

Contents

Preface — V

Introduction and basics of spectrophotometry — 1

Chapter 1

Analytical reagents having N/O/S as donor atom and miscellaneous reagents — 22

- 1.1 Dimethylglyoxime — 22
- 1.2 2-(5-Bromo-2-pyridylazo)-5-dimethyl-aminoaniline (PADMA) — 22
- 1.3 Triethylenetetramine — 22
- 1.4 Tri isopropanolamine — 23
- 1.5 Dimethylglyoxime using flotation — 23
- 1.6 Dimethyloxime — 23
- 1.7 4-(4-Chlorobenzene diazo)-amino-4'-chloroazobenzene (CDACAB) — 24
- 1.8 4-(5-Chloro-2-pyridyl)-azo-1,3-diaminobenzene (5-Cl-PADB) — 24
- 1.9 Ammonium per sulfate dimethylglyoxime — 24
- 1.10 Dimercaptophenols — 25
- 1.11 2,2',4,4'-Tetrahydroxybenzophenone (BP-2) — 25
- 1.12 2,6-Dimethyl-morpholine dithiocarbamate (DM MDTC) — 25
- 1.13 5-Methyl-2-acetylfuran-4-methyl-3-thiosemicarbazone (5-MAFMT) — 25
- 1.14 2-(5-Bromo-2-oxoindolin-3-ylidene) hydrazine carbothioamide — 26
- 1.15 bis-Thiosemicarbazone — 26
- 1.16 Miscellaneous reagents — 26
 - 1.16.1 Murexide — 26
 - 1.16.2 MEDTA — 26
 - 1.16.3 Organic detector ferrozin — 27
 - 1.16.4 Methylene blue and H_2O_2 — 27
 - 1.16.5 *m*-Acetylchlorophophanazo — 27
 - 1.16.6 Arsenazo-III — 27
 - 1.16.7 Chlorophosphanazo-III (CPA-III) — 28
 - 1.16.8 Auzarin Red S (ARS) — 28
 - 1.16.9 Eriochrome black T — 28
 - 1.16.10 Cefixime — 28
 - 1.16.11 Cyanidin — 29
 - 1.16.12 Arsenazo-III — 29
 - 1.16.13 *p*-Aminophenol on Amberlite-XAD — 29
 - 1.16.14 MESNA — 30
- References — 30

Chapter 2

Analytical reagents having nitrogen and oxygen as donors — 32

- 2.1 Imidazole derivative — **32**
- 2.2 [*N*-(*O*-hydroxybenzylidene) pyridine-2-amine] (NOHBPA) — **32**
- 2.3 *N,N'*-bis(4-methoxysalicylidene) ethylenediamine — **32**
- 2.4 α -Furildioxime — **33**
- 2.5 4-(2-Pyridylazo)-resorcinol — **33**
- 2.6 1-(4-Methylphenyl)-3-(2-(trifluoromethyl) phenyl) triaz-1-ene-1-oxide — **33**
- 2.7 1-(2-Pyridylazo)-2-naphthol (PAN) — **33**
- 2.8 2-Hydroxy-1-naphthaldehyde thiosemicarbazone (HNT) — **34**
- 2.9 Para aminophenol (PAP) — **34**
- 2.10 [*N*-(*O*-methoxybenzaldehyde)-2-aminophenol] (NOMBAP) — **34**
- 2.11 3-Hydroxy-3*m*-tolyl-1-*p*-methoxyphenyltriazenes — **34**
- 2.12 Schiff base — **35**
- 2.13 *N'*-(2-hydroxybenzylidene)-3-(4-*O*-tolylpiperazin-1-yl) propanehydrazine (HTP) — **35**
- 2.14 Tween-80-PAN — **35**
- 2.15 Antipyrine azo orcinol (APAO) — **36**
- 2.16 5-Nitrosalicylaldehyde semicarbazone (NSS) — **36**
- 2.17 5-Bromo-2-hydroxy-3-methoxybenzaldehyde-4-hydroxybenzoichydrazones (5-BHMBHBH) — **36**
- 2.18 Antipyryl azo-1-nitroso-2-naphthol — **36**
- 2.19 1-Nitroso-2-naphthol — **37**
- 2.20 2,4-Dimethoxybenzaldehyde iso nicotinoylhydrazones (DMBIH) — **37**
- 2.21 Salicylaldehyde isonicotinoyl-hydrazones (SAINH) — **37**
- 2.22 Schiff base 2-[(2-hydroxyphenylimino) methyl]-4-nitrophenol (HPIMNP) — **37**
- 2.23 Isocinchomeric acid — **38**
- 2.24 3-(1-Benzhydrylazetid-3-yl) 5-isopropyl 2-amino-1, 4-dihydro-6-methyl-4-(4-nitrophenyl) pyridine-3, 5-dicarboxylate — **38**
- 2.25 *N,N'* bis (*O*-hydroxyacetophenone) ethylene diimine derivatives (HAPED) — **38**
- 2.26 Dimethylglyoxime — **39**
- 2.27 5-Bromo-2-hydroxyl-3-ethoxybenzaldehyde-4-hydroxybenzoichydrazones (5-BHMBHBH) — **39**
- 2.28 α -Oximino acetoacetanilide benzoylhydrazones (HINABH) — **39**
- 2.29 Antipyryl azo-2,7-naphthalene-diol (1-APANDOL) — **40**
- 2.30 Pyridine-2, 3-dicarboxylic acid — **40**
- 2.31 2'-Hydroxy-4'-butoxychalconeoxime (HB CO) — **40**
- 2.32 Anthrone phenylhydrazones (APH) — **40**
- 2.33 Triazene-1-oxide derivatives — **41**

