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**SURVEY OF MASKING AGENTS USED IN QUANTITATIVE
ANALYTICAL CHEMISTRY**

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U N I T E D S T A T E S A T O M I C E N E R G Y C O M M I S S I O N

SURVEY OF MASKING AGENTS USED IN QUANTITATIVE ANALYTICAL-
CHEMISTRY

by

Ames Laboratory Staff

January 3, 1956

Ames Laboratory
at
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F. H. Spedding, Director
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SURVEY OF MASKING AGENTS USED IN QUANTITATIVE ANALYTICAL CHEMISTRY

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Abstract

Increased use in recent years of masking agents in various analytical procedures has made a compilation of such reagents desirable. This paper presents the results of a survey of the analytical literature from 1950 into 1955. Reagents for masking interfering materials in analytical titrations, precipitations, colorimetric determinations, extractions, and some instrumental techniques are listed with their applications.

In order to make quantitative analytical methods more nearly specific, much attention has been devoted toward finding reagents which are as selective as possible in their action. Although much has been accomplished along this line, most reagents used for titration, colorimetric determination, or separation of inorganic ions are still somewhat lacking in selectivity.

One excellent way to improve the selectivity of analytical processes is to use masking agents in conjunction with the reagent used for the determination or separation. This is faster than effecting a preliminary separation of the interfering ions and often permits greater accuracy as well.

At the present time data relative to masking agents and their use in analytical chemistry is rather deeply buried in the literature. This paper presents the results of a literature survey of masking

agents used in conjunction with analytical titrations, precipitations, colorimetric methods, extractive separations, and certain instrumental methods such as polarography. Our definition of masking agent is a reagent added for the purpose of preventing ions present in the sample from interfering with the determination. A substance is considered to act as a masking agent only if it prevents an interference without requiring physical separation of the interfering ion. For example, consider a determination in which chloride is added to prevent interference by silver. The chloride is considered as a masking agent if the silver chloride precipitate is not filtered, but is not a masking agent if the silver chloride is filtered off before proceeding with the determination.

The following journals were covered in this survey for the period 1950 through August, 1955: Analytical Chemistry, Analyst, Analytica Chemica Acta, Chemist-Analyst, Collection of Czechoslovakian Chemical Communications, and Zeitschrift für analytische Chemie. Comparatively few examples of masking agents in quantitative analytical procedures were noted in these journals up to about 1951 or 1952. Since that time chemists have been making greater use of this approach. We have not attempted to cover the literature exhaustively although it is believed that the journals listed above have been covered with reasonable thoroughness.

In preparing the following tables the following abbreviations have been used: Erio T for Eriochromeblack T, Enta for ethylenediaminetetraacetate, Tiron for pyrocatechol-3,5-disulfonic acid, and Arsenazo for 2(1,8-dihydroxy-3,6-disulfo-2-naphthyl)-benzenearsonic acid. The valence state of the various elements is indicated whenever possible. Where the valence state is unknown or questionable, only the symbol for the element is written.

