Table 3.2. Percentage composition of the different membranes of cadmium electrodes

X	PVC, %	Ion-pair, (%)	Plasticizer (%)	STPB (%)	Slope	Linear range, M	LDL, M
A	35.0	I (1.8)	DOP (63.0)	--	-25.7	$1x10^{-5}$ -$1x10^{-1}$	$3.0x10^{-6}$
B	34.6	I (2.7)	DOP (62.5)	--	-27	$4x10^{-6}$:$1x10^{-1}$	$2.0x10^{-6}$
C	34.3	I (3.7)	DOP (62.0)	--	-28.4	$4x10^{-6}$:$1x10^{-1}$	$1.0 x10^{-6}$
D	33.7	I (5.2)	DOP (60.9)	--	-25.4	$1x10^{-5}$ -$1x10^{-1}$	$3.5x10^{-6}$
E	34.3	I (2.7)	DOP (62.0)	0.9	-28	$1x10^{-5}$- $1x10^{-1}$	$8.0x10^{-6}$
F	34.0	I (3.7)	DOP (61.4)	0.9	-29.2	$1.0x10^{-6}$ -$1x10^{-1}$	$1.0x10^{-6}$
G	33.7	I (3.7)	DOP (60.9	1.8	-29.4	$2x10^{-6}$-$1x10^{-1}$	$1.0x10^{-6}$
H	33.4	I (3.7)	DOP (60.4)	2.7	-29.8	$1x10^{-6}$-$1x10^{-1}$	$6.0x10^{-7}$
I	33.1	I (3.7)	DOP (59.8)	3.7	-29.8	$5x10^{-5}$: $1x10^{-1}$	$4.0x10^{-6}$
J	34.0	I (3.7)	DBP (60.4)	2.7	-28.7	$1.8x10^{-5}$ -$1x10^{-1}$	$5.0x10^{-6}$
K	34.0	I (3.7)	DBS (60.4)	2.7	-27.4	$1x10^{-5}$ -$1x10^{-1}$	$2.5x10^{-6}$
L	34.0	I (3.7)	NPOE (60.4)	2.7	-27.9	$6.3x10^{-5}$ -$1x10^{-1}$	$7.9X10^{-6}$
M	35.0	II (1.8)	DOP (63.0)	--	-21.4	$1x10^{-5}$ -$1x10^{-1}$	$5.9x10^{-6}$
N	34.6	II (2.7)	DOP (62.5)	--	-23.3	$1x10^{-5}$ -$1x10^{-1}$	$3.5x10^{-6}$
O	34.3	II (3.7)	DOP (62.0)	--	-24.1	$1x10^{-5}$ -$1x10^{-1}$	$2.4x10^{-6}$
P	33.7	II (5.2)	DOP (60.9)	--	-18.5	$1x10^{-5}$-$1x10^{-1}$	$4.0x10^{-6}$
Q	33.4	II (3.7)	DOP (60.4)	2.7	-25.1	$1x10^{-6}$ -$1x10^{-1}$	$8.0x10^{-7}$
R	33.4	II (3.7)	DBP (60.4)	2.7	-23.6	$1x10^{-5}$ -$1x10^{-1}$	$5.8x10^{-6}$
S	33.4	II (3.7)	DBS (60.4)	2.7	-22.3	$1x10^{-4}$ -$1x10^{-1}$	$2.8x10^{-5}$
T	33.4	II (3.7)	NPOE (60.4)	2.7	-24.9	$1x10^{-4}$ -$1x10^{-1}$	$1.2x10^{-5}$

X. Electrode

Table.3.3. Determination of selectivity coefficient by SSM

ion	$K_{i,j}^{pot}$ H	$K_{i,j}^{pot}$ Q	ion	$K_{i,j}^{pot}$ H	$K_{i,j}^{pot}$ Q
$[Pb X_4]^{2-}$	0.29	$5.5x10^{-3}$	Mn^{2+}	$1.38x10^{-4}$	$1.6x10^{-4}$
$[CuX_4]^{2-}$	$3.4x10^{2}$	$1.3x10^{-4}$	Co^{2+}	$1.17x10^{-4}$	$2.1x10^{-4}$
$[Hg X_4]^{2-}$	$2.4x10^{3}$	31	Sr^{2+}	$1.5x10^{-4}$	$1.3x10^{-4}$
$[Zn X_4]^{2-}$	$1.38x10^{-4}$	$1.4x10^{-4}$	Na^{+}	$3x10^{-3}$	$1.2x10^{-3}$
$[Fe X_5]^{2-}$	34.7	$1.2x10^{-5}$	$NH4^{+}$	$2.09X10^{-2}$	$1.99x10^{-3}$
$[Ag X_4]^{3-}$	0.14	$1.7X10^{-4}$	As^{3+}	$2.6x10^{-5}$	$1.7x10^{-5}$
Ba^{2+}	$1.63x10^{-4}$	$1.3x10^{-4}$	Al^{3+}	$8.85x10^{-5}$	$3.46x10^{-5}$
Ni^{2+}	$1.17x10^{-4}$	$8.4x10^{-5}$	Cr^{3+}	$2.6x10^{-5}$	$1.4x10^{-5}$

* Where i is the primary ion $[CdI_4]^{2-}$ for electrode (H) and $[CdBr_4]^{2-}$ for electrode (Q) and j is the interfering ion
* X = I or Br

