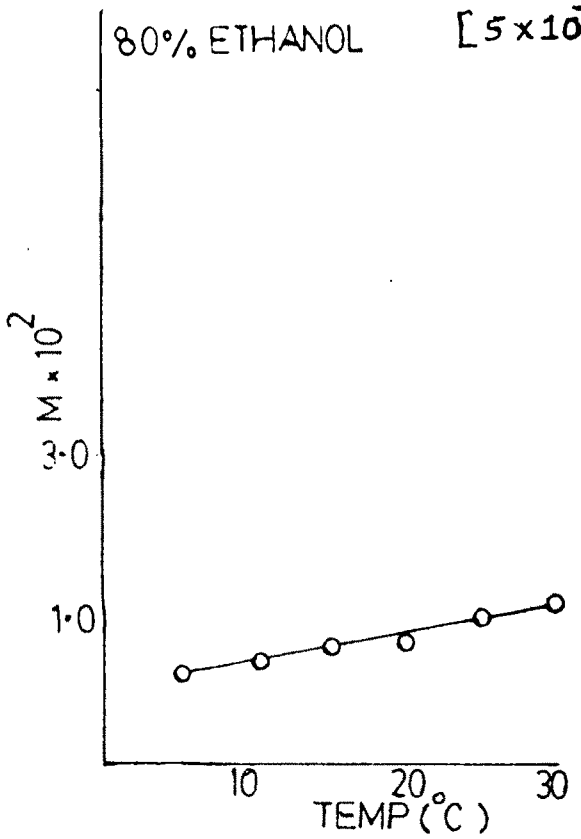

60% ETHANOL
$M\times10^2$
3·0
1·0
10
20
30
TEMP(°C)

FIG-5·18


70 % ETHANOL
$M\times10^2$
3·0
1·0
10
20
30
TEMP (°C)

SYSTEM: $K_2SO_4$ (0·00005 M), SOLVENT : ETHANOL WATER

80% ETHANOL [$5 \times 10^{-5}$ M]




90% ETHANOL

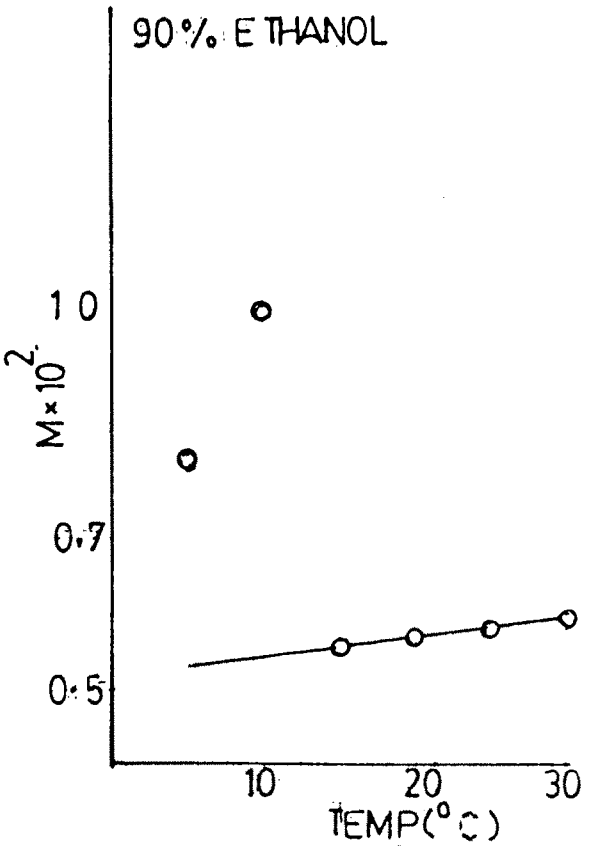



FIG-5·19

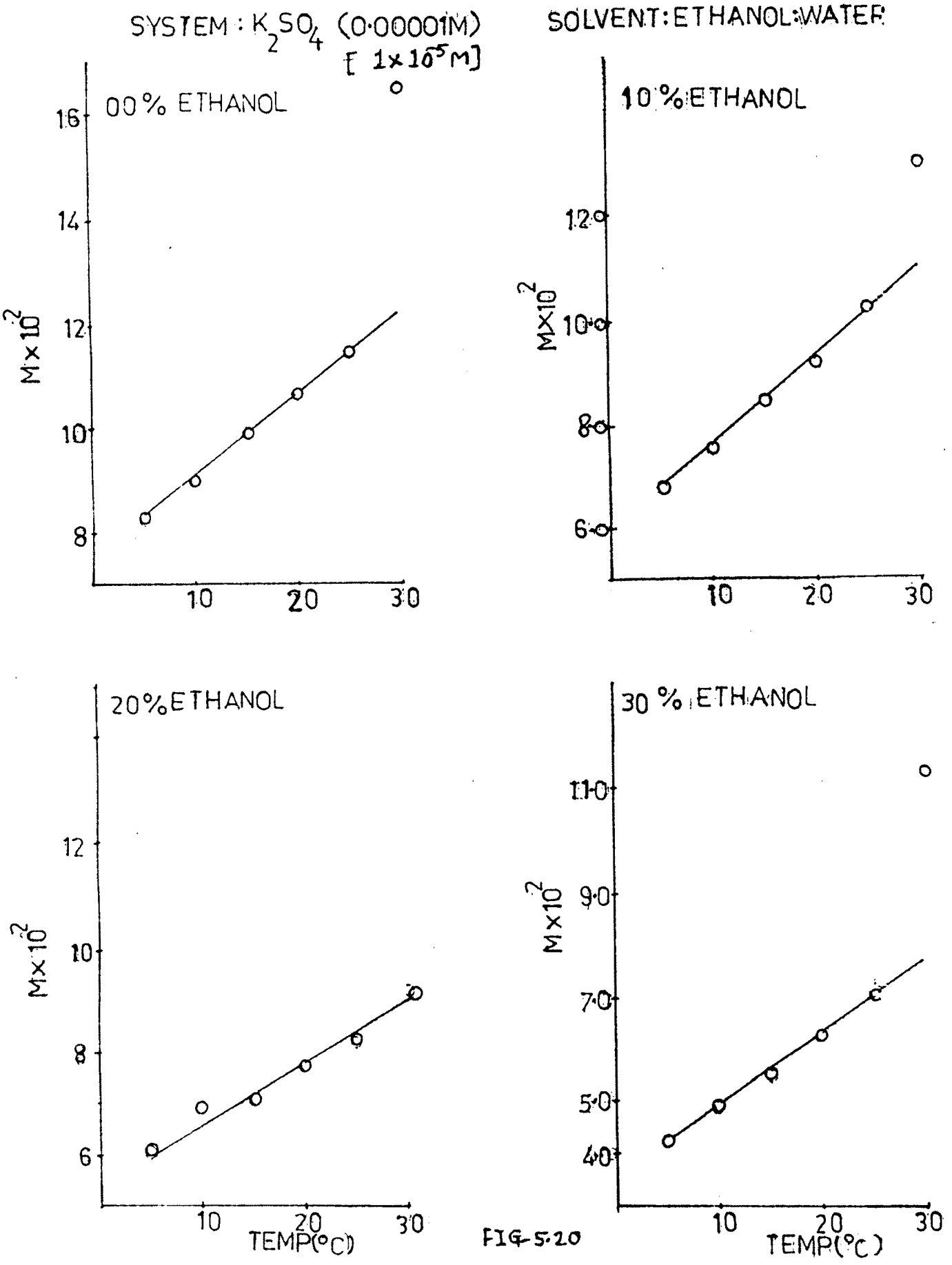

SYSTEM : $K_2SO_4$ (0·00001M)
[ $1\times10^{-5}$ M]
00% ETHANOL
10% ETHANOL
20% ETHANOL
30 % ETHANOL
$M\times10^{-2}$
TEMP(°C)
16
14
12
10
8
6
20
30

FIG-5.20

SYSTEM: $K_2SO_4$ (0·00001M), SOLVENT: ETHANOL WATER
[$1 \times 10^{-5}$ M]

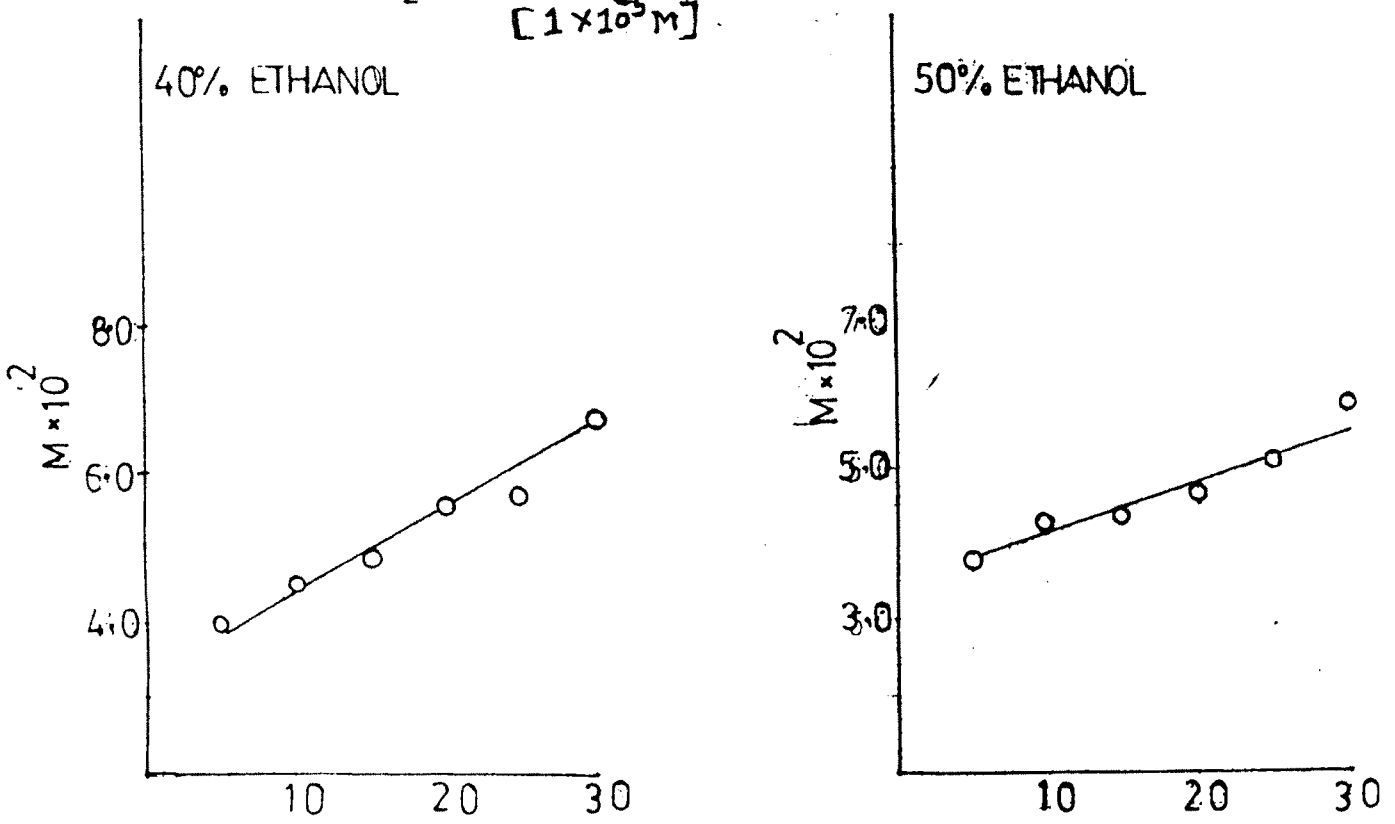
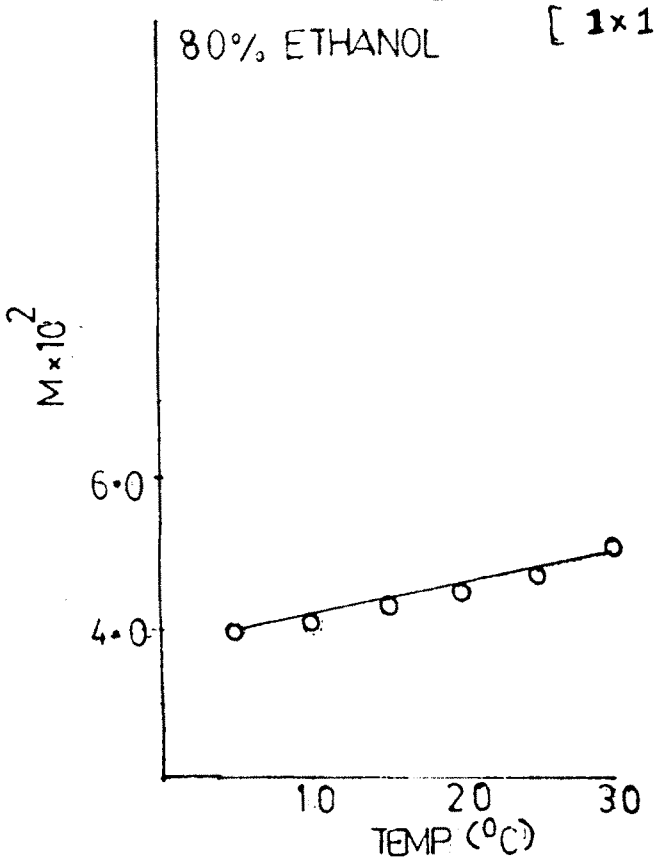