2.34	5-(4'-Chlorophenylazo-6-hydroxypyridine-2,4-dione (CPAHPD) — 41
2.35	<i>o</i> -Chlorophenylazo-bis-acetoxime — 41
2.36	2-Hydroxy-1-naphthalenecarboxaldehyde phenylhydrazone — 42
2.37	4-(2-Pyridylazo) resorcinol (PAR) — 42
2.38	2-[2-(6-Chlorobenzothiazolyl)] azo-resorcinol (6-CIBTAR = LH ₂) — 42
2.39	2,2-Furildioxime — 42
2.40	<i>p</i> -Chloro phenylazo-bis-acetoxime (<i>p</i> -CPABA) — 43
2.41	Furildioxime in micellar solution — 43
2.42	2,4-Dihydroxy-5-bromo butyro phenone oxime (DHBBO) — 43
2.43	Diacetyl monoxime isonicotinoylhydrazone — 43
2.44	Hydrazine carboxamide-2-(2-hydroxy-1-naphthalenyl) methylene] (HCHNM) — 44
	References — 44

Chapter 3

Analytical reagents having N, S, O as donor atoms — **47**

3.1	<i>NN'</i> (1E, 1"E)-(propane-1,3-diylbis (sulfanediyl) bis(1-4-bromophenyl) ethan-2-yl-1-ylidene)) bis(2-hydroxybenzohydrazide) (BAPSSHZ) — 47
3.2	4-Hydroxy-3-thiolbenzoic acid and diphenyl guanidine — 47
3.3	3-Phenyl-2,4-thiazolidenedione — 47
3.4	5-Bromo salicyldehyde-2-amino thiophenol — 48
3.5	2-Amino-3-phenolazo-1-(4-sulfophenyl)-3-methyl-5-pyrazolone — 48
3.6	Dithiophenols and diphenylguanidine — 48
3.7	1-[(5-Benzyl-1,3-thiazol-2-yl) diazenyl] naphthalene-2-ol — 48
3.8	1-2',4'-Dinitroaminophenyl)-4,4,6-trimethyl-1,4-dihydropyrimidine-2-thiol (2',4'-dinitro APTPT) — 49
3.9	2-(Benzothiazolylazo) orcinol (BTAO) — 49
3.10	5-(2-Benzothiazolylazo)-8-hydroxyquinoline (BTAHQ) — 49
3.11	1-(2-Hydroxyphenyl) thiourea (HPTU) — 50
3.12	2,6-Diacetylpyridine bis(4-phenyl-3-thiosemicarbazone) (2,6-DAPBPTSC) — 50
3.13	3,4-Dihydroxy-5-methoxy benzaldehyde thiosemicarbazone (DHMBTSC) — 50
3.14	Cinnamaldehyde thiasemicarbazone (CMTSC) — 50
3.15	3-Hydroxy-3 <i>n</i> -propyl-1-(4-sulphonamidophenyl) triazene — 51
3.16	4-Hydroxybenzaldehyde thiosemi-carbazone (HBTS) — 51
3.17	2,4-Dihydroxybenzaldehyde thiosemicarbazone (DHBATSC) — 51
3.18	3-Hydroxy-3-isopropyl-1-(4-sulphonamidophenyl) triazene — 51
3.19	2-Acetylpyridine thiosemicarbazone/semicarbazone (APT)/APS — 52
3.20	2-Acetylpyridine-4-Methyl-3-thiosemicarbazone (APMT) — 52