I. a. Complexometric Titrations with Ethylenediaminetetraacetate (Enta)

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Indicator</u>	<u>Ref. No.</u>
Ascorbic acid	Fe ⁺⁺⁺	Bi ⁺⁺⁺	Thiourea	1
	Fe ⁺⁺⁺	Zr(IV)	p-Sulfophenylazo chromotropic acid	2
Carbonate	UO ₂ ⁺⁺	Zn ⁺⁺	Murexide	3
Cyanide	Fe ⁺⁺⁺	Ca ⁺⁺ , Mg ⁺⁺ , Mn ⁺⁺ or Pb ⁺⁺	Erio T	4
	Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Hg ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺	Pb ⁺⁺	Erio T	5
	Ni ⁺⁺	Co(III)	Erio T	6
	Zn ⁺⁺	Ca ⁺⁺ , Mg ⁺⁺	Erio T	7
	Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Hg ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺	In	Erio T	8
	Cu ⁺⁺	Zn ⁺⁺	Erio T	9
	Ag ⁺ , Cd ⁺⁺ , Hg ⁺⁺ , Mn ⁺⁺ , Zn ⁺⁺	Bi ⁺⁺⁺ , Ca ⁺⁺ , Mg ⁺⁺ , Pb ⁺⁺		10
	Fe ⁺⁺⁺	Mn ⁺⁺	Erio T	11
2,3-Dimercaptopropanol	Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Ni ⁺⁺ , etc.	Mn ⁺⁺	Erio T	12
	As(III), Bi ⁺⁺⁺ , Cd ⁺⁺ , Hg ⁺⁺ , Pb ⁺⁺ , Sb(III), Sn(IV), Zn ⁺⁺	Ca ⁺⁺ , Mg ⁺⁺	Murexide	13
Fluoride	Al ⁺⁺⁺ , Ca ⁺⁺ , Mg ⁺⁺	Ni ⁺⁺	Erio T	14
	Al ⁺⁺⁺	Mn ⁺⁺	Erio T	12

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I. a. (Continued)

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<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Indicator</u>	<u>Ref. No.</u>
Fluoride	Al ⁺⁺⁺	Cu ⁺⁺	Catechol Violet	15
	Al ⁺⁺⁺ , Ca ⁺⁺ , Mg ⁺⁺	Cd ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺	Erio T	16
	Al ⁺⁺⁺ , Fe ⁺⁺⁺	Cu ⁺⁺	Chromazurol S	17
	Be ⁺⁺ , Nb(V), Ta(V)	Bi ⁺⁺⁺	Thiourea	1
Sulfate	Th ⁺⁺⁺⁺	Bi ⁺⁺⁺	Thiourea	1
Tartrate	Fe ⁺⁺⁺ , Ni ⁺⁺ , Sb(III)	Bi ⁺⁺⁺	Amperometric	18
	Sb(III)	Bi ⁺⁺⁺	Thiourea	1
	Sn(IV)	Cu ⁺⁺ , Fe ⁺⁺⁺	Salicylic acid	19
Tiron	Al ⁺⁺⁺ , Ti(IV)	Mn ⁺⁺	Erio T	11
	Fe ⁺⁺⁺	Co ⁺⁺	Murexide	20
	Al ⁺⁺⁺	Mn ⁺⁺	Erio T	12
Triethanolamine	Al ⁺⁺⁺	Mg ⁺⁺	Murexide	21
	Al ⁺⁺⁺ , Fe ⁺⁺⁺	Ca ⁺⁺	Murexide	13
	Al ⁺⁺⁺ , Fe ⁺⁺⁺ , Mg ⁺⁺ , Mn ⁺⁺	Ca ⁺⁺	Murexide	22
	Al ⁺⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺	Ni ⁺⁺	Murexide	22

I. b. Other Titrimetric Methods

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Titrant</u>	<u>Ref. No.</u>
Aluminum (ion)	F^-	Zr(IV)	Cupferron	23
Acetone	Hg^{++}	Br^- , Cl^- , CNS, I	Ag^+ (Mohr method)	24
Bromide	Ag^+	Au^+	Dithizone	25
Citrate	Cu^{++} , Fe^{+++} , Ni^{++}	Co^{++}	Ferricyanide	26
	Al^{+++} , Ca^{++} , Cd^{++} , Mu^{++} , Zn^{++}	Mg^{++}	8-Quinolinol	38
Cobalticyanide	Cu^{++}	Se	Iodine	27
Enta	Bi^{+++} , Cu^{++}	Hg^{++}	2-Mercaptobenzothia- zole	28
	Cu^{++} , Fe^{+++}	$Ce(IV)$, $CrO_4^{=}$, MnO_4	Iodometric	29
	Cu^{++} , Fe^{+++}	PbO_2 , MnO_2	Iodometric	30
Fluoride	Fe^{+++} , Ni^{++}	Co^{++}	Iodometric	31
	Fe^{+++}	Cu^{++}	Iodometric	32, 33
8-Quinolinol	Fe^{+++}	H_2O	Karl Fischer	34
Sulfosalicylic acid	Cu^{++} , Mn^{++} , Ni^{++}	Co^{++}	Ferricyanide	26
Tartrate	Fe^{+++} , Zu^{++}	Cu^{++}	Quinaldic acid	114
Thiocyanate	Cu^{++}	Sn(II)	Iodine	35