FIG-5·21

SYSTEM : $K_2SO_4$ (0·00001 M), SOLVENT : ETHANOL WATER
[ $1 \times 10^{-5}$ M]



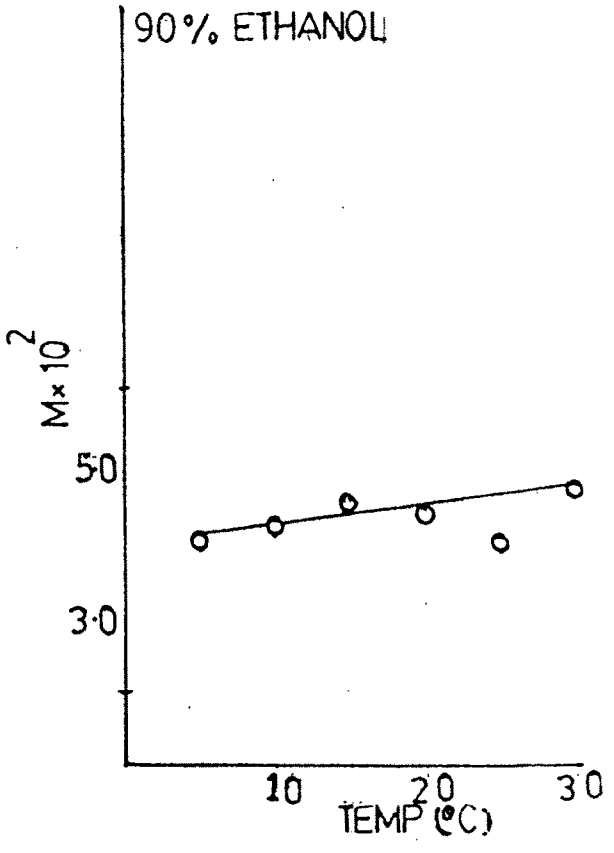
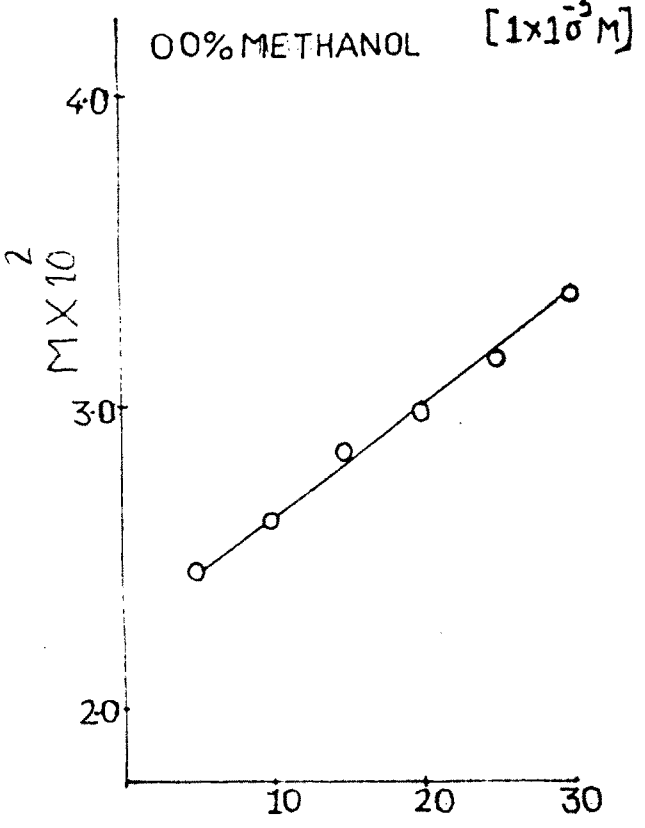
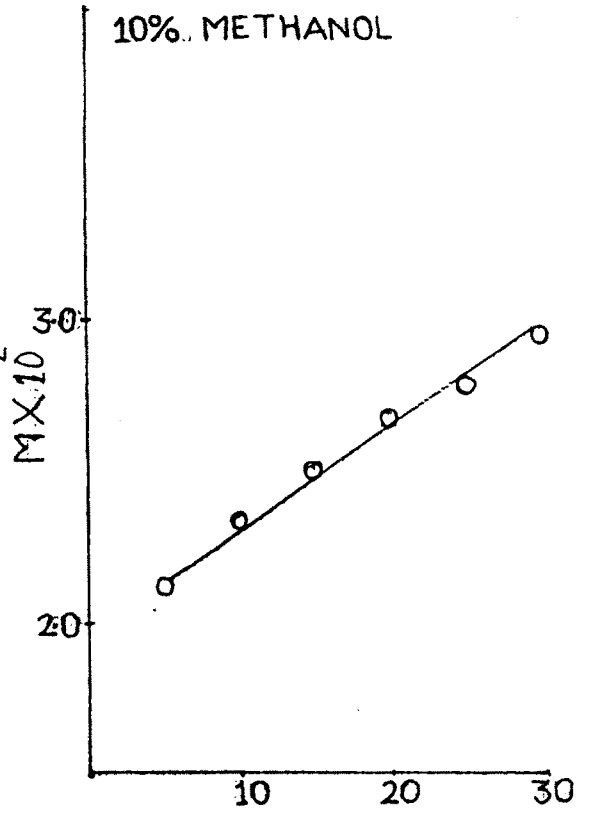
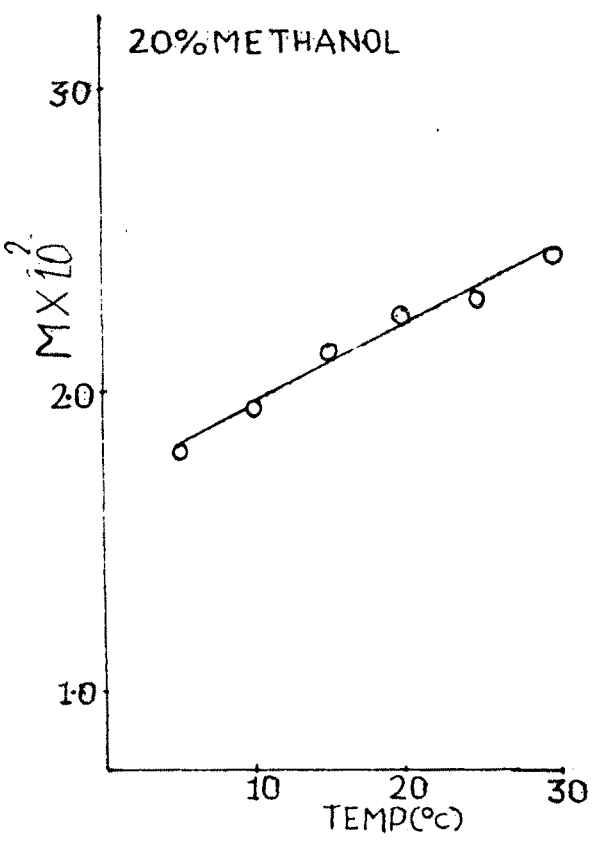




FIG-5.22

SYSTEM: $K_2SO_4$ (0·001M), SOLVENT: METHANOL- WATER



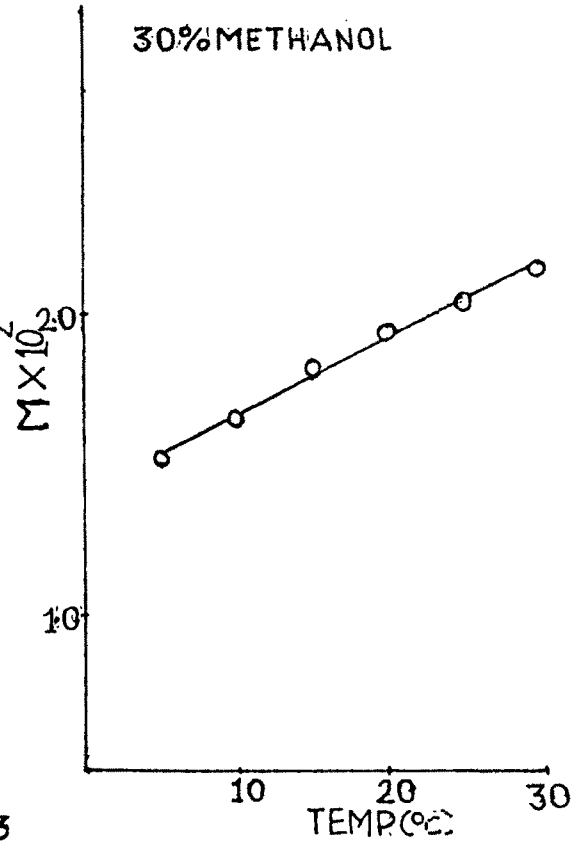




FIG-5·23

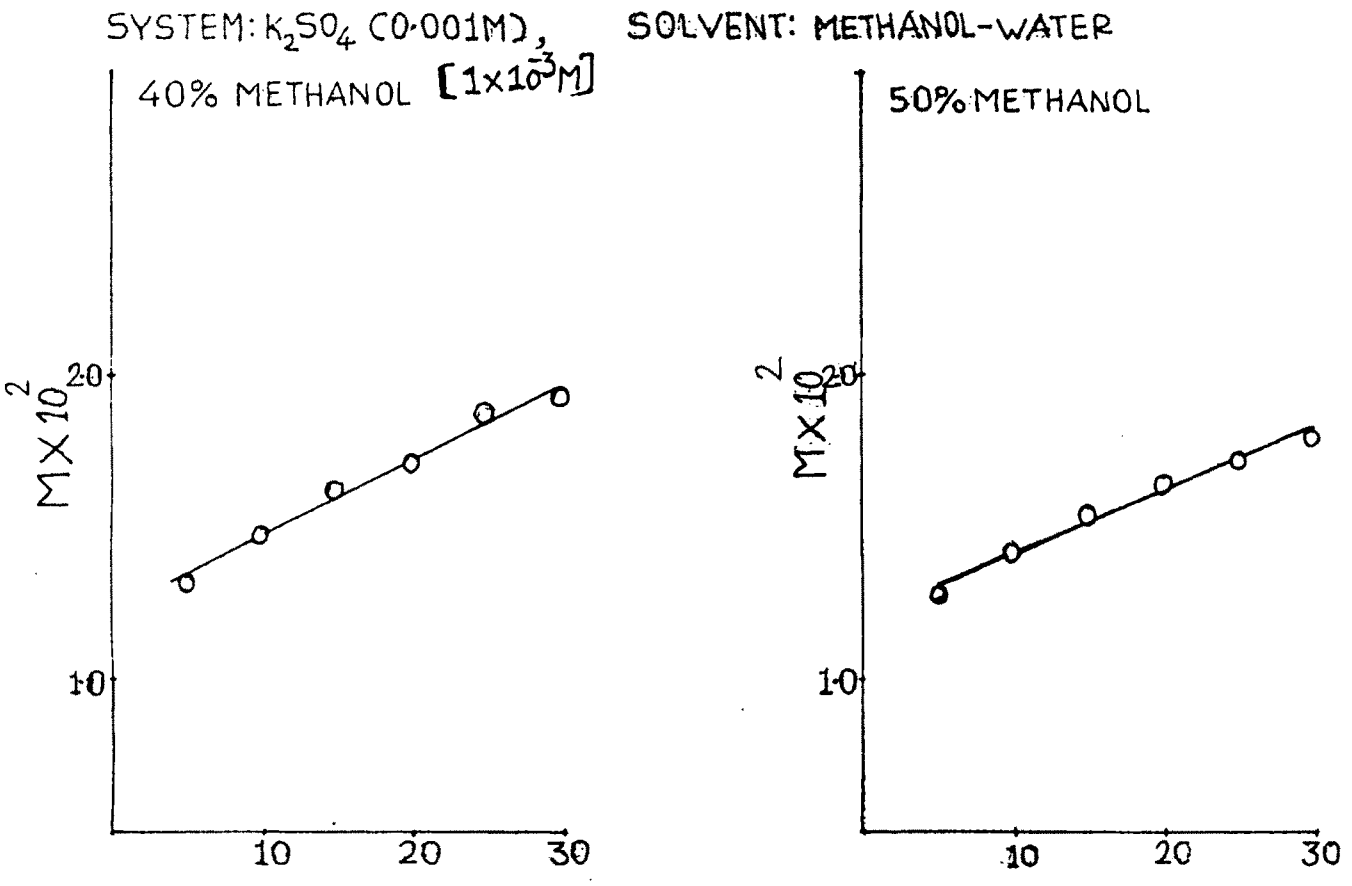

SYSTEM: $K_2SO_4$ (0·001M),
40% METHANOL [$1\times10^{-3}$M]
SOLVENT: METHANOL-WATER
50% METHANOL
60% METHANOL
70% METHANOL
$M \times 10^2$
2·0
1·0
10
20
30
TEMP(°c)