Table.3.4. Determination of selectivity coefficient by MPM

ion	K^{MPM} electrode F	K^{MPM} electrode Q	ion	K^{MPM} electrode F	K^{MPM} electrode Q
Cu^{2+}	5.86	$4.7 x10^{-4}$	Hg^{2+}	15.62	4.3
Pb^{2+}	0.51	$5.3 x10^{-4}$	Fe^{3+}	3.1	$7.2 x10^{-4}$
Cr^{3+}	$1.8x10^{-3}$	No. I	Al^{3+}	$4x10^{-4}$	No. I
Ag^{+}	0.62	0.12	Ni^{2+}	No. I	No. I

No. I: No Interference

3.5. Comparison between some cadmium selective electrodes

Ser No	Membrane type	Ion-pair/ionophore	Slope mV/d	Linear range, M	Response, s	Life time	In
1	PVC	Tetrathia-12-crown	29±1	$4X10^{-7}$ - $1X10^{-1}$	<10	6 w	C
2	PVC	Benzo-12-crown-5	29	$2.1x10^{-5}$ - $1x10^{-1}$	<10	3 m	K, H
3	PVC	Dibenzo-24-crown-8	30±1	$3.9x10^{-5}$ - $1x10^{-1}$	25	5 m	N K,
4	PVC	4,4`-di-(5-nonyl)-2,2` bipyidyl	NM	?$1x10^{-3}$	NM	10 d	C
5	PVC	[1,1'-bicyclohexyl] 1,1',2,2'-tetrol	27.8	$1x10^{-5}$ - $1x10^{-1}$	<15	2 m	Z
6	PVC	Dicyclohexano-18-crowen-6	29±1	$2.1x10^{-5}$ - $1x10^{-1}$	17	6 m	N
7	Styrene co-acrylonitrile	8-hydroxyqunoline	29	$4.4x10^{-4}$- $1X10^{-1}$	12	6 m	P
8	Solid-state	CdS-AgI-Sb_2S_3		$1x10^{-6}$ - $1x10^{-1}$	-	-	P
9	Solid-state	PATENT	NM	$1x10^{-7}$ – 1.0	?60	NM	A F
10	Solid-state	PATENT	26±3	$2.1x10^{-5}$ - $1x10^{-1}$	<10	NM	A F
11	Coated graphite	I	-29.8	$1x10^{-6}$ - $1x10^{-1}$	? 3	4m	A F
12	Coated graphite	II	-25.2	$1x10^{-6}$ - $1x10^{-1}$	?7	4m	H

Table.3.6. Determination of cadmium in different metal alloys

sample	Added mg/ml	Found mg/ml		Recovery %±STD		Found mg/ml	Recovery %
		electrode H	electrode Q	electrode H	electrode Q	AAS	AAS
Copper alloy	0.5	0.478	0.502	95.6±3.3	100.4±4.8	0.49	98.0
Silver brazing alloy	1.5	1.42	1.49	94.8±3.3	99.33±4.9	1.49	99.3
Welding wire	0.05	--	0.0503	--	101±4.2	0.05	100.0

Number of three replicate

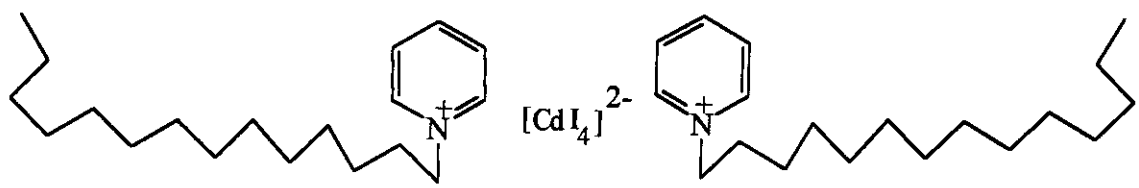

Fig. 3.1. The structure of cetylpyridinium-tetraiodocadmate ion-pair.