II. Colorimetric Determinations

6

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Color Forming Reagent</u>	<u>Ref. No.</u>
Ascorbic acid	Fe ⁺⁺⁺	Co ⁺⁺	Thiocyanate	36
Boric acid	F ⁻	Sn(IV)	Gossypol	37
Citrate	Al ⁺⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺	Ca ⁺⁺	Oxalate	39
	Cu ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺	Co ⁺⁺	β -nitroso- α -naphthol	40
	Fe ⁺⁺⁺	Cu ⁺⁺	2,2'-Biquinoline	41
	Fe ⁺⁺⁺	Ni ⁺⁺	Nioxime	42
	Cu ⁺⁺	Mg ⁺⁺	Titan yellow	43
Cyanide				
Enta	Al ⁺⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , Zn ⁺⁺	Ag ⁺	p-Dimethylaminobenzal- rhodanine	44
	Co ⁺⁺	Fe ⁺⁺	Terosine	46
	Al ⁺⁺⁺ , Co ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Ti(IV), Zn ⁺⁺ , Zr(IV)	Be ⁺⁺	Aluminon	47
Fluoride	Ce(IV), Cr ⁺⁺⁺ , Fe ⁺⁺⁺ , Ni ⁺⁺ , V(IV)	Co ⁺⁺	Nitroso R salt	48
	Fe ⁺⁺⁺	Se	Diaminobenzidine	49
	Fe ⁺⁺⁺	Co ⁺⁺	Triphenylmethylarsonium thiocyanate	50
	Fe ⁺⁺⁺	Cu ⁺⁺	Tetraethylthiuram di- sulfide	51

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II. (Continued)

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Color Forming Reagent</u>	<u>Ref. No.</u>
Fluoride	Fe^{+++}	Hydroquinone	1, 10-Phenanthroline	52
	Co^{++} , Fe^{+++} , Ni^{++}	Cu^{++}	3-Nitrosalicylic acid	53
	Fe^{+++} , Mo, V	Co^{++}	Tetraphenylarsonium thiocyanate	54
	Mg^{++}	Li^{+}	8-Quinolinol	56
Hydrogen Peroxide	UO_2^{++}	Rare earths	Arsenazo	55
Hypophosphite	Cu^{++}	Ni^{++}	None	57
Malonic acid	Al^{+++} , Cd^{++} , Co^{++} , Fe^{+++} , Ni^{++}	Cu^{++}	Dithiooxamide	58
	Fe^{+++}	Cu^{++}	Dithiooxamide	59
Mercaptoacetic acid	Cu^{++} , Fe^{+++} , Sn(IV)	Al^{+++}	Aluminon	60
Phosphoric acid	Fe^{+++}	Mn^{++} , SiO_2	Persulfate, molybdate	61
	Fe^{+++}	$\text{Cr}_2\text{O}_7^{=}$	HClO_4	62
	Fe^{+++}	V	Diphenylbenzidine	63
8-Quinolinol	Fe^{+++}	Rare earths	Arsenazo	55
Salicylate	Al^{++}	Rare earths	Arsenazo	55
Tartrate	Al^{+++} , Th(IV), Ti(IV), Zr(IV)	UO_2^{++}	Mercaptoacetic acid	64
	Ti^{++++}	Fe^{++}	1, 10-Phenanthroline	115
Thiosulfate	Cu^{++}	Rare earths	Arsenazo	55
Thiourea	Cu^{++}	Co^{++}	Thiocyanate-acetone	36