FIG-5.24

SYSTEM: $K_2SO_4$ (0·001M); SOLVENT: METHANOL-WATER

80% METHANOL [$1\times10^{-3}$M]

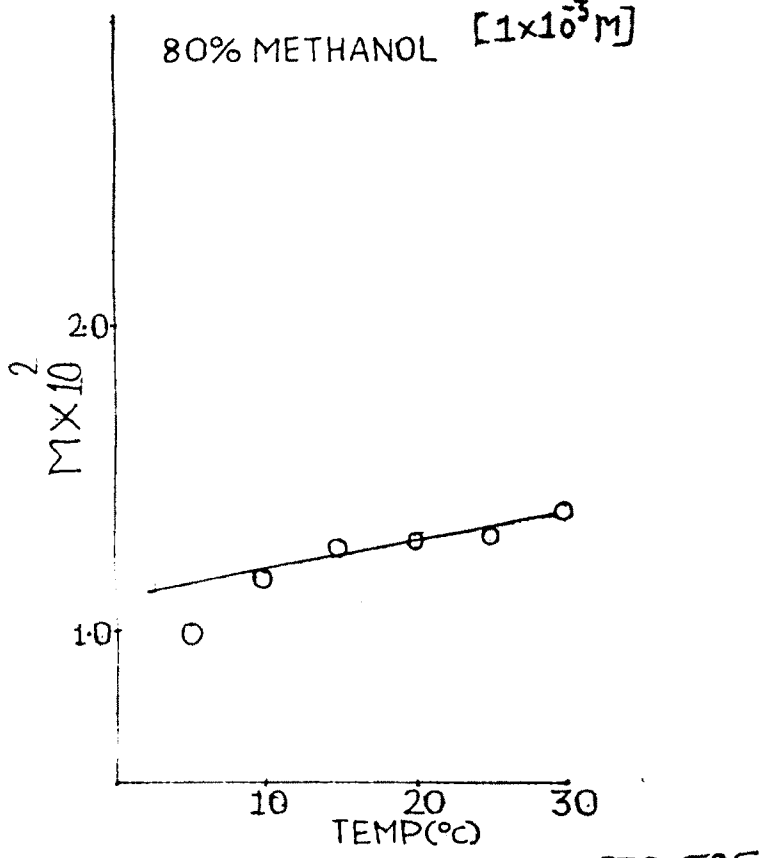
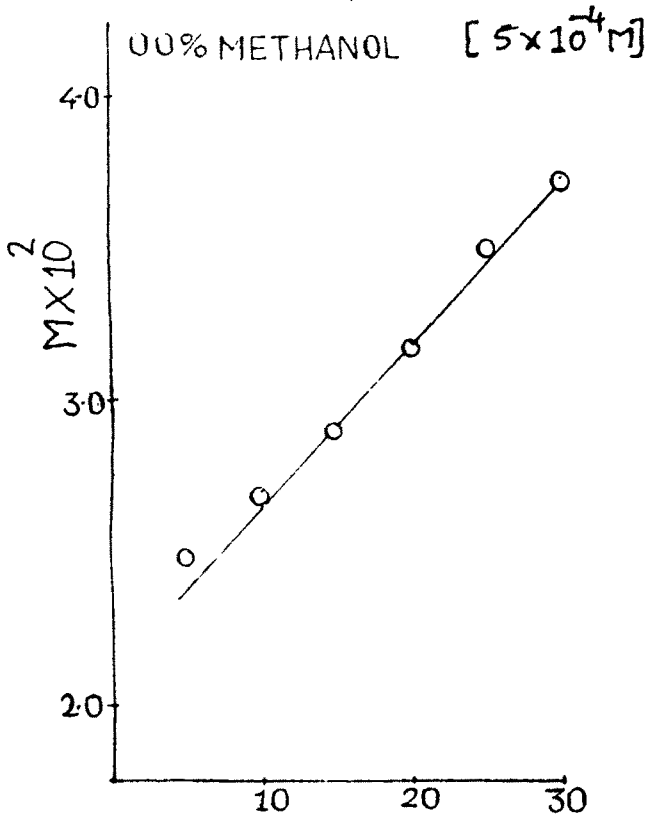
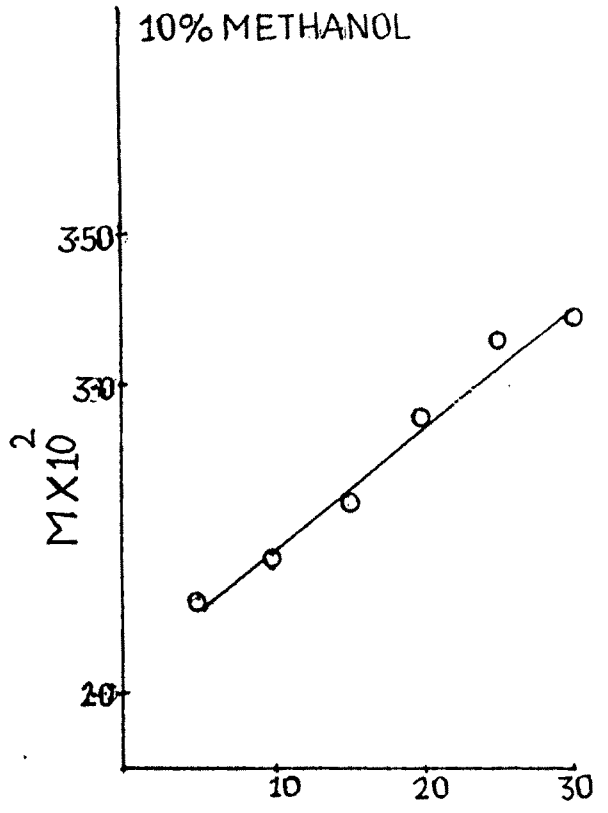



FIG-5.25

SYSTEM: $K_2SO_4$ (0·0005M), SOLVENT: METHANOL-WATER



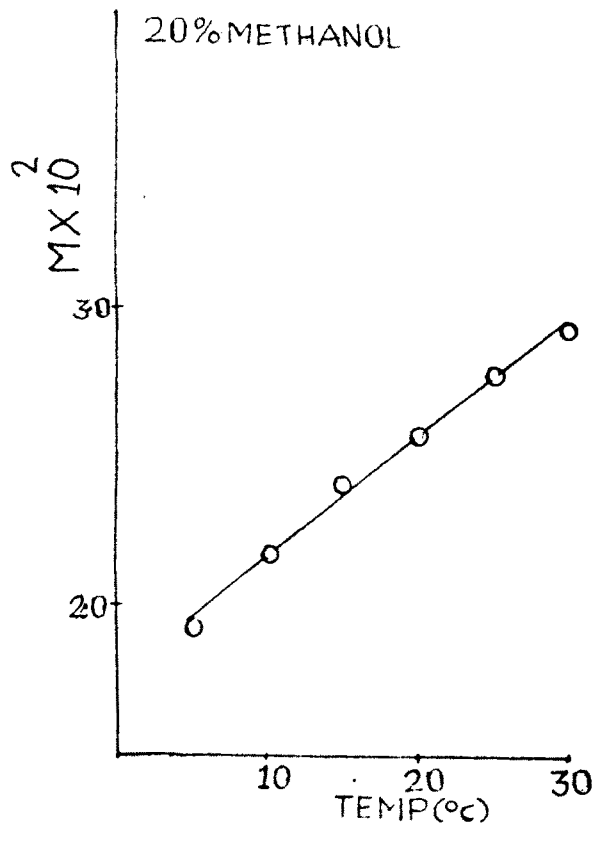
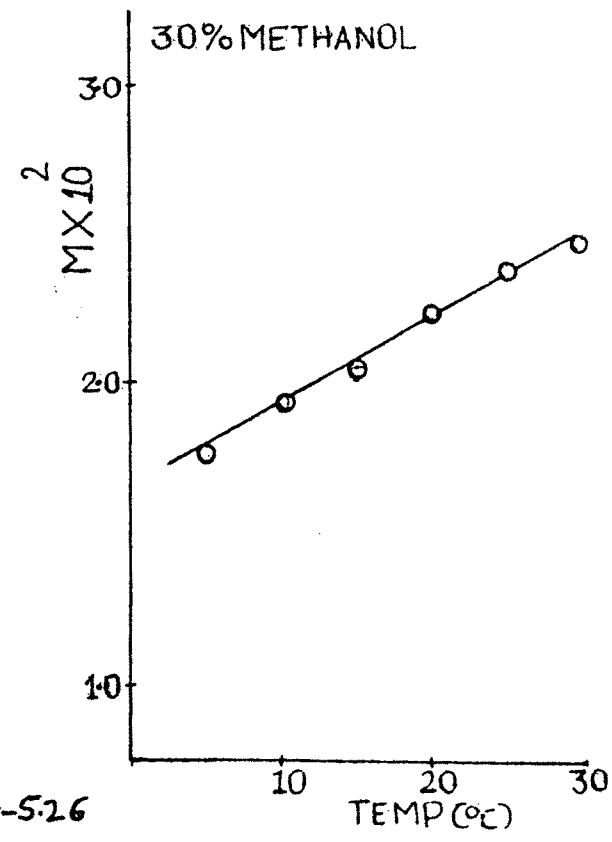
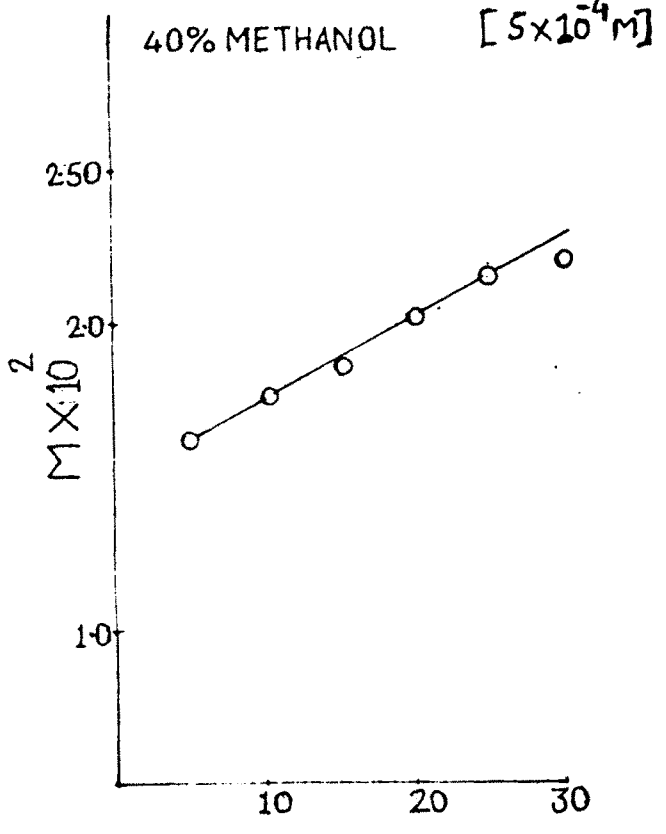
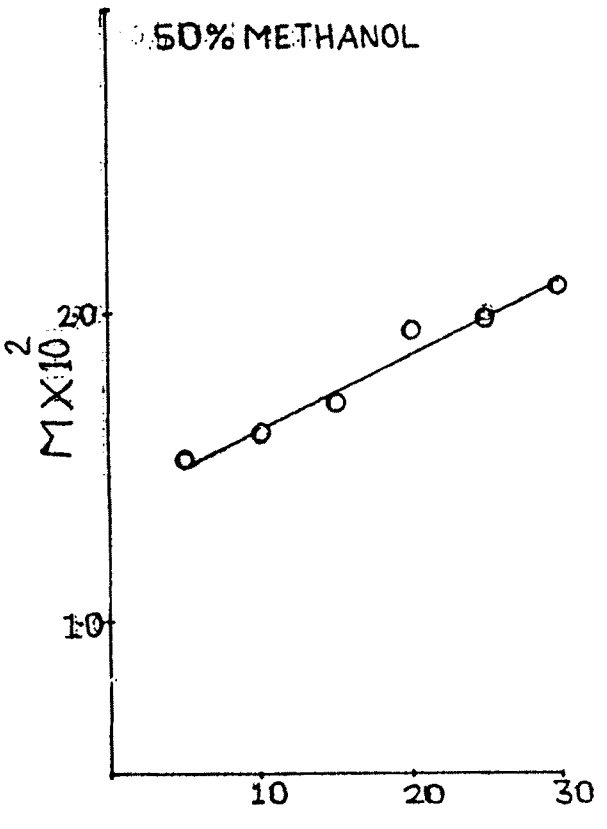




