BioUltra Reagents

Chelators

Introduction

The Greek origin of the word chelate signifies the plier-like claws of a crab. A chelate is a water-soluble complex between a metal ion and a complexing agent. It usually does not dissociate easily in solution, but forms an inert complex. In labile complexes, however, the metal ion can be readily exchanged. Metal complexes of transition elements are well known here, chelation occurs within a much wider range of elements. Chelating agents yielding soluble metal complexes are also called sequestering agents [1]. A chelating agent has at least two functional groups which donate a pair of electrons to the metal, such as = O, $-NH_2$ or $-COO^-$. Furthermore, these groups must be located so as to allow ring formation with the metal. Chelating agents are widely found in living systems and are of importance in cellular metabolism.

For applications, requiring highest quality products, we offer a range of BioUltra Chelators.

Natural Chelators

- Water
- Carbohydrates, including polysaccharides
- Organic acids with more than one coordination group
- Lipids
- Steroids
- Amino acids and related compounds
- Peptides
- Phosphates
- Nucleotides
- Tetrapyrrols
- Ferrioxamines
- Ionophores, such as gramicidin, monensin, valinomycin
- Phenolics

Synthetic Chelators

- 2,2'-Bipyridyl
- Dimercaptopropanol
- Ethylenediaminotetraacetic acid, EDTA Ethylenedioxy-diethylene-dinitrilo-tetraacetic acid,
- EGTA, Ethylene glycol-bis-(2-aminoethyl)-N,N,N', N'-tetraacetic acid
- Ionophores Nitrilotriacetic acid, NTA ortho-Phenanthroline
- Salicylic acid
- Triethanolamine, TEA

Chelators as Tools in Biochemistry

Chelating agents have various uses in biochemistry:

1. They constitute nutrient solutions for microorganisms and plants in hydroculture. They may be added to animal food in order to prevent precipitation or absorption of the essential metals [2].
2. They may complex inhibitory heavy metals, either masking them or making their removal possible, e.g. in buffer solutions or in the preparation of dialysis tubings.
3. Chelators may reduce interference of heavy metals when specific metal indicators are used for the determination of intracellular cation concentration, e.g. the measurement of Ca^{2+} with QUIN or FURA [3].
4. Some chelators are important reagents in the quantitative complexometric determination of metals [4].
5. In chelation affinity chromatography, elution is carried out with EDTA or EGTA for a quick group-specific elution [7]

	EDTA	EGTA	HEDTA	NTA
Ag(I)	7.32	6.88	6.71	5.16
Ca(II)	10.96	11.00	8.14	6.41

Cd(II)	16.46	16.70	13.6	9.54
Co(II)	16.31	12.50	14.4	10.38
Cr(III)	23.40			>10
Cu(II)	18.80	17.88	17.55	12.96
Fe(II)	14.33	11.92	12.2	8.84
Fe(III)	25.1	20.5	19.8	15.87
Hg(i)	21.8	23.12	20.1	14.6
Li(I)	2.79	1.17		2.51
Mg(II)	8.69	5.21	7.0	5.46
Mn(II)	14.04	12.3	10.7	7.44
Na(I)	1.66	1.38		2.15
Ni(II)	18.62	13.55	17.0	11.54
Pb(II)	18.04	14.71	15.5	11.39
Sn(II)	18.3	23.85		
Tl(III)	22.5			18
Zn(II)	16.50	14.5	14.5	10.67

Physicochemical Data of Some Complexanes

The term complexane has been recommended by IUPAC for EDTA and other aminopolycarboxylic acids of related structure. The pK values of some complexanes are given below.
In the table above, the absolute stability constants of various metal complexes of these complexanes are reported. As mentioned above these data permit calculation the apparent stability constants of these complexes at any pH. Data were taken from reference [6].

	EDTA	EGTA	HEDTA	NTA
pk_1	1.99	2.00	2.51	1.89
pk_2	2.67	2.65	5.31	2.49
pK_3	6.16	8.85	9.86	9.73
pK_4	10.26	9.46		

EDTA	Ethylenediamine-tetraacetic acid Disodium salt
EGTA	Ethyleneglycol-O, O'-bis(2-aminoethyl)-N, N, N', N'-tetraacetic acid
HEDTA	N-(2-Hydroxyethyl)ethylenediamine-N, N', N'-triacetic acid Trisodium salt
NTA	Nitrilotriacetic acid

References

1. S. Chaberek, A. E. Martell, Organic Sequestering Agents, Wiley, New York 1959.
2. Chelates in Nutrition, F H. Kratzer, Vohra, eds., CRC Press, Boca Raton 1986.
3. P. Arisan et al., J. Biol. Chem. 260, 2719 1985.
4. Die Komplexometrische Titration G. Schwarzenbach, H. Flaschka, eds. Stuttgart 1976.
5. R. M. C. Dawson, D. C. Elliott, W. H. Elliott K. M. Jones, Data for Biochemical Research, 3rd ed., Clarendon Press,. Oxford 1986.
6. CRC Handbook of Organic Analytical Reagents, K. L.Cheng, K. Ueno, T. Imamura ebs., CRC Press, Boca Raton 1982.
7. S. Ostrove, S. Weiss, Methods Enzymol. 182, 373 1990.

Back to Top

Back to BioUltra home

Back to Biochemiclas home