III. Gravimetric Separations or Determinations

8

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Precipitating Reagent</u>	<u>Ref. No.</u>
Acetate	Pb ⁺⁺	Ni ⁺⁺	Heptoxime	65
Citrate	Pb ⁺⁺	Ag ⁺	Chloride	66
Cyanide	Cu ⁺⁺	Bi ⁺⁺⁺	Diethyldithiocarbamate	67
N,N-Dihydroxyethyl-glycine	Co ⁺⁺ , Fe ⁺⁺⁺	Ni ⁺⁺	Dimethylglyoxime	68
Enta	Al ⁺⁺⁺ , Ca ⁺⁺ , Fe ⁺⁺⁺ , Mg ⁺⁺ , Mn ⁺⁺	Be ⁺⁺	Ammonia	69
	Al ⁺⁺⁺ , Bi ⁺⁺⁺ , Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , Zn ⁺⁺	Be ⁺⁺	Ammonia	70
	Cd ⁺⁺ , Cu ⁺⁺ , Pb ⁺⁺	Bi ⁺⁺⁺	Ammonia-Ca ⁺⁺	71
	Pb ⁺⁺	Bi ⁺⁺⁺	Diethyldithiocarbamate	67
	Ba ⁺⁺ , Ca ⁺⁺ , Co ⁺⁺ , Cr ⁺⁺⁺ , Fe ⁺⁺⁺ , Mg ⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , Sr ⁺⁺ , Zn ⁺⁺	Cu ⁺⁺	2-(o-hydroxyphenyl) benzooxazole	72
	All except Ag ⁺ , Au ⁺ , Tl ⁺ , Pt group	Hg ⁺⁺	Bismuthiol II	73
	Al ⁺⁺⁺ , Ba ⁺⁺ , Ca ⁺⁺ , Co ⁺⁺ , Cr ⁺⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Mg ⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , Sb, Ti(IV)	K ⁺	Sod. tetraphenylboron	74
	Fe ⁺⁺⁺ , Mn ⁺⁺ , Mo, V	Ti(IV)	Ammonia	45

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III. (Continued)

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Precipitating Reagent</u>	<u>Ref. No.</u>
Enta	Al ⁺⁺⁺ , Bi ⁺⁺ , Co ⁺⁺ , Cr ⁺⁺⁺ , Cu ⁺⁺ , Cd ⁺⁺ , Fe ⁺⁺⁺ , Hg ⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , Ti(IV), UO ₂ ⁺⁺ , Zn ⁺⁺	MoO ₄ ⁼	8-Quinolinol	75
	Al ⁺⁺⁺ , Bi ⁺⁺⁺ , Cd ⁺⁺ , Cr ⁺⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺	Ti(IV)	Ammonia	76
	Ba ⁺⁺ , Bi ⁺⁺⁺ , Ca ⁺⁺ , Co ⁺⁺ , Cd ⁺⁺ , Hg ⁺⁺ , Mn ⁺⁺ , Pb ⁺⁺ , Sr ⁺⁺ , Zn ⁺⁺	UO ₂ ⁺⁺	8-Quinolinol	77
	Al ⁺⁺⁺ , Bi ⁺⁺⁺ , Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , R.Earths, Th(IV), Zn ⁺⁺ , Zr(IV)	MoO ₄ ⁺⁺	8-Quinolinol	78, 79
	Al ⁺⁺⁺ , Bi ⁺⁺⁺ , Cd ⁺⁺ , Co ⁺⁺ , Cr ⁺⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Hg ⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Pb ⁺⁺ , UO ₂ ⁺⁺	WO ₄ ⁼	8-Quinolinol	77
Fluoride	Fe ⁺⁺	K ⁺	Sod. tetraphenylboron	80
	Nb, Ta, Ti(IV)	Co ⁺⁺	Potassium nitrite	81
Formaldehyde	CN ⁻	Cu ⁺⁺	Alizarin blue	82
Phosphoric Acid	Fe ⁺⁺⁺	Sb ⁺⁺⁺	Rhodamine B	116
Tartrate	Most metals except Co ⁺⁺ , Cu ⁺⁺ , Ni ⁺⁺	Cd ⁺⁺	2-(o-hydroxyphenyl) benzooxazole	83
	Most metals	Co ⁺⁺	Potassium nitrite	81