FIG-5.26



SYSTEM: $K_2SO_4$ (0·0005M), , SOLVENT: METHANOL-WATER



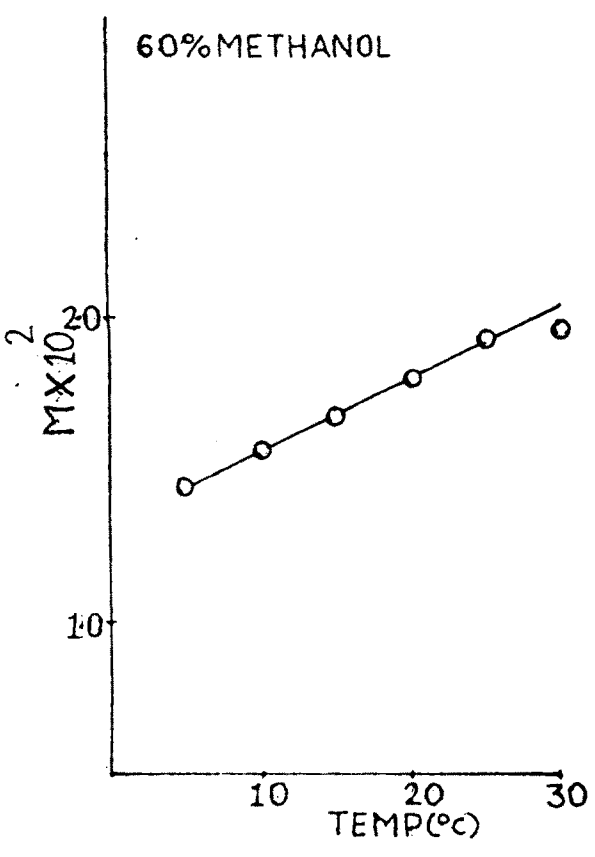
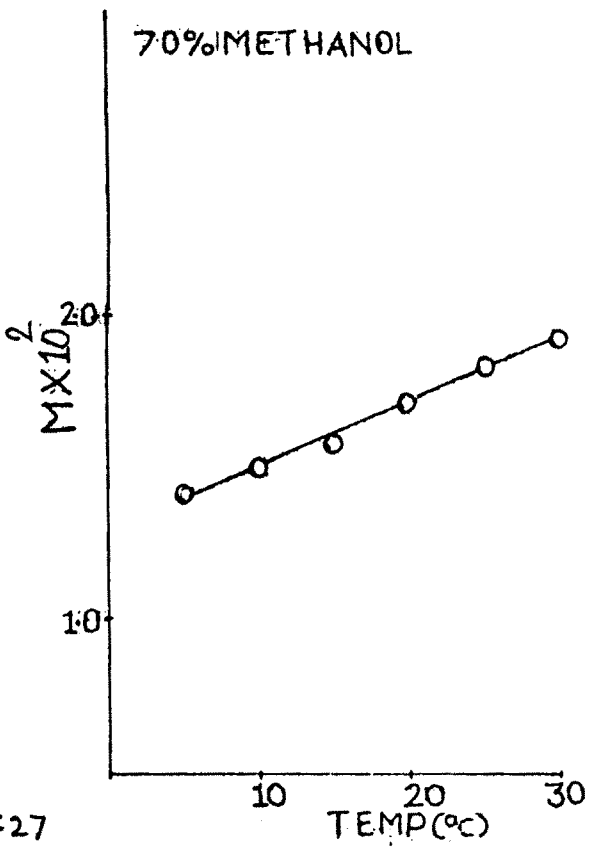
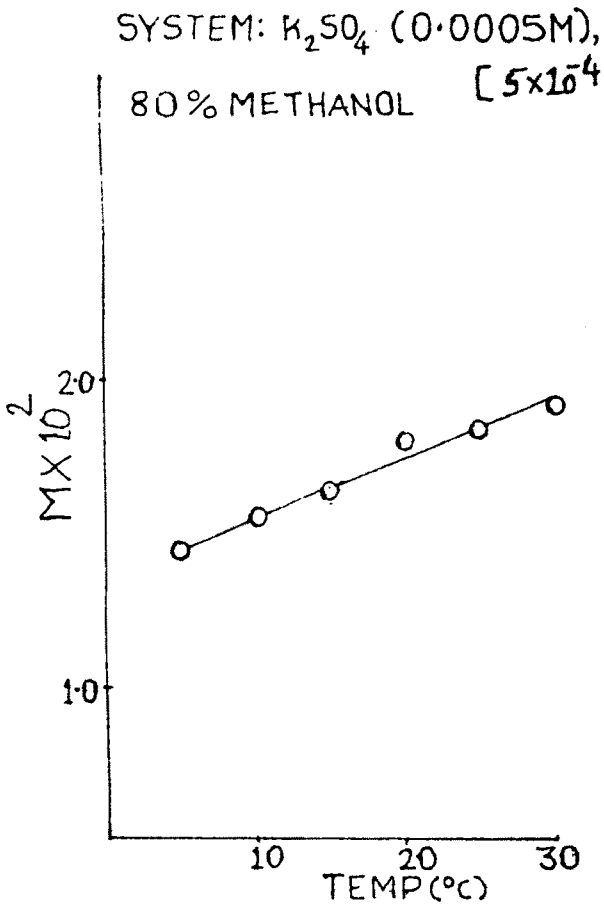




FIG-5·27




SYSTEM: $K_2SO_4$ (0·0005M),
80% METHANOL
[$5\times10^{-4}$M]
$M \times 10^2$
2·0
1·0
10
20
30
TEMP (°C)

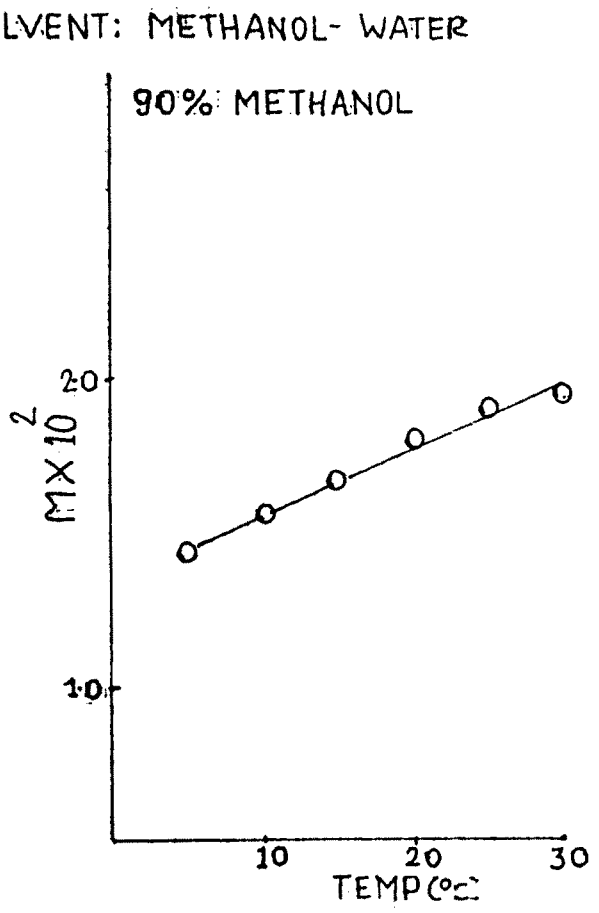
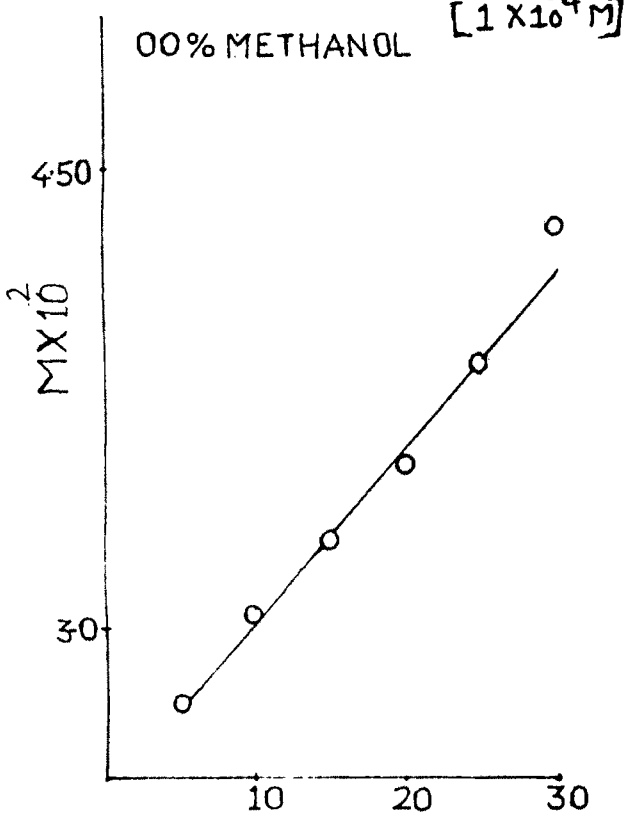
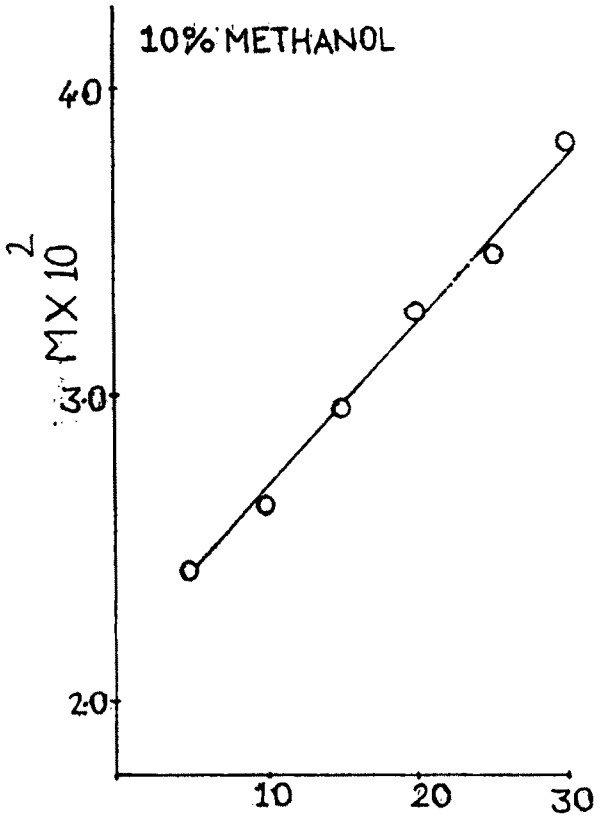

SOLVENT: METHANOL- WATER
90% METHANOL
$M \times 10^2$
2·0
1·0
10
20
30
TEMP (°C)