- 3.21 *p*-Chloroacetophenon-4-(2'-carboxy-5'-sulphophenyl)-3-thiosemicarbazone (*p*-CACST) — **52**
- 3.22 5-Bromosalicylaldehyde thiosemicarbazone (5-BSAT) — **53**
- 3.23 6-(Anthracen-2-yl)-2,3-dihydro-1,2,4-triazine-3-thione (ADTT) — **53**
- References — **53**

Chapter 4

Analytical reagents having N, O or S as donor atoms and miscellaneous reagents — **56**

- 4.1 2-(5-Cyano-2-pyridylazo)-2,4-diaminotoluene (5-CN-PADT) — **56**
- 4.1.1 Triethylenetetramine — **56**
- 4.1.2 Monotetrazolium — **56**
- 4.1.3 5-Chloro-2-(pyridyl)-1,3-diaminobenzene — **57**
- 4.1.4 5-Bromo-2-hydroxy-3-methoxy benzaldehyde-4 hydroxy benzoic hydrazone (5-BHMBHBH) — **57**
- 4.1.5 5-(5-Iodo-2-pyridylazo)-2,4-diaminotoluene (5-1-PADT) — **57**
- 4.1.6 4-(5-Chloro-2-pyridylazo)-1,3-phenylenediamine (5-Cl-PADAB) — **57**
- 4.1.7 Salicyl fluorone — **58**
- 4.2 Miscellaneous reagents — **58**
- 4.2.1 Wright stain — **58**
- 4.2.2 Murexide — **58**
- 4.2.3 Crown ether (DB-18-C6) — **58**
- 4.2.4 Orange G and *m*-cresol purple — **59**
- 4.2.5 Methylene blue (MB) — **59**
- 4.2.6 Esomeprazole — **59**
- 4.2.7 Nitroso-R-salt — **60**
- 4.2.8 Brilliant green — **60**
- 4.2.9 Chelating resin — **60**
- 4.2.10 Salen — **60**
- 4.2.11 Methylene blue — **61**
- 4.2.12 Nitroso-R-salt — **61**
- 4.2.13 Carmine — **61**
- 4.2.14 Alizarin Red-S — **61**
- 4.2.15 Picramazochrom — **62**
- 4.2.16 Phenosafranine and potassium periodate — **62**
- 4.2.17 Ninhydrin — **62**
- 4.2.18 Quercetin — **62**
- 4.2.19 Hydrophobic AZO dye — **63**
- References — **63**