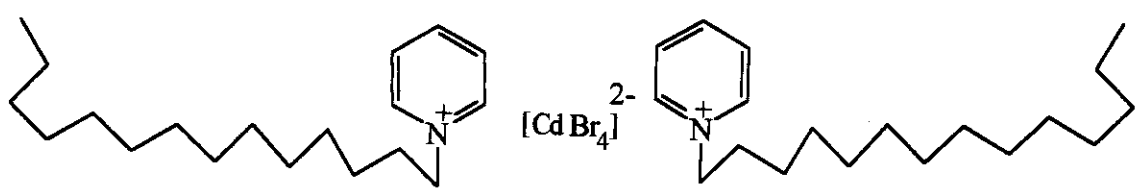

Fig. 3.2. The structure of cetylpyridinium-tetrabromocadmate ion-pair

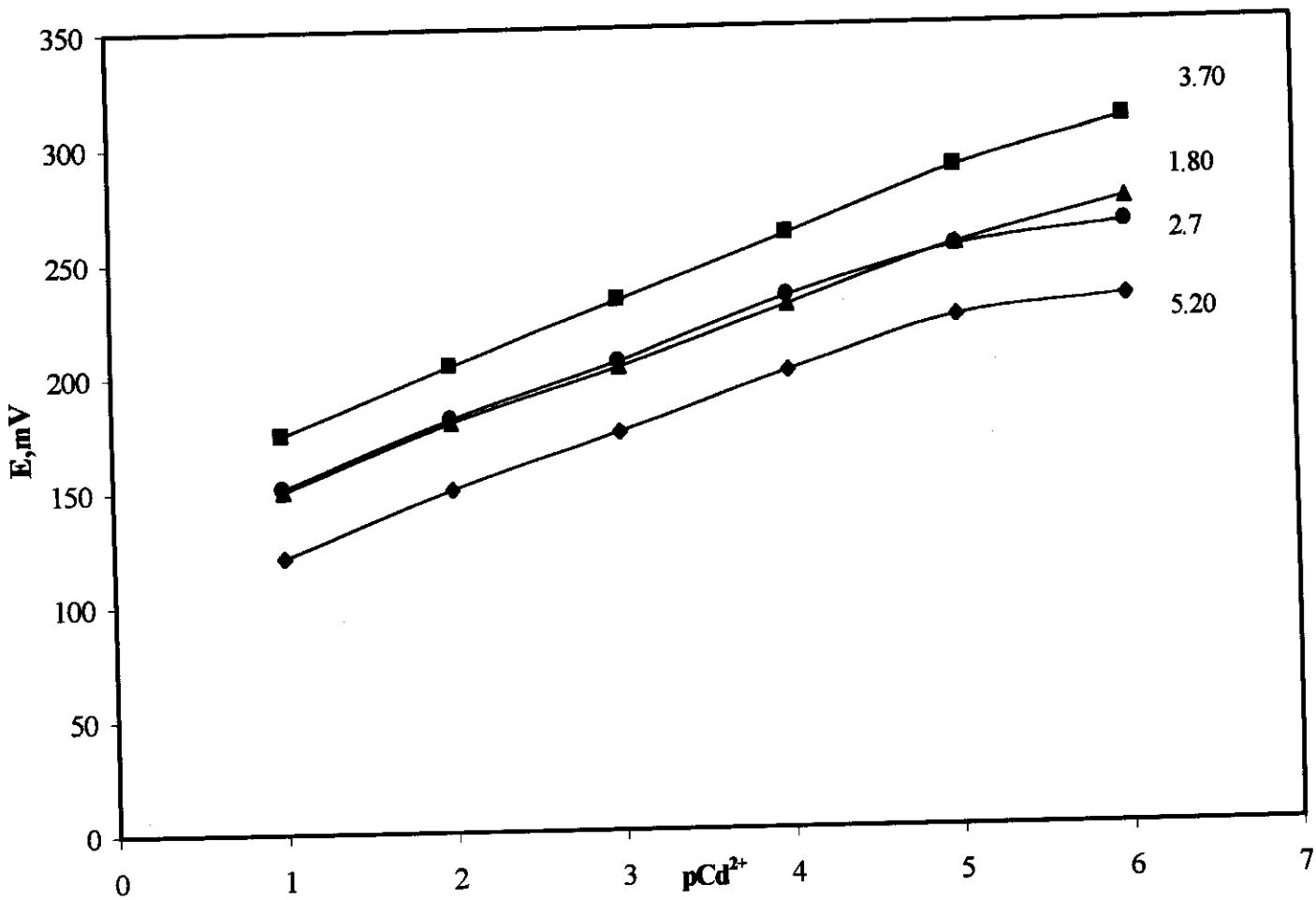

Fig.3.3. The effect of cetylpyridinium-tetraiodocadmate concentration on the response of cadmium electrodes