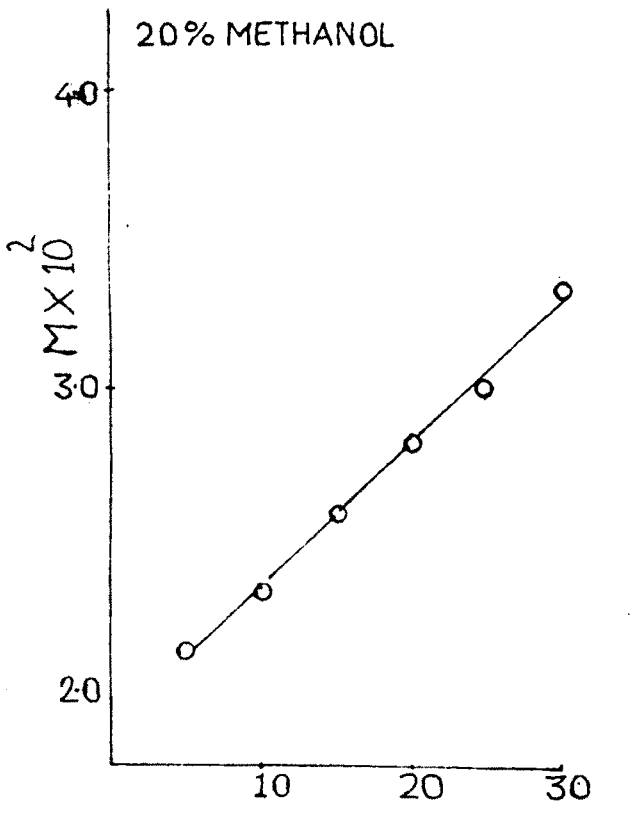
FIG-5·28

SYSTEM: $K_2SO_4$ (0·0001M), [$1 \times 10^{-4}$ M]

SOLVENT: METHANOL - WATER



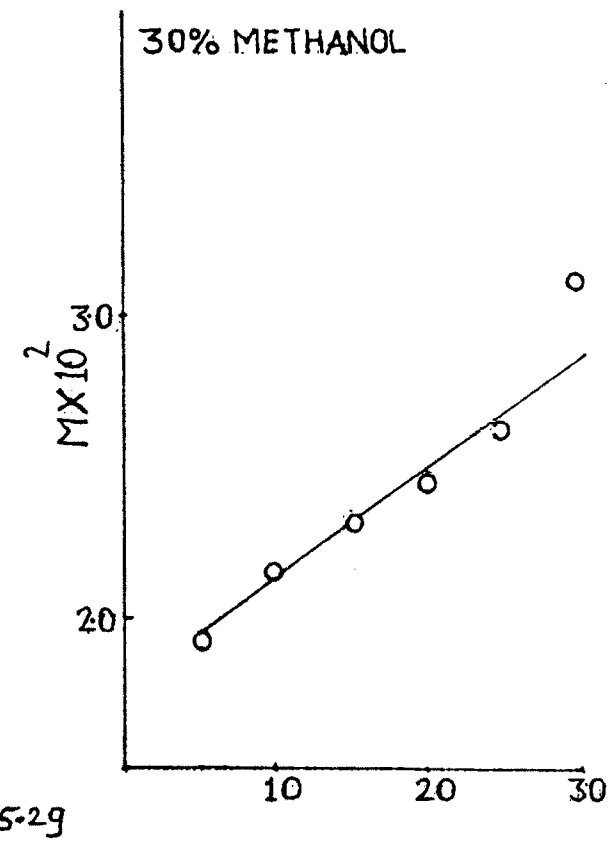




FIG-5·29

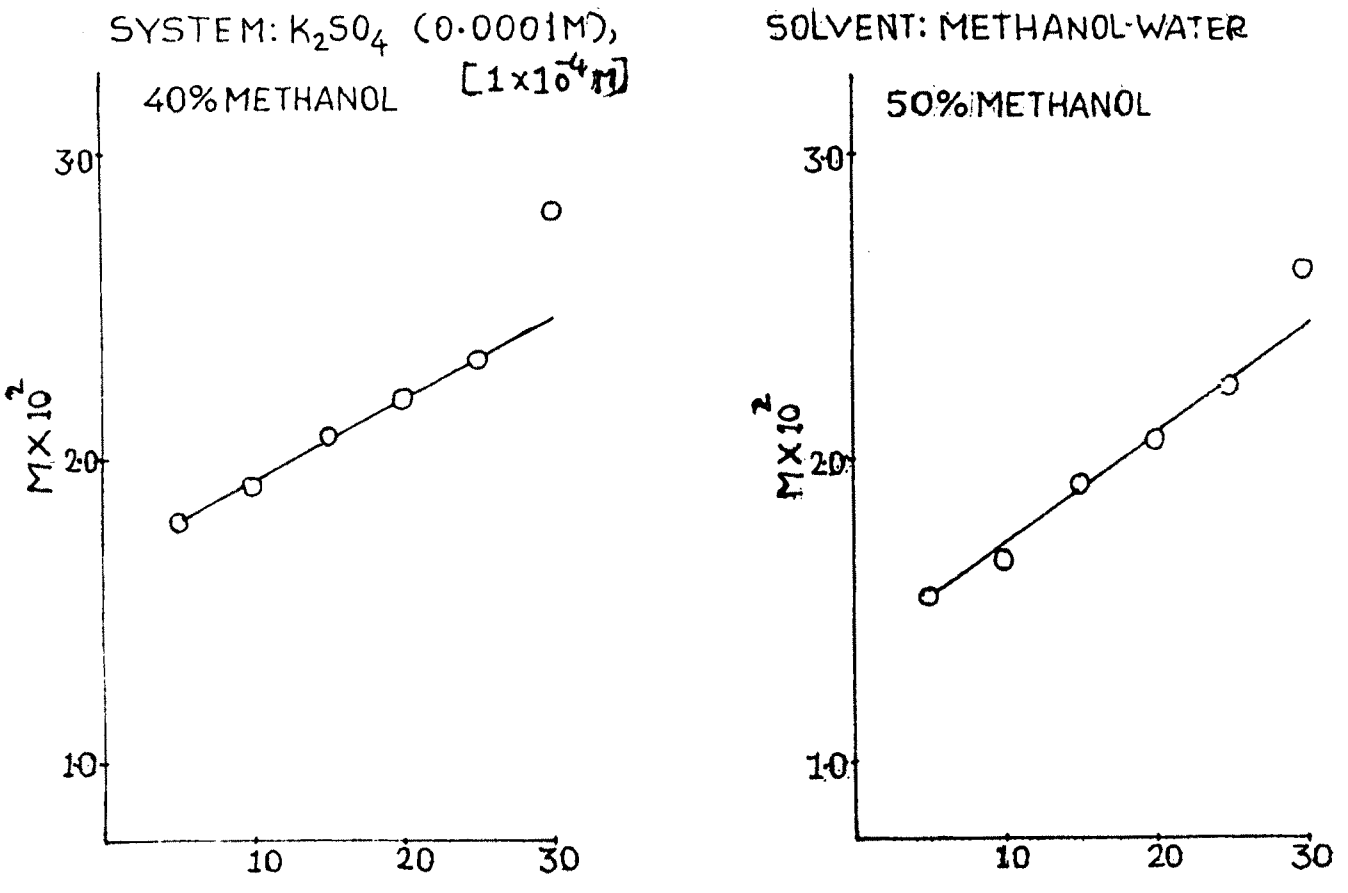

SYSTEM: $K_2SO_4$ (0·0001M), [$1 \times 10^{-4}$ M]
40% METHANOL
50% METHANOL
60% METHANOL
70% METHANOL
$M \times 10^2$
30
20
10
10
20
30
TEMP(°C)

FIG-5.30

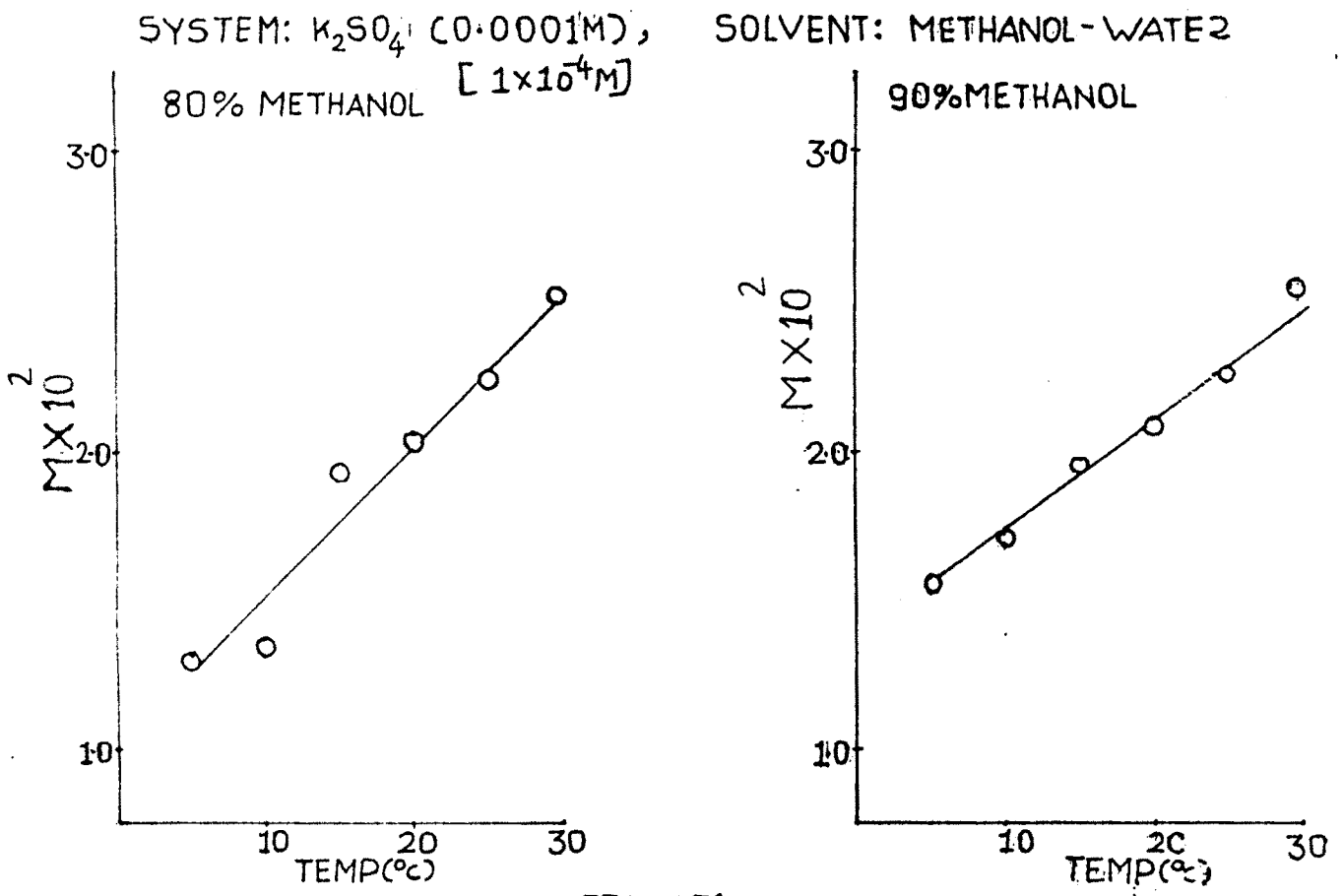

SYSTEM: $K_2SO_4$ (0·0001M), [$1\times10^{-4}$M]
80% METHANOL
SOLVENT: METHANOL-WATER
90%METHANOL
$M\times10^2$
3·0
2·0
1·0
10
20
30
TEMP(°C)