Chapter 5**Analytical reagents having N-O as donor atoms — 65**

- 5.1 2-(5-Bromo-2-pyridylazo)-5-dimethyl-aminophenol (5-Br-PADAP) — **65**
- 5.2 *N,N'*-bis(salicylidine)-ethylenediamine (salen) — **65**
- 5.3 1-(2-Pyridylazo)-2-naphthol — **65**
- 5.4 4-Nitro-*o*-phenylenediamine-salicylaldehyde — **66**
- 5.5 (1,5-Dimethyl-2-phenyl-4-[(2,3,4-trihydroxyphenyl) diazenyl]-1H-pyrazol-3 (2H)-one) (DPTPD) — **66**
- 5.6 2-[(2-Mercurychlorid) 4-methyl phenylimino] methyl} phenol (K) — **66**
- 5.7 1-(2-Pyridylazo)-2-naphthol — **66**
- 5.8 2-Hydroxy-3-methoxybenzaldehydeisonicotinoyl hydrazone (HMBAINH) — **67**
- 5.9 Iodonitrotetrazolium chloride — **67**
- 5.10 2-(5-Bromo-2-pyridylazo)-5 [*N-n*-propyl-*N*-(3-sulfopropyl) amino] aniline — **67**
- 5.11 4-(Nitrophenyl azo imidazole) NPAI — **67**
- 5.12 1-(2-Pyridylazo)-2-naphthol — **68**
- 5.13 [2-(4-Methoxyphenyl) azo (4,5-diphenylimidazole)] (MPAI) — **68**
- 5.14 4-(2-Pyridylazo)-resorcinol — **68**
- 5.15 2-Aminoacetyl-3-hydroxy-2-naphthoic hydrazone — **68**
- 5.16 1-(2-Pyridylazo)-2-naphthol — **69**
- 5.17 3-[4-(Dimethylamino) cinnamoyl]-4-hydroxy-6-methyl-2H-pyran-2-one — **69**
- 5.18 2-(5-Nitro-4-methyl-2-pyridyl-azo)-5-dimethylaniline — **69**
- 5.19 1-Nitroso-2-naphthol in aq. sodium dodecyl sulfate (NNPh) — **70**
- 5.20 Res-acetophenolene guanylhiazine (RAG) — **70**
- 5.21 2-Carboxy-5, methyl-3-nitrobenzaldoxime — **70**
- 5.22 Anthrone phenylhydrazone (APH) — **70**
- 5.23 4-[(4-*n*-(3-O X O-1,2-Oxazolldin-4-yl) carboxymidoyl phenyl} methylidene) amino] 1-2-oxazolidin-3-one (OOCMAO) — **71**
- 5.24 Nicotinohydroxamic acid (NHA) — **71**
- 5.25 2-Hydroxy-1-naphthalenecarboxaldehyde phenylhydrazone — **71**
- 5.26 Pyridylazoresorcinol — **71**
- 5.27 2-Hydroxy-4-butoxy-5-bromoacetophenone oxime (HBA) — **72**
- 5.28 1,2-Propanedime, 1-phenyl-1-(2-hydroxyl-5-bromo-benzidineazine)-2-oxime [PDPHBBAO] — **72**
- 5.29 2,4-Dihydroxy-5-bromo [2-methyl] propiophenone oxime [DHBMP] — **72**
- 5.30 Hydrazine carboxamide-2-[(2-hydroxy-1-naphthalenyl) methylene] — **72**
- 5.31 2-Hydroxy-1-naphthaldehyde-*p*-hydroxy benzoichydrazone [HNAHBH] — **73**
- References — **73**

Chapter 6**Analytical reagents having N/S/O as donor atoms — 76**

- 6.1 6-Hexyl-4-(2-thiazolylazo) resorcinol (HTAR, HZL) — **76**
- 6.2 5-(4-Hydroxy benzylidene)-2,4-thiazolidindion — **76**
- 6.3 L-Cysteine — **76**
- 6.4 2,6-Dithiophenols in the presence of aminophenols — **76**
- 6.5 [4-Hydroxy-3] (2-hydroxyphenyl) methane [amino benzene sulphonica acid] (HPHMAB) — **77**
- 6.6 5-(2-Hydroxybenzylidene)-2,4-thiozolidindion — **77**
- 6.7 Ammonium pyrrolidine dithiocarbamate — **77**
- 6.8 3-Phenyl-2,4-thiazolidinedione (Ph TAD) — **77**
- 6.9 Thiocyanate-cetyltrimethylammonium bromide — **78**
- 6.10 5-Bromosalicylaldehyde thiosemicarbazone (5-BSAT) — **78**
- 6.11 2,6-Dithiol-4-ethylphenol and phenanthroline (DTEP) — **78**
- 6.12 2,6-Dithiophenols in the presence of hydrophobic amines — **79**
- 6.13 3-(4-N-pyridine-2-yl benzene sulfonamide azo)-1-nitroso naphthol — **79**
- 6.14 Dithiophenols and diphenylguanidine — **79**
- 6.15 5-Methylfuran-2-carboxaldehyde thiosemicarbazone (5-MFAT) — **79**
- 6.16 2-(5-Bromo-2-oxoindolin-3-ylidene) hydrazinecarbothioamide (HBITSC) — **80**
- 6.17 (N',N"E,N"N"E)-N',N"-((2,2' (propane-1,3-diylbis(sulfanediyl) bis 1-(4-chlorophenyl) ethan-2-yl-l-ylidene) bis(z-hydroxybenzohydrazide) (CAPSH) — **80**
- 6.18 2-Hydroxy-3-methoxy benzaldehyde thiosemicarbazone (HMBATSC) — **80**
- 6.19 5-(2-Benzothiazolylazo)-8-hydroxyquinolene (BTAHQ) — **81**
- 6.20 3,4-Dihydroxy-5-methoxy benzaldehyde thiosemicarbazone (DHMBTSC) — **81**
- 6.21 2-Acetyl furan-4-methyl-3-thiosemicarbazone 2-AFMT — **81**
- 6.22 2,4-Dihydroxy benzaldehyde thiosemicarbazone (DHBATSC) — **81**
- 6.23 1-(2-Thiazolylazo)-2-naphthol (TAN) — **82**
- 6.24 Isatin-3-thiosemicarbazone (HITSC) — **82**
- 6.25 2,6-Pyridinedicarboxaldehyde thiosemicarbazone (PDTSC) — **82**
- 6.26 5-Nitro salicylaldehyde thiosemicarbazone (NSTS) — **82**
- 6.27 Mercapto acetic acid — **83**
- 6.28 (E)-N1-((1-Thiophen-2-yl) ethylidene) benzene-1,2-diamine — **83**
- References — **83**