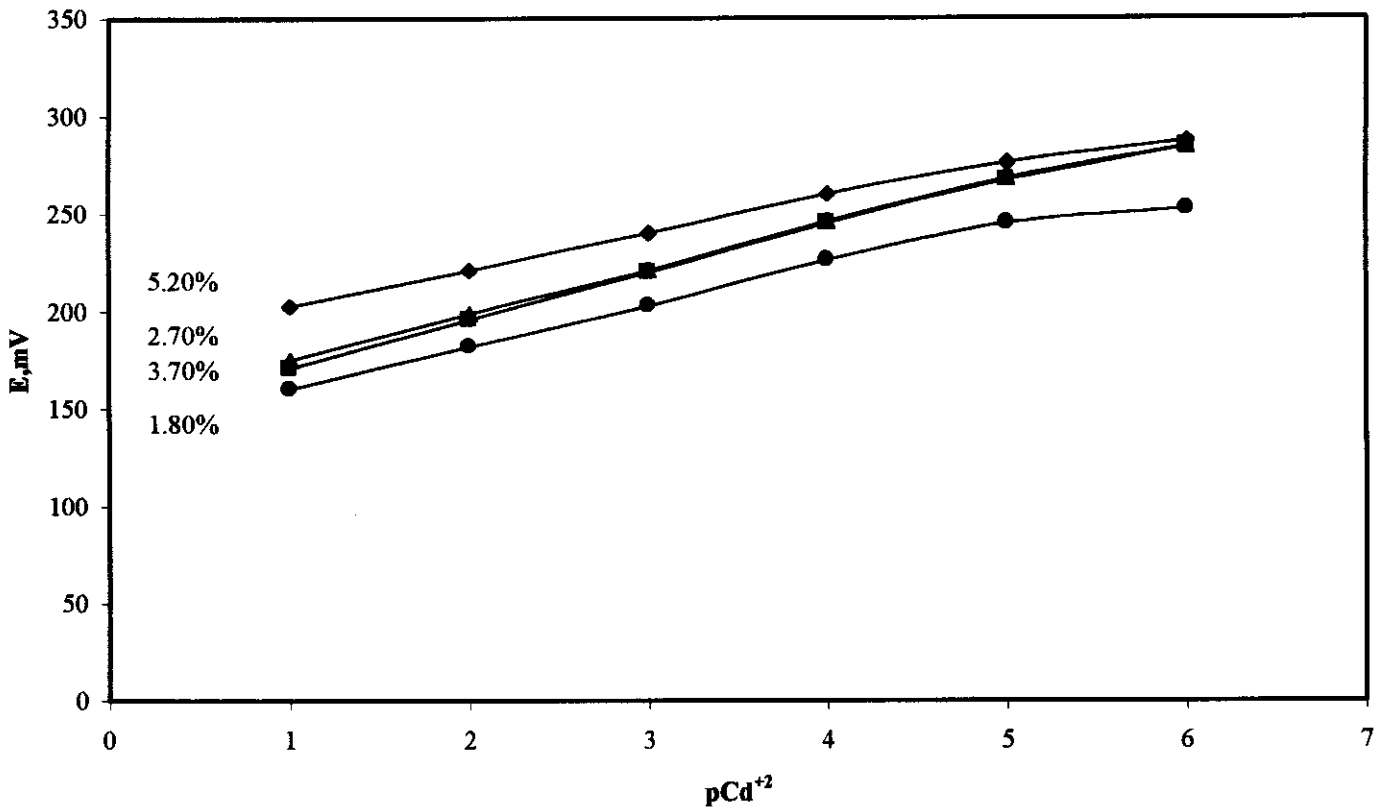

Fig.3.4. The effect of cetylpyridinium-tetrabromocadmate concentration on the response of cadmium electrodes

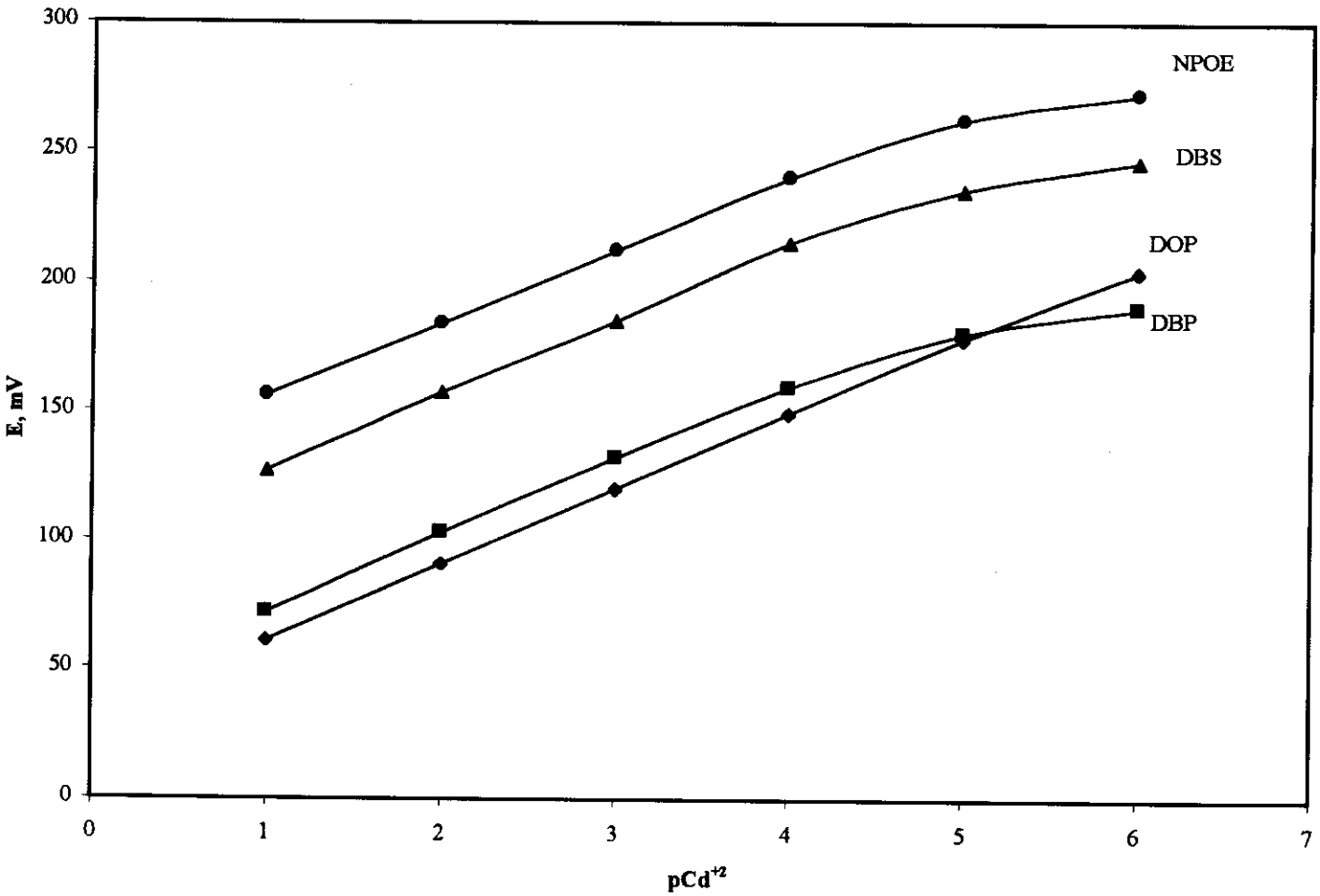

Fig.3. 5. The effect of different plasticizer on the performance of tetraiodocadmate electrodes