FIG-5·31

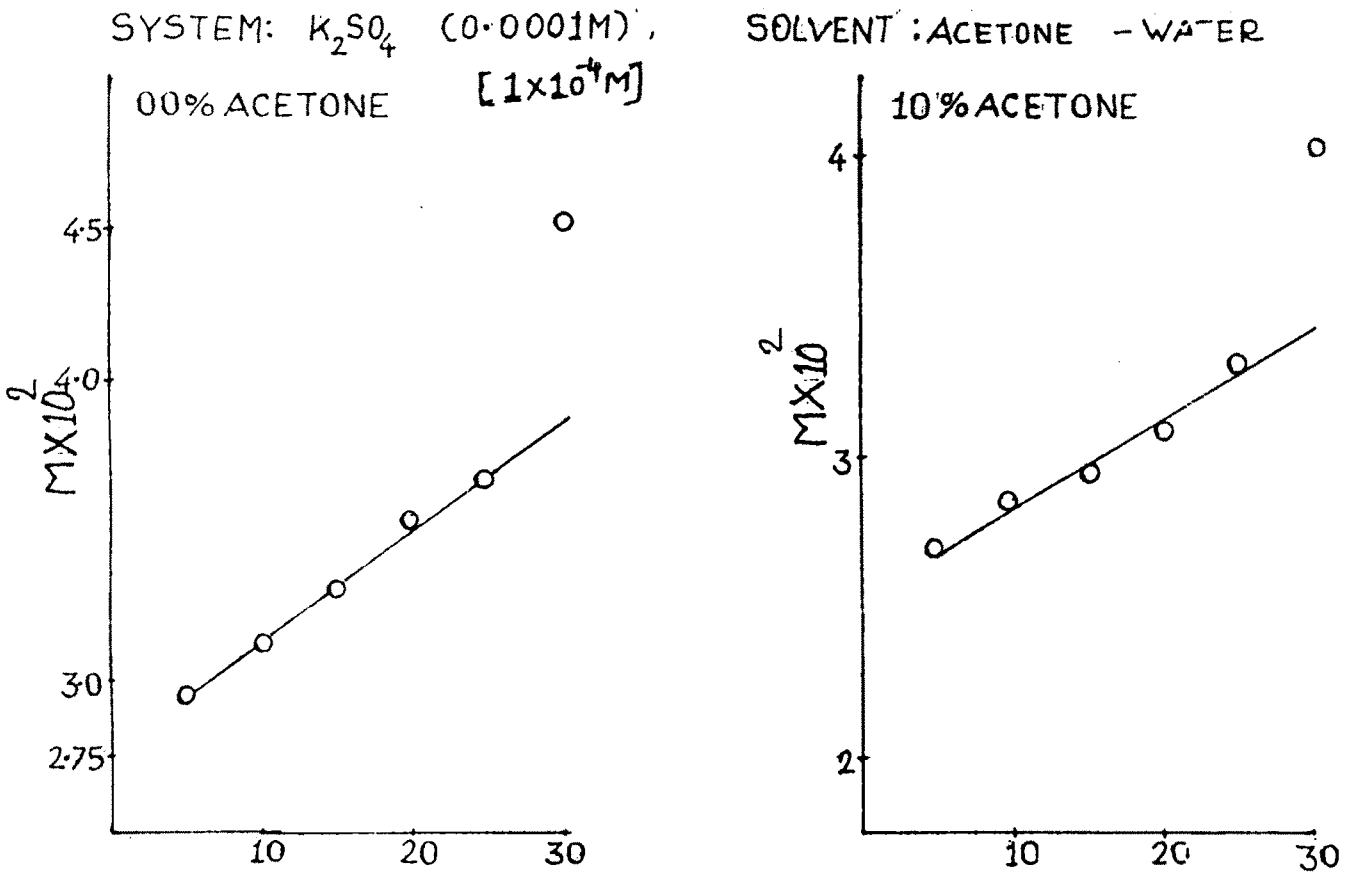

SYSTEM: $K_2SO_4$ (0·0001M), [$1\times10^{-4}$M]
SOLVENT : ACETONE - WATER
00% ACETONE
10% ACETONE
20% ACETONE
30% ACETONE
$M\times10^2$
4·5
4·0
3·0
2·75
4
3
2
3·50
10
20
30
TEMP (°c)

FIG-5·32

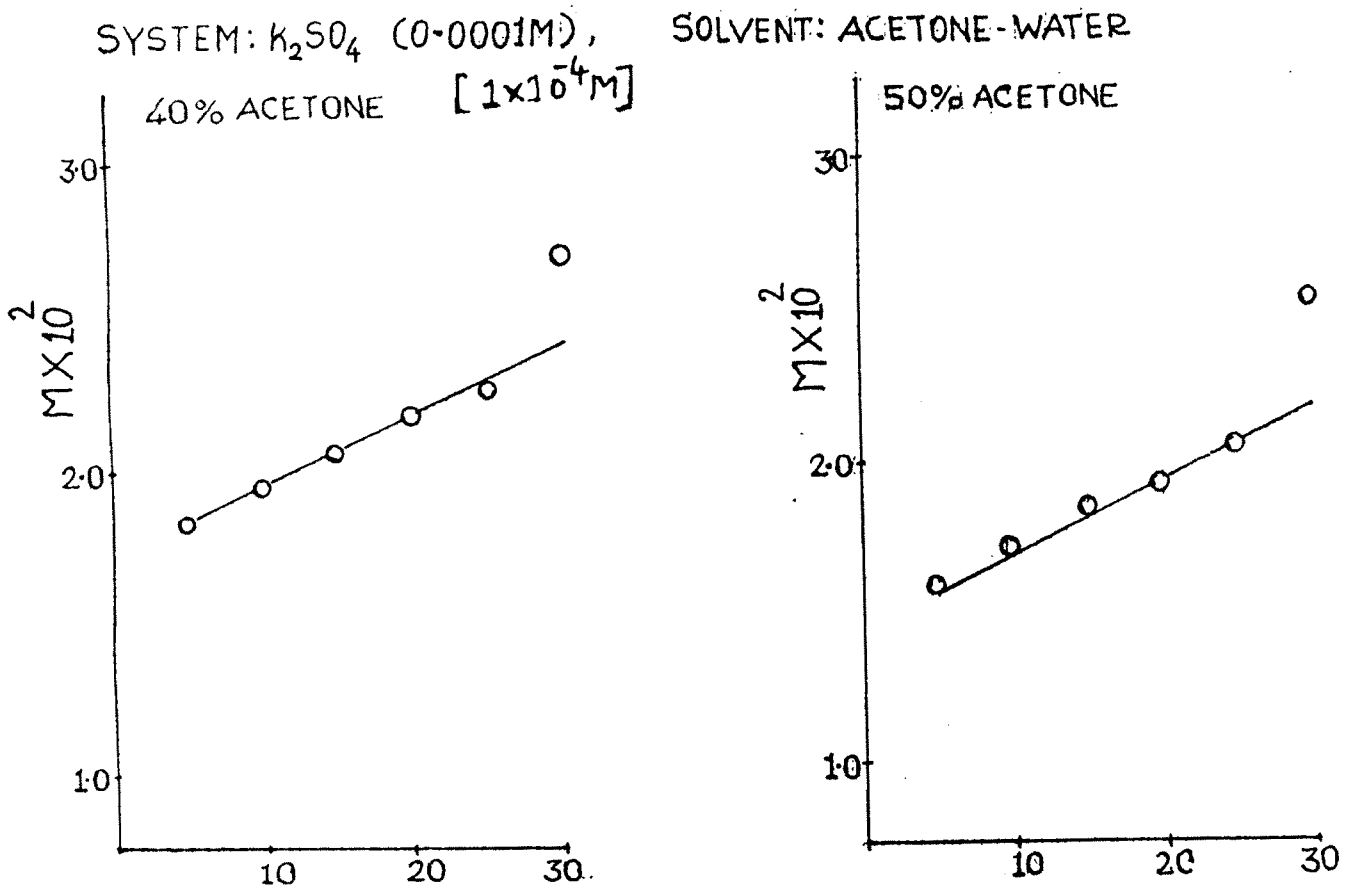

SYSTEM: $K_2SO_4$ (0·0001M), SOLVENT: ACETONE-WATER
40% ACETONE [$1\times10^{-4}$M]
50% ACETONE
60% ACETONE
70% ACETONE
$M \times 10^2$
3·0
2·0
1·0
10
20
30
TEMP(°C)

FIG-5·33

SYSTEM: $K_2SO_4$ (0·0001M) „ SOLVENT: ACETONE - WATER.

80 % ACETONE [$1\times10^{-4}$M]

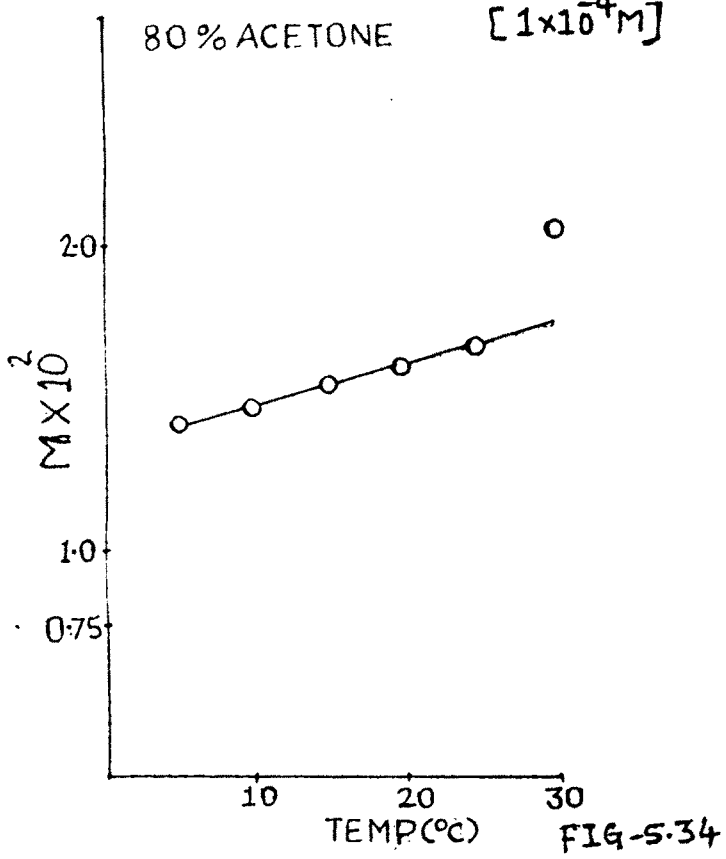



FIG-5.34

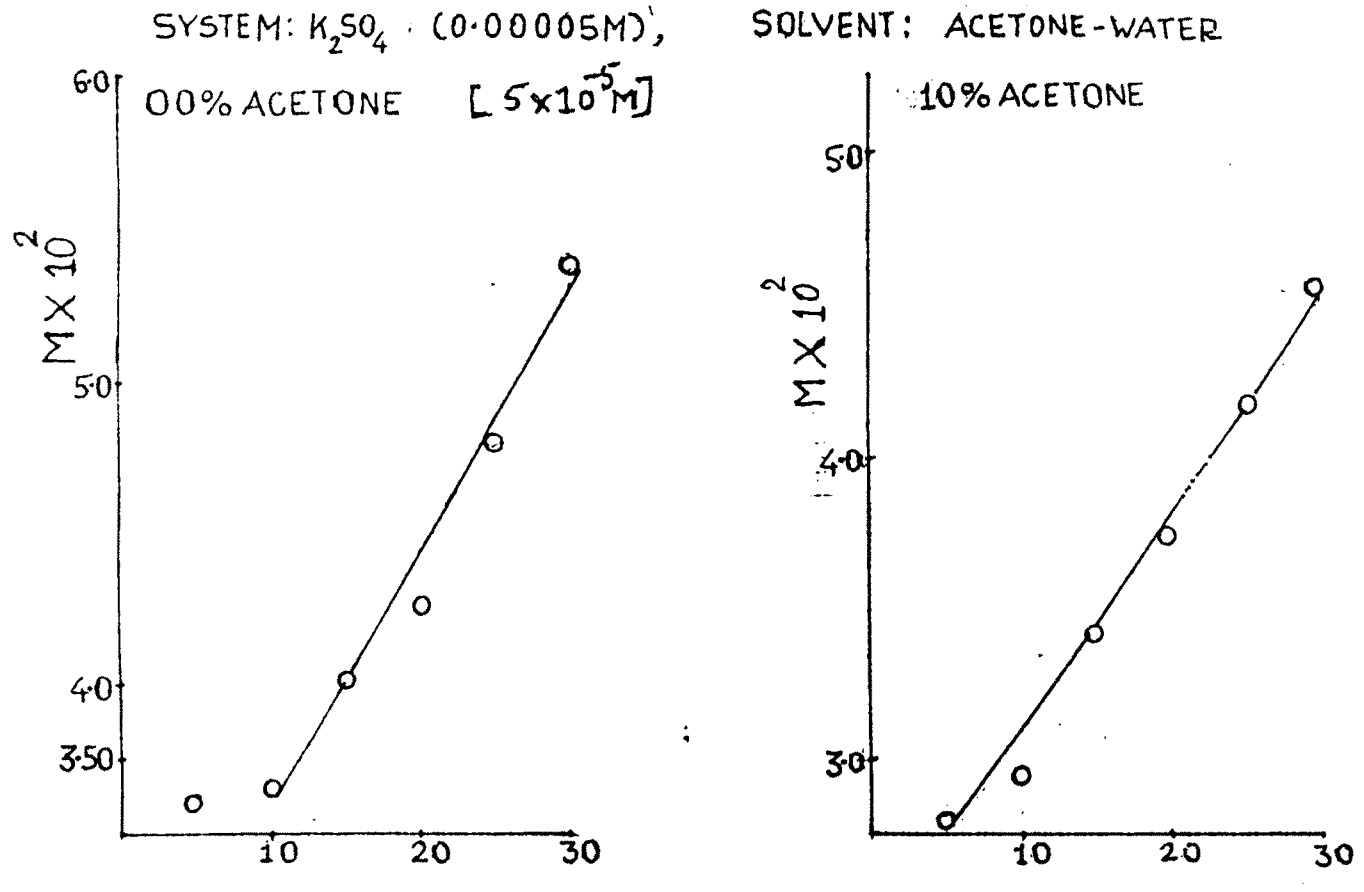

SYSTEM: $K_2SO_4$ (0·00005M),
00% ACETONE [$5 \times 10^{-5}$M]
SOLVENT: ACETONE-WATER
10% ACETONE
20% ACETONE
30% ACETONE
$M \times 10^2$
6·0
5·0
4·0
3·50
3·0
2·0
5·0
4·0
3·0
10
20
30
TEMP (°C)

