Online Supporting Information

A Novel Isotachophoresis of Cobalt and Copper Complexes by Metal Ion Substitution Reaction in a Continuous Moving Chelation Boundary

Wei Zhang,[†] *Jian-Feng Chen,*[†] *Liu-Yin Fan,* [†,**]*Cheng-Xi Cao,*[†,*] *Ji-Cun Ren,*[‡] *Si, Li,*[†] *Jing Shao*[†]

[†] *Laboratory of Analytical Biochemistry & Bio-separation, Key Laboratory of Microbiology of Educational Ministry, School of Life Science and Biotechnology, Shanghai Jiao Tong University, Shanghai 200240, China*

[‡] *School of Chemistry and Chemical Engineering, Shanghai Jiao Tong University, Shanghai 200240, China*

The results of ICP-AES shown in Table 2 were obtained through multiplying the diluted folds of sample by the direct results of ICP-AES.

The results of UV-vis shown in Table 2 were achieved with multiwavelength mapping analysis method. The detailed procedure was given as below.

As mentioned in Section 2.3.3, the 500 μL sample was detected by UV-vis spectroscopy at 208 nm, 212 nm, 226 nm, 236 nm and 261 nm wavelength. Noticeably, at 212 nm $[\mathrm{Cu\text{-}EDTA}]^{2-}$ and $[\mathrm{Co\text{-}EDTA}]^{2-}$ have the same molar absorption coefficient. The spectra were corrected background absorbance by subtracting the absorbance of a cell filled with the blank contrast. The molar absorptivities (ε) of $[\mathrm{Cu\text{-}EDTA}]^{2-}$ and $[\mathrm{Co\text{-}EDTA}]^{2-}$ at 208 nm, 212 nm, 226 nm, 236 nm and 261 nm and the ratio (f) of $\varepsilon_{[\mathrm{Co\text{-}EDTA}]}{}^{2-}/\varepsilon_{[\mathrm{Cu\text{-}EDTA}]}{}^{2-}$ were shown in Table S-1.

The linear relation between absorption and concentration of a single determination is given by Lambert-Beer's law.

$$A(\lambda)l^{-1} = \sum_{i=1}^{n} \varepsilon_i(\lambda)\cdot c_i \qquad \text{(I)}$$

Where, A_λ is the absorption of the sample at wavelength λ, l is the optical path length of the matched silica cell, i is the component i, c_i is the concentration of component i, λ is the

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[*] To whom the first correspondence should be addressed. email: cxcao@sjtu.edu.cn, Fax: 86-21-3420 5820, phone: 86-21-3420 5682

[**] To whom the second correspondence should be addressed. Email: lyfan@sjtu.edu.cn, phone: 86-21-3420 5682

corresponding wavelength. For a mixture in solution containing two components at concentrations c_1 and c_2, the absorbance at any wavelength λ is, for unit path length, given by

$$A(\lambda) = c_1 \cdot \varepsilon_1(\lambda) + c_2 \cdot \varepsilon_2(\lambda) \qquad \text{(II)}$$

Both side of Equation (Ⅱ) divide $\varepsilon_1(\lambda)$, the Lambert-Beer's law can be written as

$$\frac{A(\lambda)}{\varepsilon_1(\lambda)} = c_1 + c_2 \cdot \frac{\varepsilon_2(\lambda)}{\varepsilon_1(\lambda)} \qquad \text{(III)}$$

For our experiment, ε_1 is $\varepsilon_{[\text{Cu-EDTA}]^{2-}}$, ε_2 is $\varepsilon_{[\text{Co-EDTA}]^{2-}}$, c_1 is the concentration of $[\text{Cu-EDTA}]^{2-}$, c_2 is the concentration of $[\text{Co-EDTA}]^{2-}$, and $\varepsilon_2/\varepsilon_1$ is the ratio *f*. According to the absorptions A(λ) of the samples at the five different wavelengths and the diluted folds, we use the ratio *f* as an independent variable, $A(\lambda)/\varepsilon_1(\lambda)$ as the dependent variable, and a straight line could be obtained. The slope of the straight line is c_2, and the intercept at *x* axis is c_1. After a run, one straight line would be gained for phase β' (or α'). The data shown in Table 5 are the mean values of five repeated runs.

Table S-1. The molar absorptivities of $[\text{Cu-EDTA}]^{2-}$ and $[\text{Co-EDTA}]^{2-}$ and the ratio of $\varepsilon_{[\text{Co-EDTA}]^{2-}}/\varepsilon_{[\text{Cu-EDTA}]^{2-}}$ at five different wavelengths.

	208 nm	212 nm	226 nm	236 nm	261 nm
$\varepsilon_{[\text{Co-EDTA}]^{2-}}$	2.87 $\text{mM}^{-1}\text{cm}^{-1}$	2.33 $\text{mM}^{-1}\text{cm}^{-1}$	1.17 $\text{mM}^{-1}\text{cm}^{-1}$	0.74 $\text{mM}^{-1}\text{cm}^{-1}$	0.07 $\text{mM}^{-1}\text{cm}^{-1}$
$\varepsilon_{[\text{Cu-EDTA}]^{2-}}$	2.27 $\text{mM}^{-1}\text{cm}^{-1}$	2.33 $\text{mM}^{-1}\text{cm}^{-1}$	2.95 $\text{mM}^{-1}\text{cm}^{-1}$	3.26 $\text{mM}^{-1}\text{cm}^{-1}$	2.75 $\text{mM}^{-1}\text{cm}^{-1}$
Ratio (*f*)	1.26	1.00	0.40	0.23	0.02

The regression equation and correlation coefficient (*R*) in CE are: for complex $[\text{Cu-EDTA}]^{2-}$, $y = 1.12\times10^{-3}x + 1.87\times10^{-6}$, $R = 0.9988$; for complex $[\text{Co-EDTA}]^{2-}$, $y = 1.12\times10^{-3}X + 6.37\times10^{-7}$, $R = 0.9992$ (absorption, *y*, mAU, versus concentration of complex, *x*, mM).