III

III. (Continued)

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Determination</u>	<u>Precipitating Reagent</u>	<u>Ref. No.</u>
Tartrate	Al ⁺⁺⁺ , Fe ⁺⁺⁺	Mg ⁺⁺	8-Quinolinol	84
	Fe ⁺⁺⁺ , etc.	Ni ⁺⁺	Dimethylglyoxime	85
	Al ⁺⁺⁺ , AsO ₃ ⁼ , Bi ⁺⁺⁺ , Cr ⁺⁺⁺ , Fe ⁺⁺⁺ , SbO ₃ ⁼ , Ti(IV)	Ni ⁺⁺	Heptoxime	65
	Al ⁺⁺⁺	SO ₄ ⁼	4,4'-diaminotolane	86
Thiocyanate	Cu ⁺⁺	Ni ⁺⁺	Heptoxime	65
Thiourea	Cu ⁺⁺	Zn ⁺⁺	8-Hydroxyquinoline	87
Tiron	M ⁺³ , M ⁺⁴	PO ₄ ⁼	Mg ⁺⁺ , NH ₃	88

IV. Quantitative Extractive Separations

IV. 1. Extraction with an Organic Solvent

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Ions Extracted</u>	<u>Extractive Reagent</u>	<u>Solvent</u>	<u>Ref. No.</u>
Acetate	Th(IV)	Al ⁺⁺⁺	8-Quinolinol	CHCl ₃	89
Ammonia	Fe ⁺⁺⁺	V	8-Quinolinol	CHCl ₃	90
Citrate	"metal hydroxides" Pb ⁺⁺		Dithizone	CHCl ₃	91
Cyanide	Cd ⁺⁺ , Co ⁺⁺ , Cu ⁺⁺ , Al ⁺⁺⁺ Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺		8-Quinolinol	CHCl ₃	92
	Cu ⁺⁺	Bi ⁺⁺⁺	Diethyldithio- carbamate	CHCl ₃	67
	Cu ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺ , etc.	Cd ⁺⁺	Thiocyanate	2-Butanone-- n-butylphos- phate	93
	Most metals except Bi ⁺⁺⁺ , Pb ⁺⁺ , Sn(II), Th(IV)	Pb ⁺⁺	Dithizone	CHCl ₃	91
Cyanide-Enta	Co ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ Mn ⁺⁺ , Ni ⁺⁺ , Zn ⁺⁺	Bi ⁺⁺⁺	Diethyldithio- carbamate	CCl ₄	94
Dimethylglyoxime	Co ⁺⁺ , Ni ⁺⁺	Cd ⁺⁺	Dithizone	CCl ₄	95
	Co ⁺⁺ , Ni ⁺⁺	Mn ⁺⁺ , Zn ⁺⁺	Diethyldithio- carbamate	CHCl ₃	117
Enta	Pb ⁺⁺	Bi ⁺⁺⁺	Diethyldithio- carbamate	CHCl ₃	67
	Co ⁺⁺ , Fe ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺	Cu ⁺⁺	Diethyldithio- carbamate	Et. Acetate	96