FIG-5.35

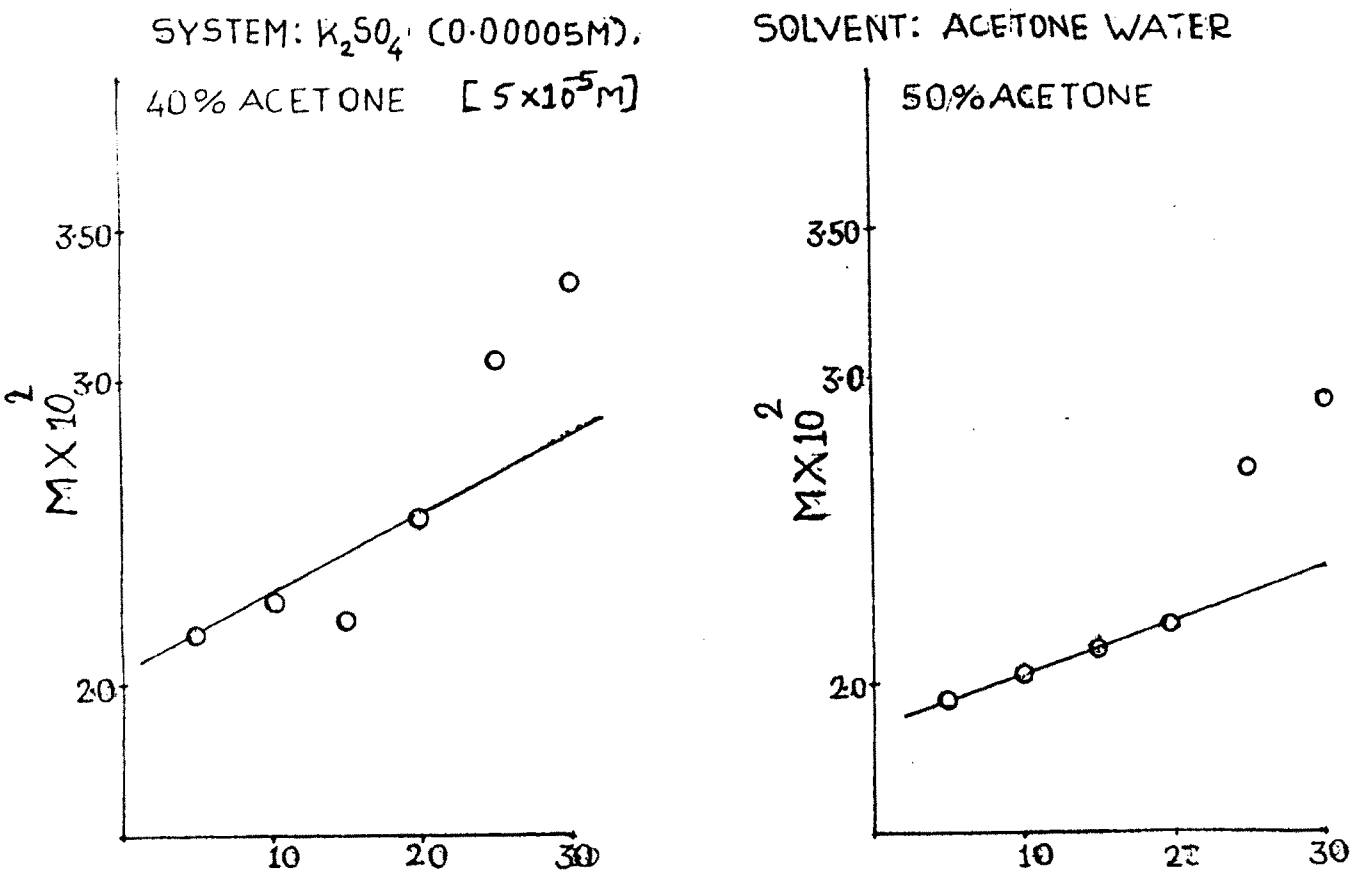

SYSTEM: $K_2SO_4$ (0·00005M).
40% ACETONE [$5 \times 10^{-5}$M]
SOLVENT: ACETONE WATER
50% ACETONE
60% ACETONE
70% ACETONE
$M \times 10^2$
3·50
3·0
2·0
1·75
10
20
30
TEMP (°C)

FIG-5.36

SYSTEM: $K_2SO_4$ (0·00005M), SOLVENT: ACETONE WATER

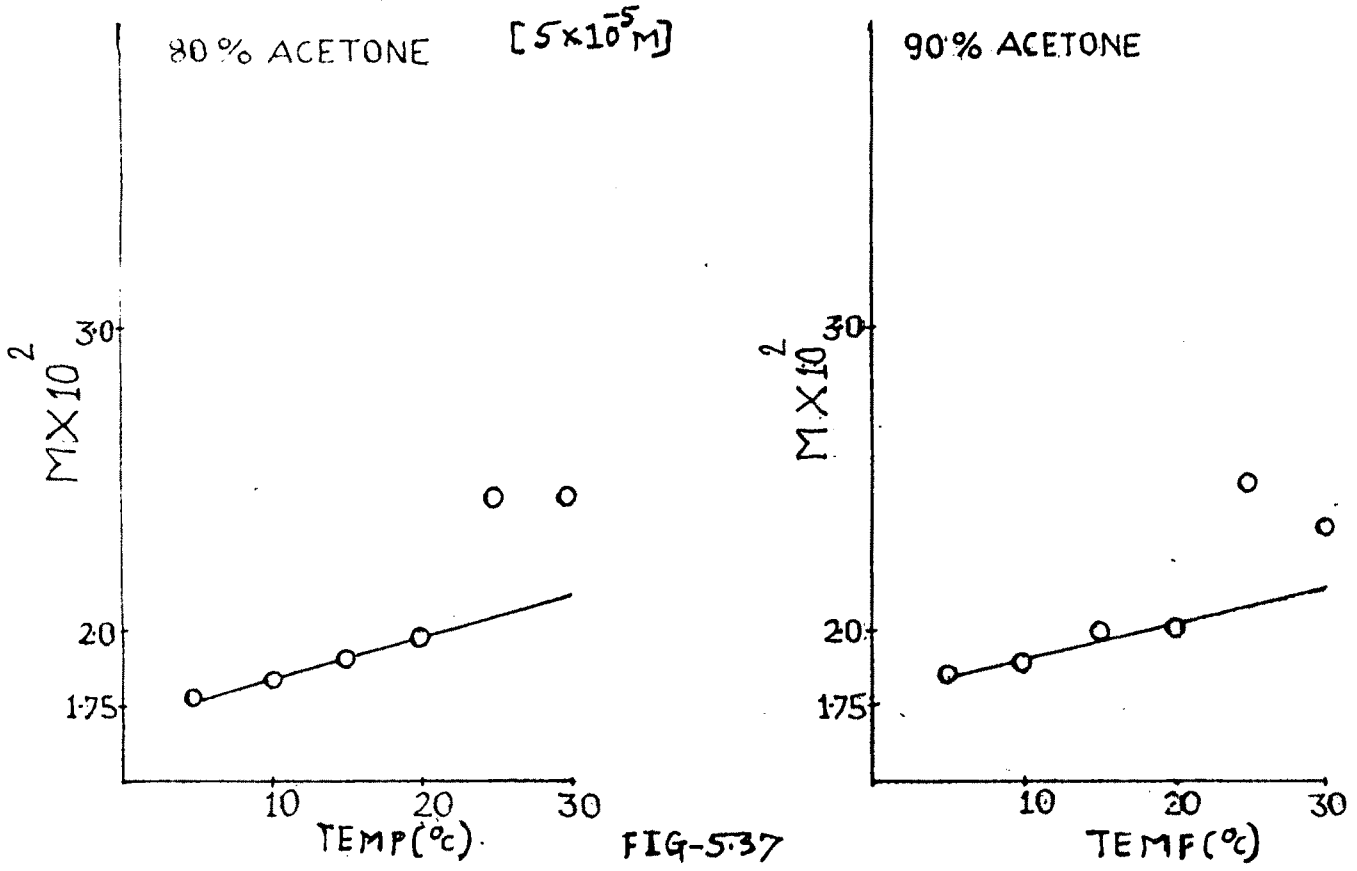
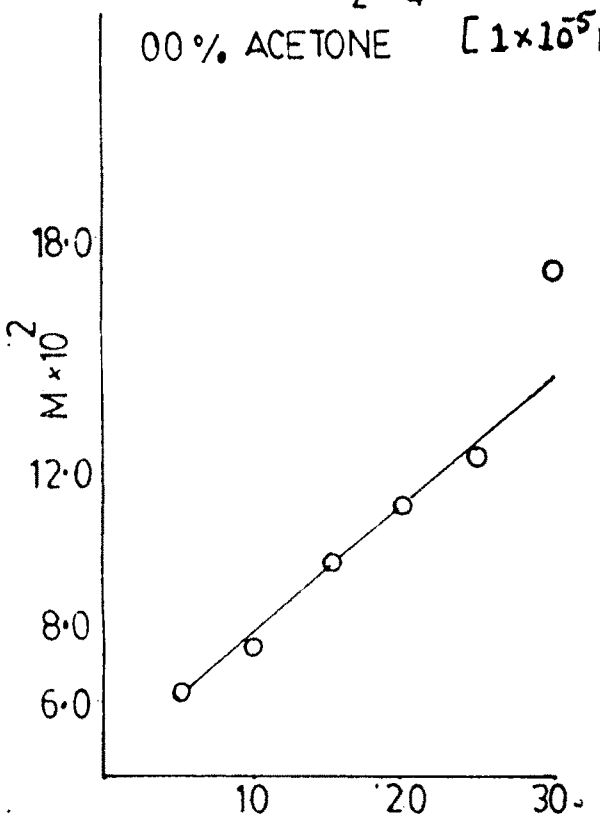
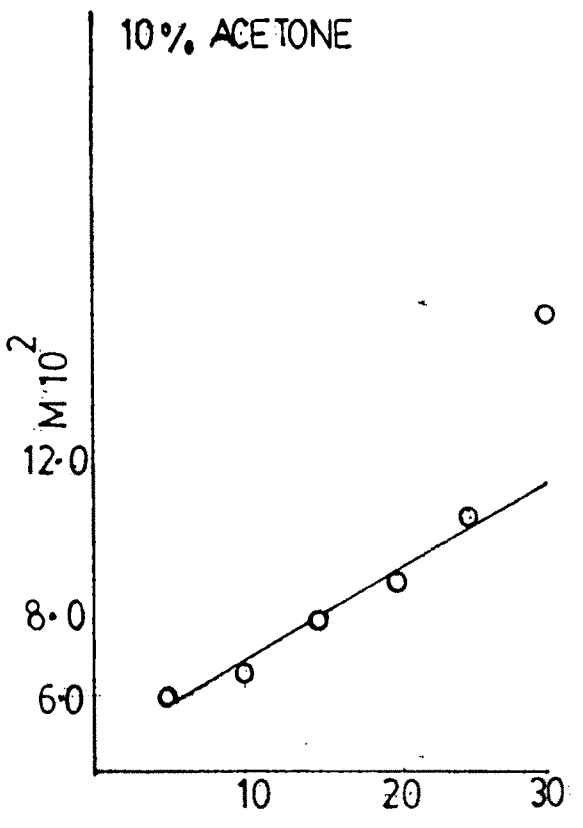