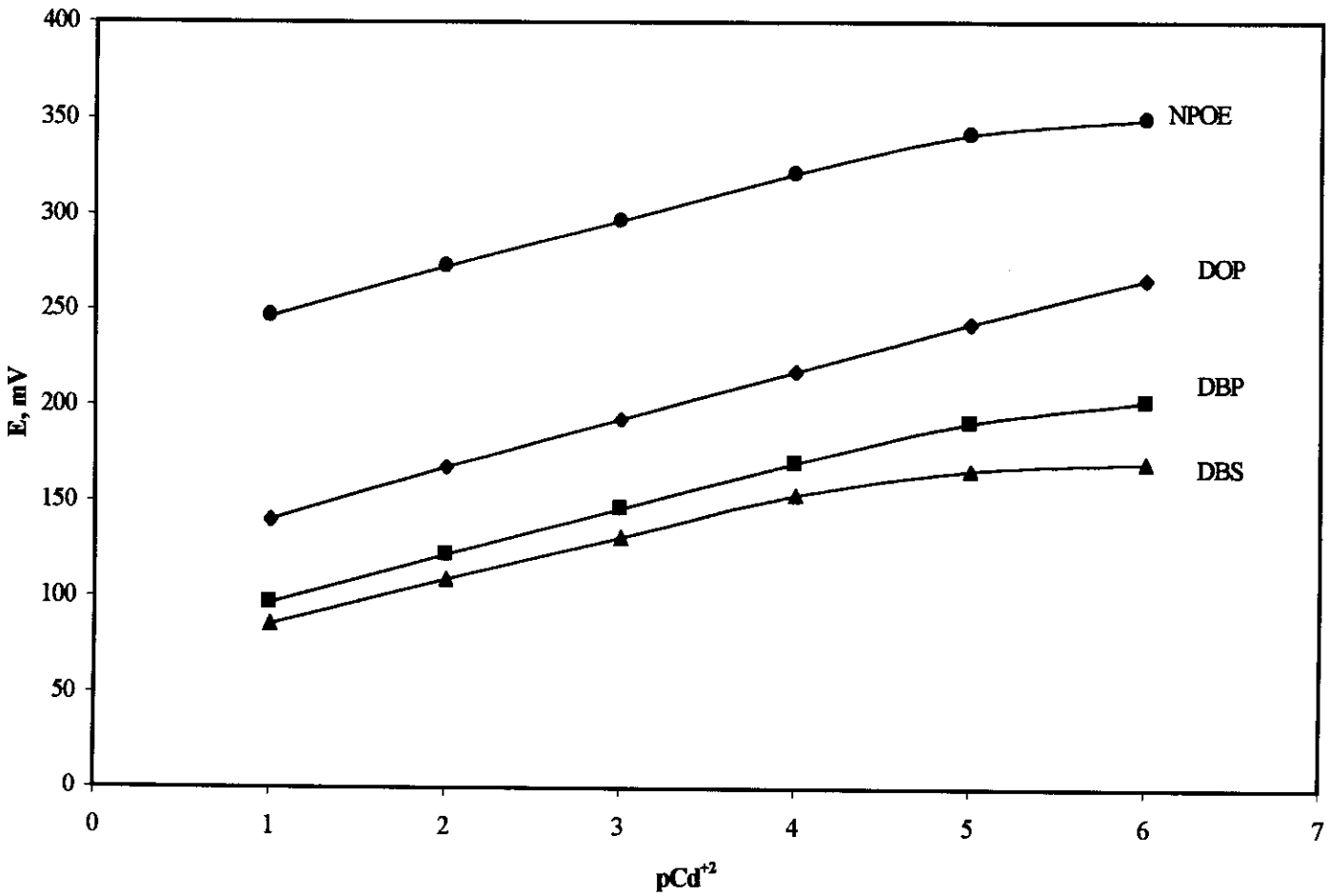

Fig. 3.6. The effect of different plasticizer on the performance of tetrabromocadmate electrodes