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Ions Extracted</u>	<u>Extractive Reagent</u>	<u>Solvent</u>	<u>Ref.No.</u>
Enta	Most metals, except Bi	Cu ⁺⁺	Diethyldithio-carbamate	CCl ₄	97
	Co ⁺⁺ , Fe ⁺⁺⁺ , Ni ⁺⁺	Cu ⁺⁺	Diethyldithio-carbamate	CHCl ₃	98
	Common cations in H ₂ O	Cu ⁺⁺	Diethyldithio-carbamate	CHCl ₃	99
	Most metal ions	Hg ⁺⁺	Dithizone	CCl ₄	100
	Co ⁺⁺ , Cr ⁺⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Ni ⁺⁺	Pd ⁺⁺	2-Nitroso-1-naphthol	toluene	101
Fluoride	Fe ⁺⁺⁺	Co ⁺⁺	Thiocyanate	CH ₃ COCH(CH ₃) ₂	36
	Zn ⁺⁺	Cd ⁺⁺	Thiocyanate	CH ₃ COC ₅ H ₁₁ Butylphosphate	93
Hexametaphosphate	Ca ⁺⁺ , Mg ⁺⁺	Pb ⁺⁺	Dithizone	CHCl ₃	102
Iodide	Cu ⁺⁺	Co ⁺⁺	Tetraphenyl-arsonium thiocyanate	CHCl ₃	103
4-Sulfobenzene-arsonic acid	Th(IV)	Al ⁺⁺⁺	8-Quinolinol	CHCl ₃	89
Tartrate	Sb ⁺⁺⁺ , Sn ⁺⁺⁺	Bi ⁺⁺⁺	Cupferron	CHCl ₃	104
	As ⁺⁺⁺ , Be ⁺⁺ , Sb ⁺⁺⁺ , Sn ⁺⁺⁺	Bi	Diethyldithio-carbamate	CCl ₄ , CHCl ₃ , etc.	94
	Fe ⁺⁺⁺	Al ⁺⁺⁺	8-Quinolinol	CHCl ₃	92
	Fe ⁺⁺⁺	Co ⁺⁺	Thiocyanate-sulfite	CH ₃ COCH(CH ₃) ₂	36

IV. (Continued)

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Ions Extracted</u>	<u>Extractive Reagent</u>	<u>Solvent</u>	<u>Ref. No.</u>
Tartrate	Ta(V)	Nb ⁺⁺⁺	Thiocyanate	CH ₃ OCH ₃	118
	Most metals	Pb ⁺⁺	Dithizone	CHCl ₃	91
	Sc(III)	Th(IV)	Thiocyanate	Ether-nitric acid	105
Thiocyanate	Ag ⁺	Hg ⁺⁺	Dithizone	CCl ₄	100
Thiourea	Ag ⁺ , Cu ⁺⁺	Cd ⁺⁺	Thiocyanate	2-Butanone-n-butylphosphate	93
	Cu ⁺⁺	Co ⁺⁺	Thiocyanate	CH ₃ COCH(CH ₃) ₂	36
Tiron	Al ⁺⁺⁺ , Cr ⁺⁺⁺ ,	Co ⁺⁺	Diethyldithiocarbamate	CH ₃ CO ₂ C ₂ H ₅	106

13

IV. 2. Extraction From An Organic Solvent Into Water

<u>Masking Agent</u>	<u>Ions Masked</u>	<u>Ions Extracted</u>	<u>Organic Solvent</u>	<u>Aqueous Extractive Reagent</u>	<u>Ref. No.</u>
Dithizone	Bi ⁺⁺⁺ , Cd ⁺⁺ , Pb ⁺⁺ , Zn ⁺⁺	Cu ⁺⁺	Chloroform	Iodide-HCl	107
Diethyldithiocarbamate	Co ⁺⁺	Cu ⁺⁺ , Ni ⁺⁺	Ethyl acetate	Cyanide	106
Diethyldithiocarbamate	Co ⁺⁺	Bi ⁺⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , UO ₂ ⁺⁺ , etc.	Ethyl acetate	Mercuric chloride	106