FIG-5·37

SYSTEM : $K_2SO_4$ (0·00001M) , SOLVENT: ACETONE WATER



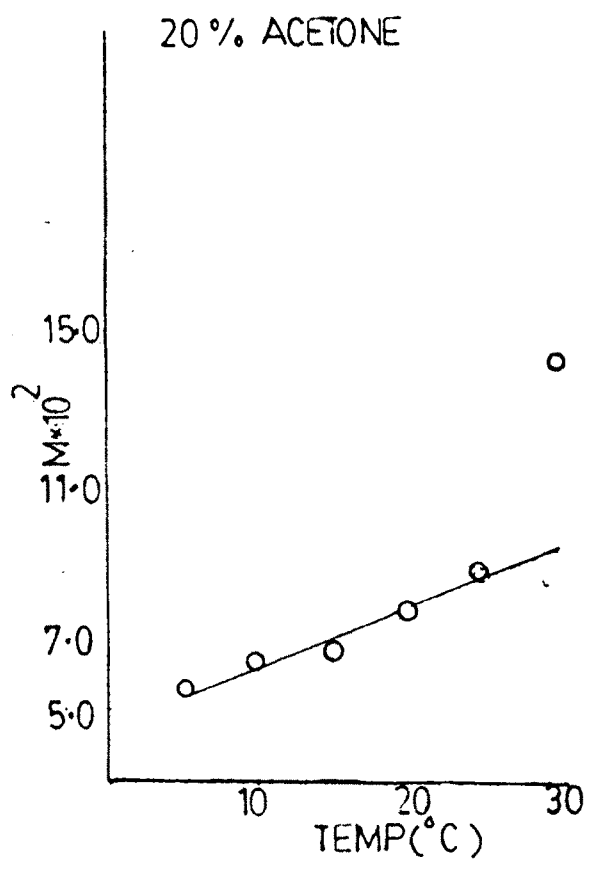
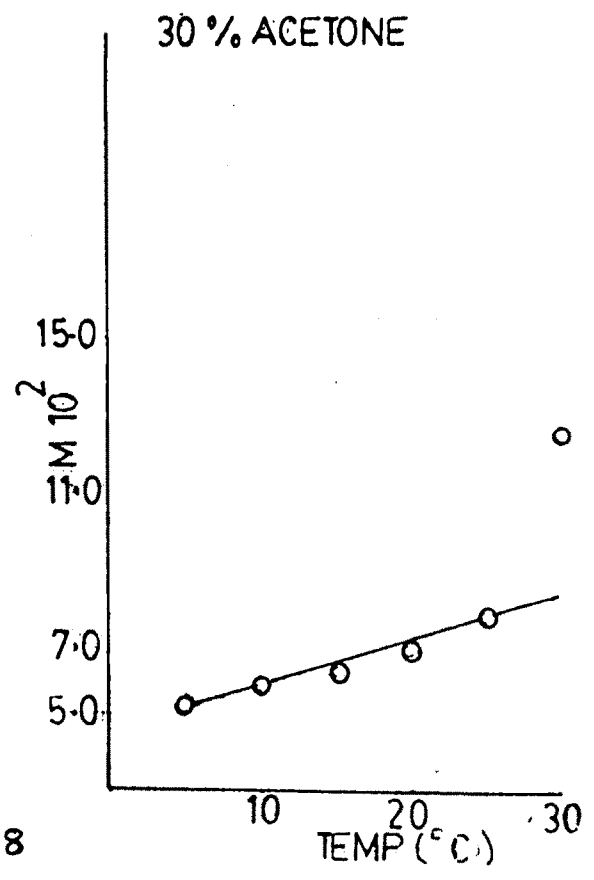




FIG-5·38



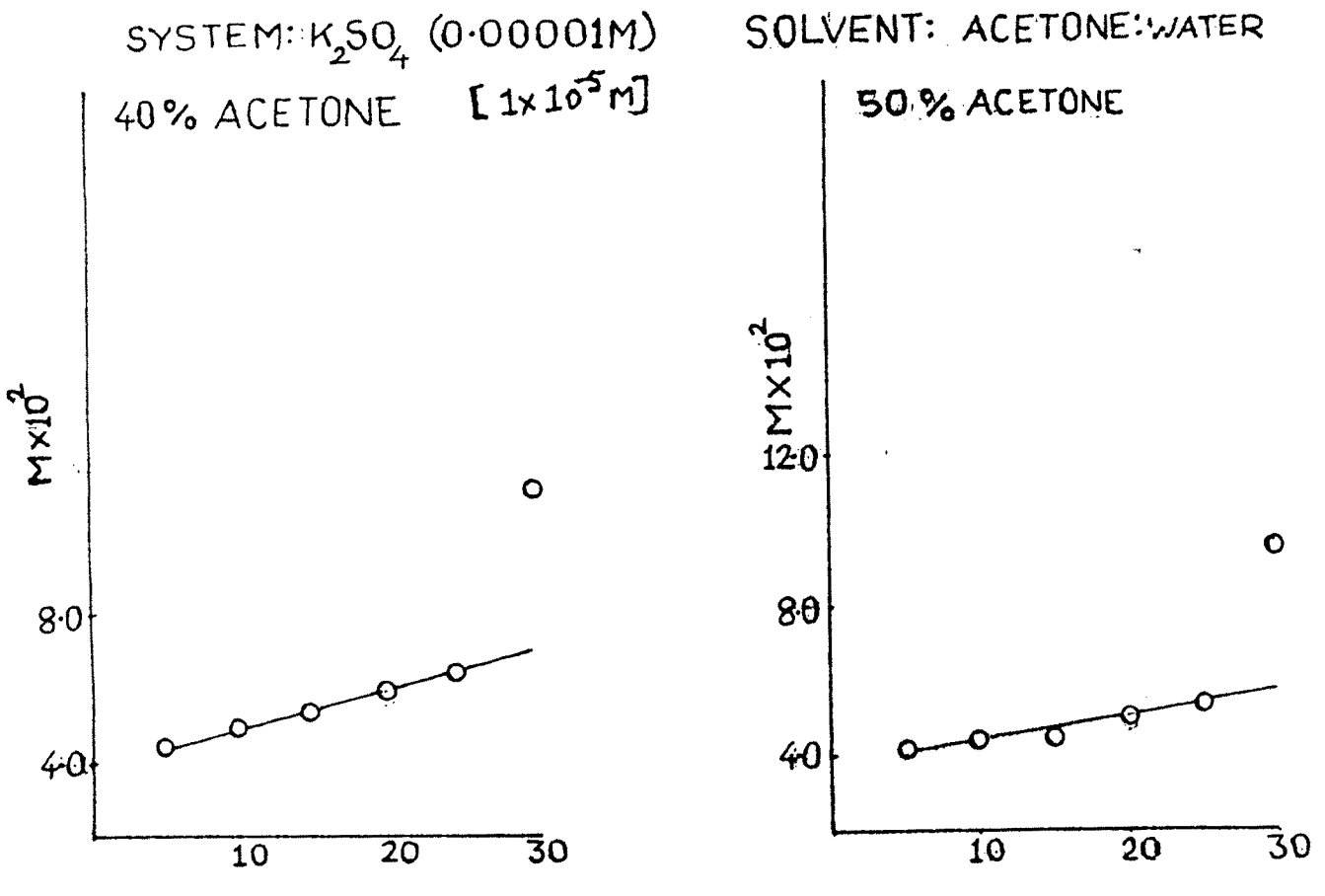
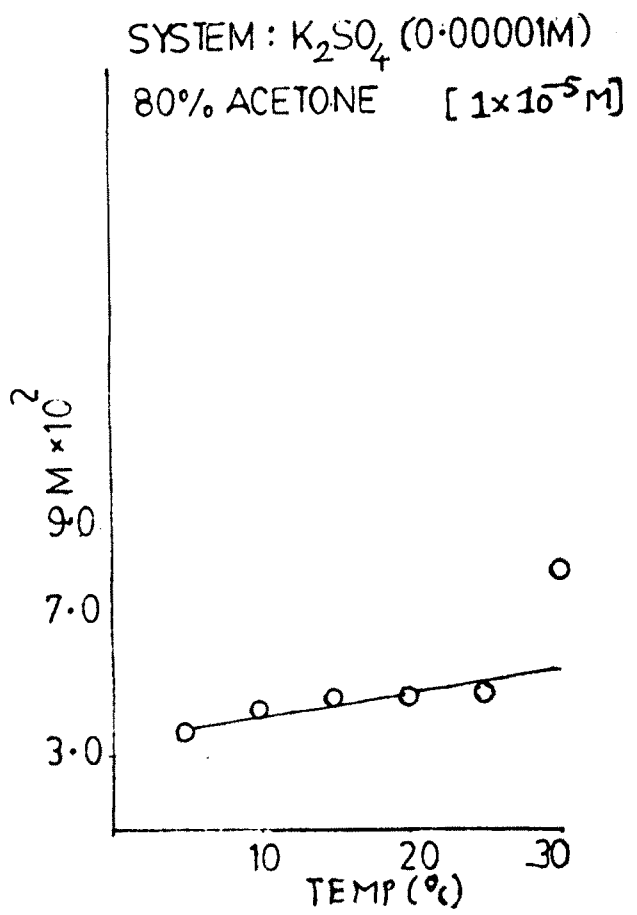

SYSTEM: $K_2SO_4$ (0·00001M)
SOLVENT: ACETONE:WATER
40% ACETONE [$1 \times 10^{-5}$ M]
50% ACETONE
60% ACETONE
70% ACETONE
M X $10^2$
8·0
4·0
12·0
11·0
7·0
3·0
10
20
30
TEMP(°C)

FIG-5.39


SYSTEM : $K_2SO_4$ (0·00001M)
80% ACETONE [ $1\times10^{-5}$M]
$M\times10^2$
9·0
7·0
3·0
10
20
30
TEMP (°c)

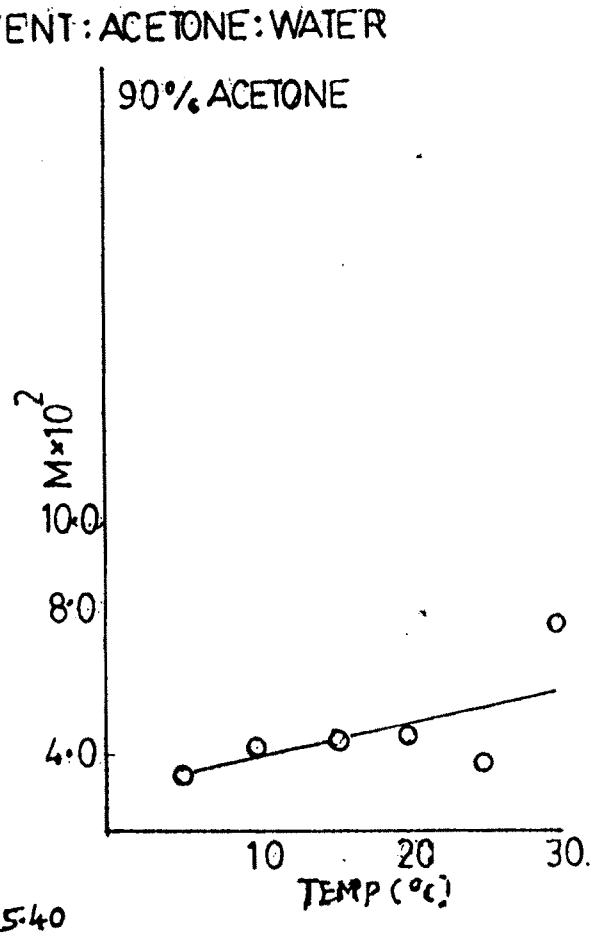

SOLVENT : ACETONE : WATER
90% ACETONE
$M\times10^2$
10·0
8·0
4·0
10
20
30.
TEMP (°c)

FIG-5.40