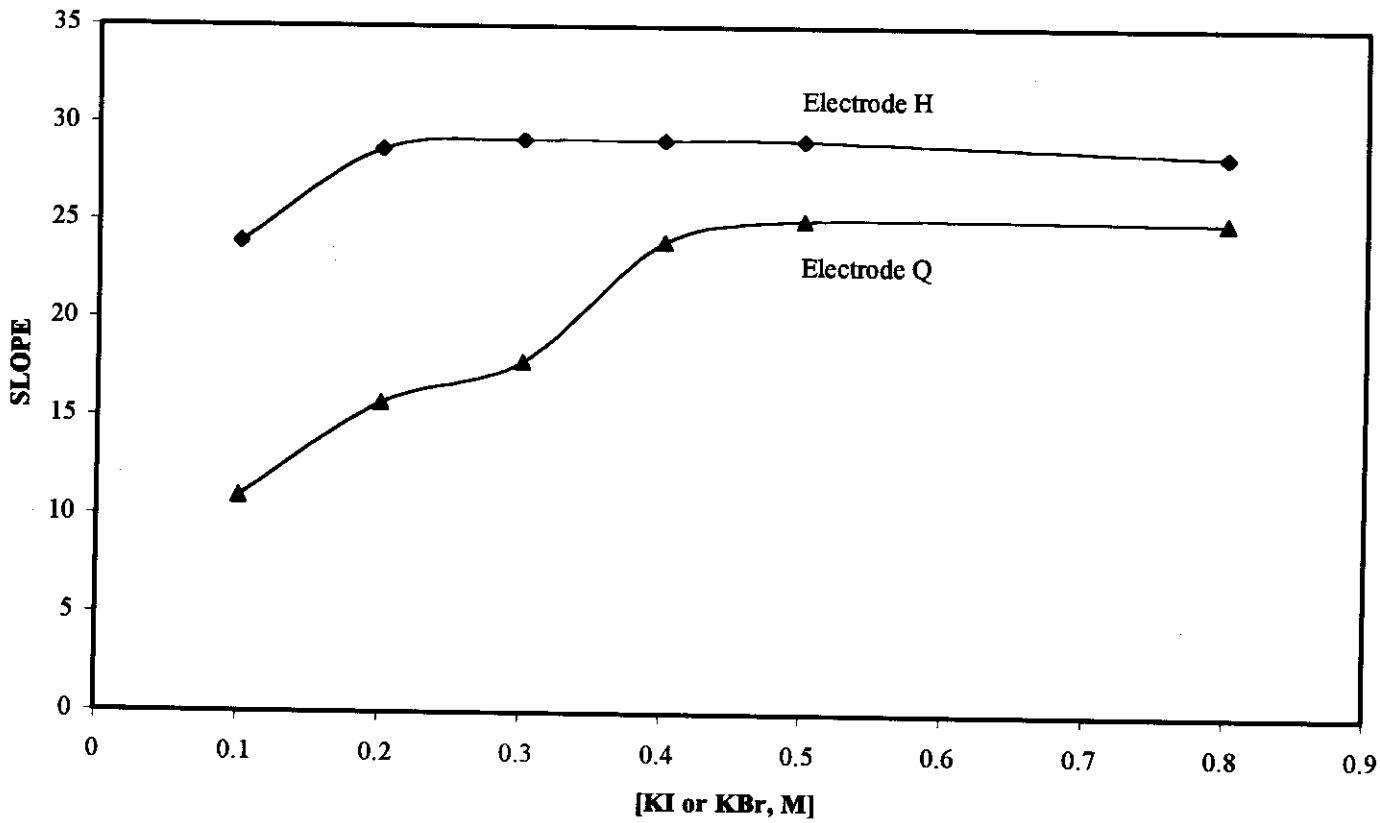

Fig. 3.7. The effect of iodide or bromide ion concentration on the performance of cadmium electrodes