Chapter 7**Simultaneous spectrophotometric determination of Ni and cobalt — 86**

- 7.1 2,6-Dimethyl morpholine dithiocarbamate (DMMDTC) — **86**
- 7.2 5-(2'-Carboxyphenyl) azo 8-hydroxyquinoline — **86**
- 7.3 2,6-Dimethyl-morpholinedithiocarbamate-K salt (DMMDTC) — **87**
- 7.4 1-(2-Pyridylazo) 2-naphthol — **87**
- 7.5 3-Hydroxy-5-(hydroxymethyl)-2-methyl-4-pyridine carboxyaldehyde
-4-phenyl-3-thiosemicarbazone — **87**
- 7.6 Solid phase extraction and partial least squares approach — **88**
- 7.7 (2Z, 2'Z)-2,2'-((4S, 5R)-4,5,6-trihydroxy hexane-1,2-diylidene bis
(N-phenyl hydrazine carbothioamide) — **88**
- 7.8 1-(2-Pyridylazo)-2-naphthol in Triton X-100 — **88**
- 7.9 Alizarin Red S — **88**
- 7.10 1-Nitroso-2-naphthol — **89**
- 7.11 Sodium diethyldithiocarbamate (Na-DDTC) — **89**
- 7.12 4-(5-Br-2-Pyridylazo)-1,3-diaminobenzene (5-Br-PADAB) — **89**
- 7.13 Ammonium purpurate (murexide) — **90**
- 7.14 Alizarin Red S — **90**
- 7.15 Diethanoldithiocarbamate (DEDC) — **90**
- 7.16 1-(2-Thiazolylazo)-2-naphthol — **90**
- 7.17 2-Aminocyclopentene-1-dithiocarboxylate — **91**
- 7.18 Partial least square method — **91**
- 7.19 Diphenylcarbazone — **91**
- 7.20 2-Hydroxy-3-methoxy benzaldehydethiosemicarbazone
(HMBATSC) — **91**
- 7.21 1-(2-Pyridylazo)-2-naphthol — **92**
- 7.22 2-Hydroxy-3-methoxy benzaldehydethiosemicarbazone
(HMBATSC) — **92**
- 7.23 1-(2-Pyridylazo)-2-naphthol — **92**
- 7.24 1-(2-Pyridylazo)-2-naphthol — **93**
- 7.25 2-Amino-cyclopentene-1-dithio carboxylic acid (ACDA) — **93**
- 7.26 Nitroso-R-salt — **93**
- 7.27 1-(2-Pyridylazo)-2-naphthol (PAN) — **93**
- 7.28 2-(5-Bromo-2-pyridylazo)-5-dimethylaminophenol (5-Br-PADAP) — **94**
- 7.29 2-Carboxy-2'-hydroxy-5'-sulfo-formazyl benzene (Zincon) — **94**
- 7.30 2-Aminocyclo-1-pentene dithiocarboxylic acid (ACDA) — **94**
- References — **95**

Index — 97