V. Electrometric Methods

14

Masking Agent	Ions Masked	Ions Determined	Method of Determination	Ref. No.
Ascorbic acid	Cr(VI), Fe(III), Mo(VI), Ti(IV), V(V)	UO ₂ ⁺⁺	Polarographic	108
Enta	Al ⁺⁺⁺ , Be ⁺⁺ , Co ⁺⁺⁺ , Cr ⁺⁺⁺ , Mn ⁺⁺ , Ni ⁺⁺ , Ti(IV), Zn ⁺⁺	UO ₂ ⁺⁺	Polarographic	109
Nitrite	Cu ⁺⁺	Ag ⁺	Electrodeposition	110
1,10-Phenanthroline	Fe ⁺⁺	U(IV)	Potentiometric titration	111
Tartrate	Bi ⁺⁺⁺ , Cd ⁺⁺ , Cu ⁺⁺ , Fe ⁺⁺⁺ , Zn ⁺⁺	Pb ⁺⁺ , Sb, Sn	Polarographic	112
Tetraphenylarson- ium chloride	Pb ⁺⁺	Sn(IV)	Polarographic	113
Tiron	Fe ⁺⁺⁺	Cu ⁺⁺ , Pb ⁺⁺	Polarographic	88
	Cu ⁺⁺	Bi ⁺⁺⁺	Polarographic	88
	Cu ⁺⁺ , Fe ⁺⁺⁺	Pb ⁺⁺	Polarographic	88

VI. Summary of Masking Agents Used for Ions of Various Elements

<u>Element</u>	<u>Reagents Used for Masking</u>
Ag	Bromide, cyanide, thiourea, thiocyanate
Al	Citrate, enta, fluoride, malonate, salicylate, tiron, triethanolamine, tartrate
As	2,3-Dimercaptopropanol, enta, tartrate
Ba	Enta
Be	Enta, fluoride
Bi	2,3-Dimercaptopropanol, dithizone, enta, tartrate
Ca	Citrate, enta, fluoride, hexametaphosphate
Cd	Citrate, cyanide, 2,3-dimercaptopropanol, dithizone, enta, malonate, tartrate.
Ce	Fluoride
CN ⁻	Formaldehyde
Co	Citrate, cyanide, diethyldithiocarbamate, N,N-dihydroxyethylglycine, dimethylglyoxime, enta, fluoride, malonate.
Cr	Ascorbic acid (Cr(VI)), enta, fluoride, tartrate, tiron.
Cu	Citrate, cobalticyanide, cyanide, enta, hypophosphite, iodide, mercaptoacetate, nitrite, sulfosalicylate, tartrate, thiocyanate, thiosulfate, thiourea.
F	Boric acid
Fe	Ascorbic acid, ammonia, citrate, cyanide, enta, fluoride, malonate, mercaptoacetate, 1,10-phenanthroline (Fe ⁺⁺), phosphoric acid, 8-quinolinol, tartrate, tiron, triethanolamine.
Hg	Acetone, cyanide, 2,3-dimercaptopropanol, enta.
Mg	Enta, fluoride, hexametaphosphate, triethanolamine.

VI. (Continued)

<u>Element</u>	<u>Reagents Used For Masking</u>
Mn	Citrate, cyanide, enta, sulfosalicylate, tiron, triethanolamine.
Mo	Ascorbic acid (Mo(VI)), enta, fluoride.
Nb	Fluoride
Ni	Citrate, cyanide, dimethylglyoxime, enta, fluoride, malonate, sulfosalicylate, tartrate.
Pb	Acetate, citrate, 2,3-dimercaptopropanol, enta, tetraphenylarsonium chloride.
Rare Earths	Enta.
Sb	2,3-Dimercaptopropanol, enta, tartrate.
Sc	Tartrate.
Sn	2,3-Dimercaptopropanol, enta, mercaptoacetate, tartrate.
Sr	Enta.
Ta	Fluoride.
Th	Enta, sulfate, 4-sulfobenzenearsonic acid, tartrate.
Ti	Ascorbic acid, enta, fluoride, tartrate, tiron.
U	Carbonate, enta, hydrogen peroxide.
V	Ascorbic acid (V(V)), enta, fluoride.
Zn	Citrate, cyanide, 2,3-dimercaptopropanol, dithizone, enta, fluoride.
Zr	Enta, tartrate.

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