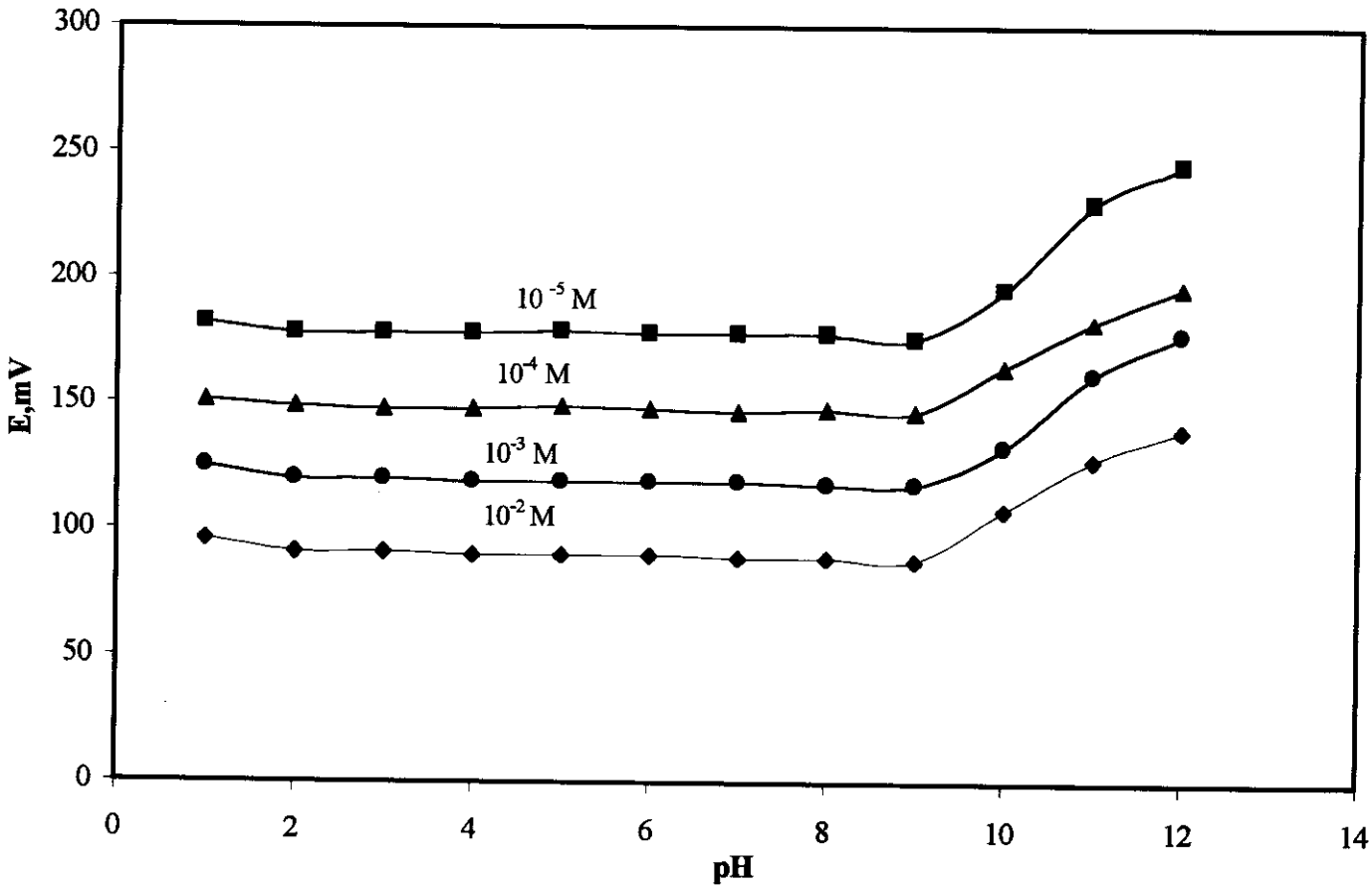

Fig 3.8. The effect of pH on Tetraiodocadmate electrode

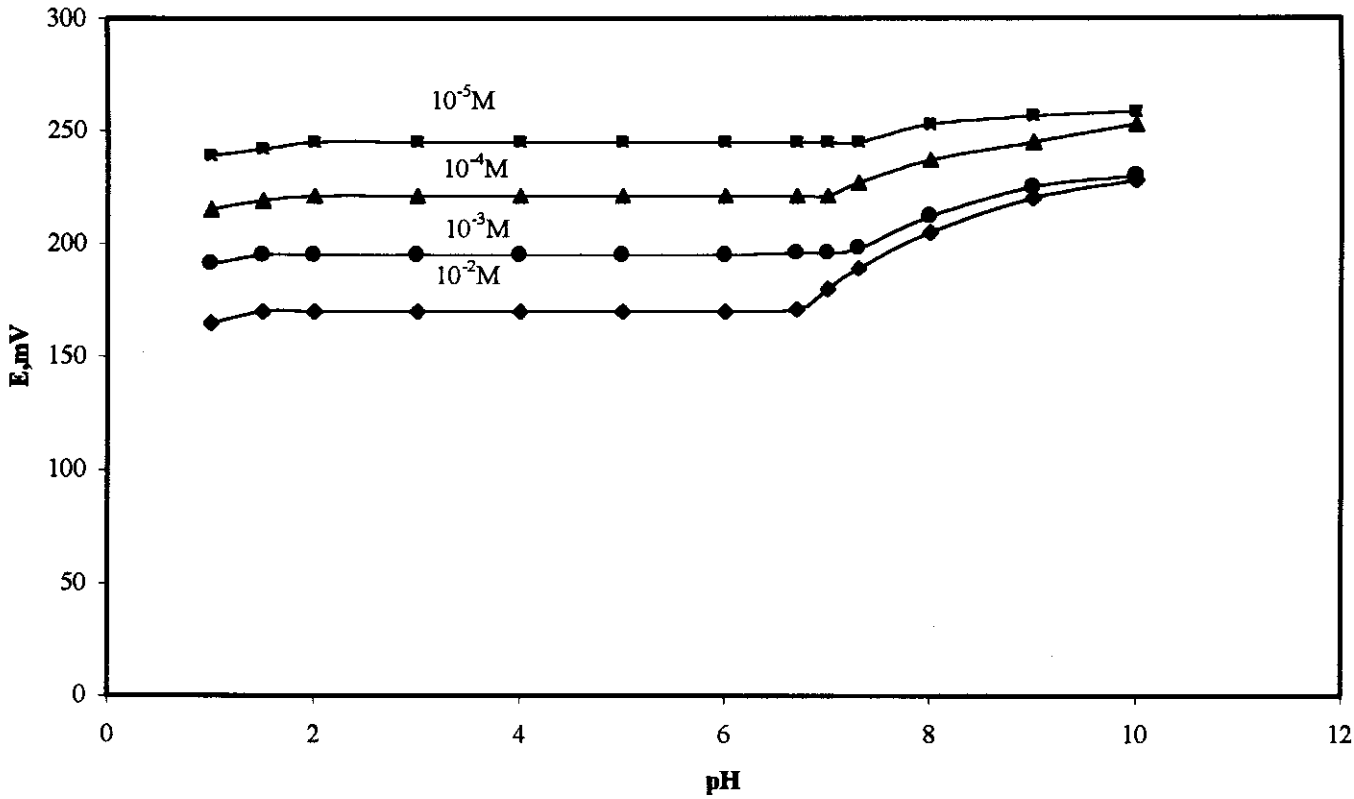

Fig.3.9. The effect of pH on tetrabromocadmate electrode

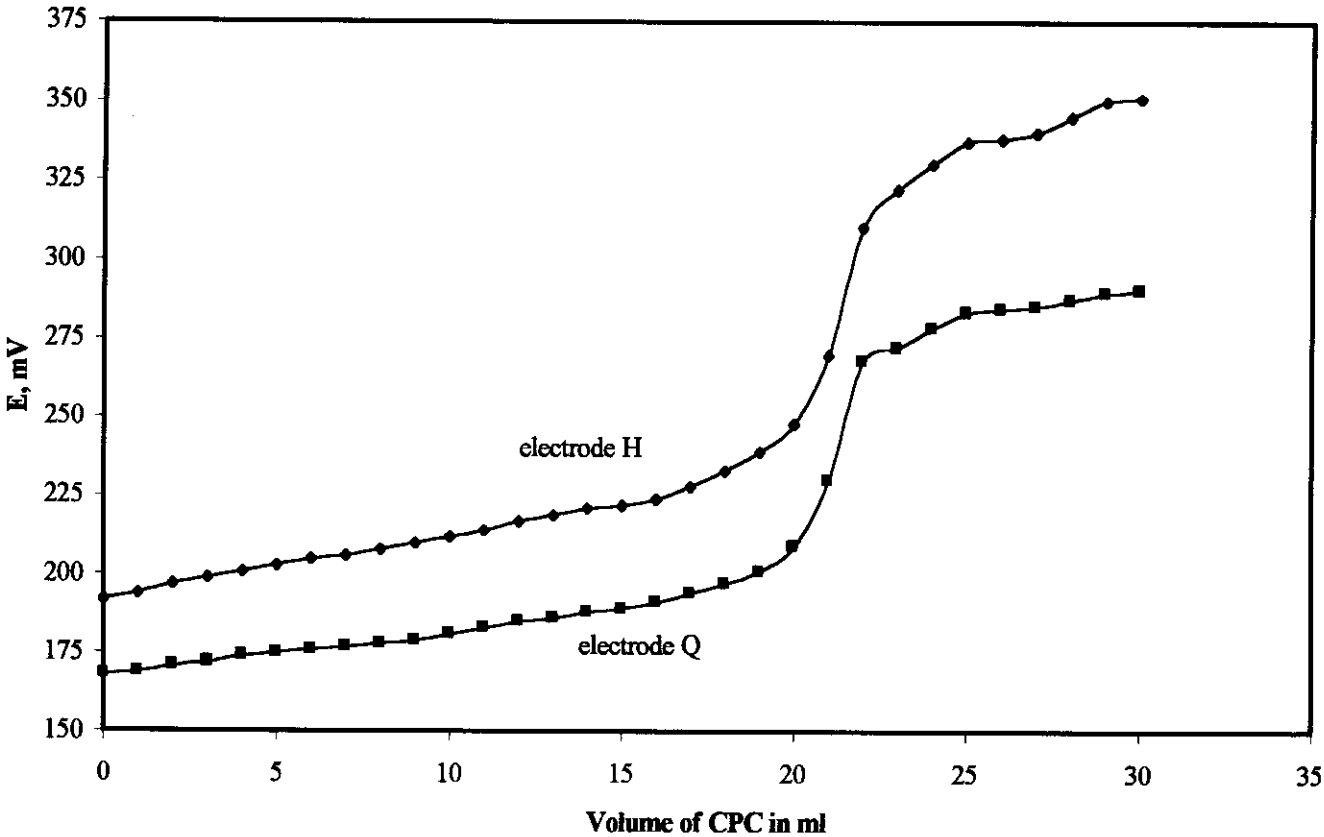

Fig.3.10. Potentiometric titration of tetraiodocadmate and tetrabromocadmate with CPC.

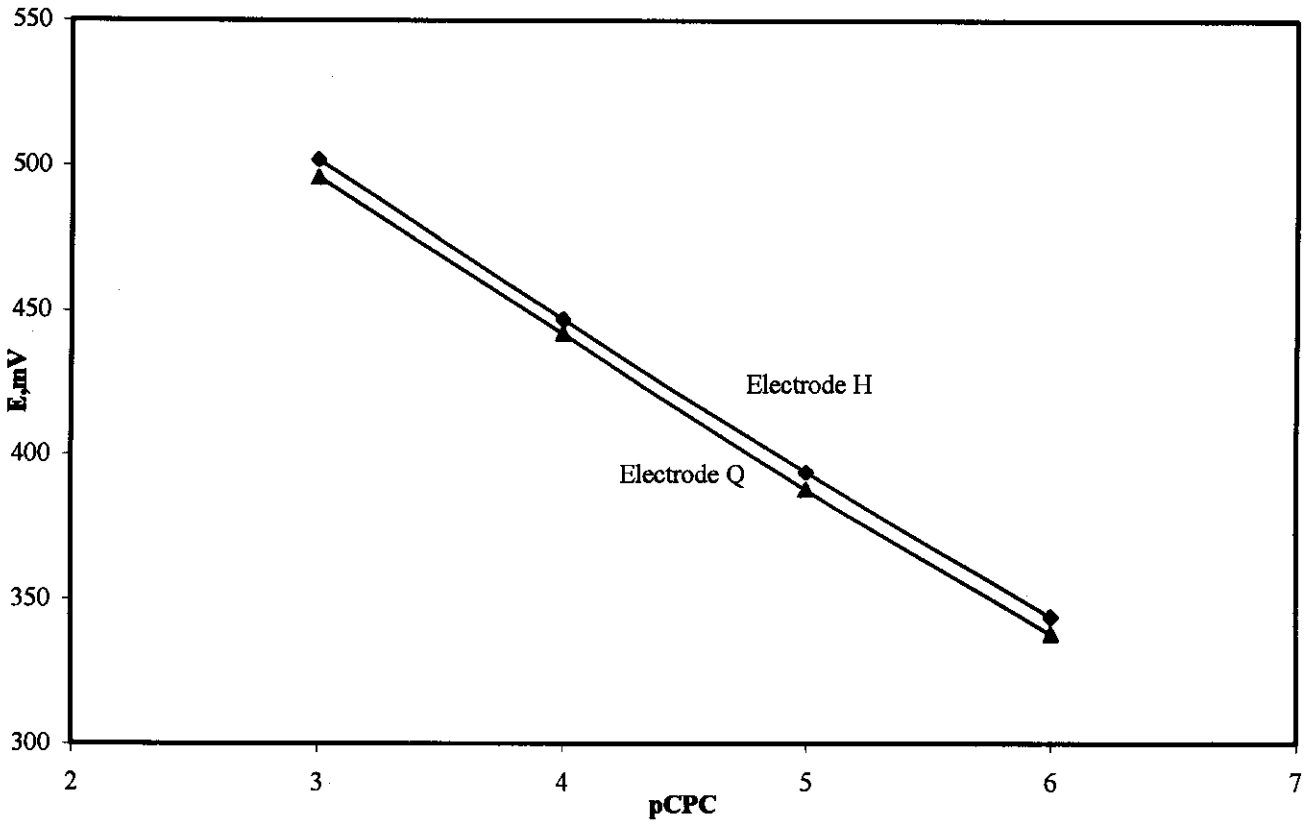

Fig.3.11. Determination of CPC uses the two proposed electrodes.