Detection of anions and cations in dialysate

Introduction:

Dialysate is one of the important components of blood dialysis treatment, and its composition is similar to that of the human body's internal environment, mainly consisting of four cations: sodium, potassium, magnesium, and calcium, Cl and base are two anions. The accuracy of ion concentration preparation in hemodialysis fluid directly affects the effectiveness of dialysis treatment, especially Na K. If there is a significant deviation in the concentration of Ca and Mg cations, it not only fails to achieve the expected effect of dialysis treatment, but also may cause serious clinical complications, posing a great threat to the patient's life safety. This article uses a dual channel ion chromatograph to simultaneously determine anions and cations in dialysate.

Table 1: Detection items

Anions	Cl^-	CA^{3-}		
Cations	Na^+	K^+	Mg^{2+}	Ca^{2+}

Keywords: Dialysate, blood, ion chromatograph.

Instruments and equipment

- **Ion chromatograph**: CIC-D300$^+$
- **Ultra pure water machine**:EU-20

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Requirements

Reagents

Unless otherwise specified, all reagents used are superior grade. Commercially available certified standard solution for Cl^-, CA^{3-}, Na^+, K^+, Mg^{2+}, Ca^{2+} (1000 mg/L).

Deionized Water

When preparing standard samples manually or diluting real samples, please use ASTM filtration and deionization requirements that meet the specifications listed in the table 2.

Table 2: Deionized water specification.

Specification	
Ions Resistivity	≥18.25MΩ·cm
Organics-TOC	<10ppb
Iron/Transition Metals	<1ppb
Pyrogens	<0.03Eu/mL
Particulates（>0.2μm）	<1unit/mL
Colloids-Silica	<10ppb
Bacteria	<1cfu/mL

Chromatography conditions

Table 3: Analysis conditions (Anions)

Instrument	CIC-D300⁺ B Channel
Eluent	25mM KOH
Flow rate	0.7 mL/min
Injection volume	25 μL
Analytical column	SH-AP-1
Column oven temperature	35℃
Conductivity detector temperature	35℃
Suppressor current	60mA

Sample preparation

Self prepared dialysate stock solution: According to the instructions accurately weigh 24.9091 g (24.9097 g) of A , Accurately weigh 7.5714 g (7.5749 g) of B,then dilute separately to the mark with 100 mL glass volumetric flasks. Dissolve and mix well. According to the ratio of A: B: water=1:1.26:32.74, use a pipette to transfer 1 mL, 1.26 mL, and 32.74 mL respectively into a 50 mL plastic centrifuge tube, mix well, and prepare as the original solution to be tested for later use.
Dilute the above test solution by 10 times and 400 times, and inject it for analysis on the instrument.

Standard chromatogram

Standard chromatogram, As shown in below:

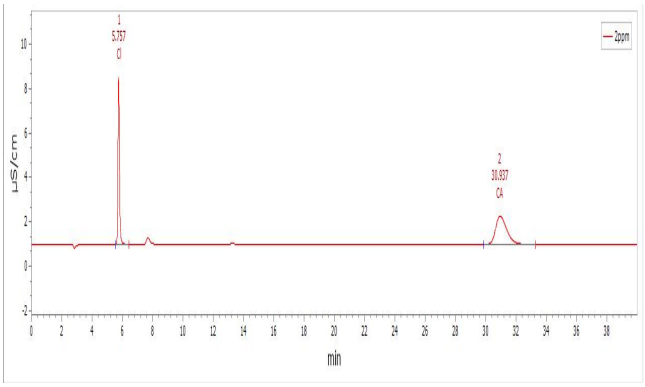

Figure 1. Chromatogram of standard (Anions).

Blank chromatogram

Blank chromatogram, As shown in below:

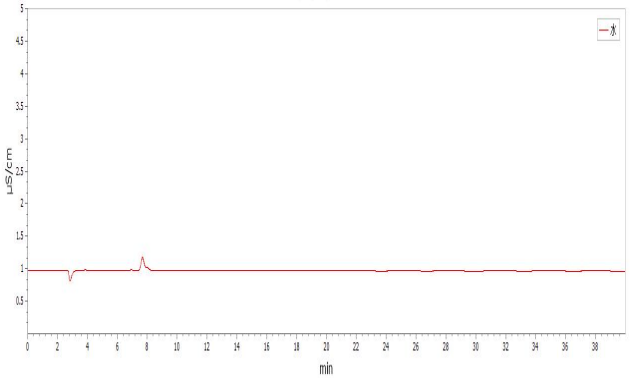

Figure 2. Chromatogram of blank (Anions).

Sample chromatogram

Sample chromatogram, As shown in below:

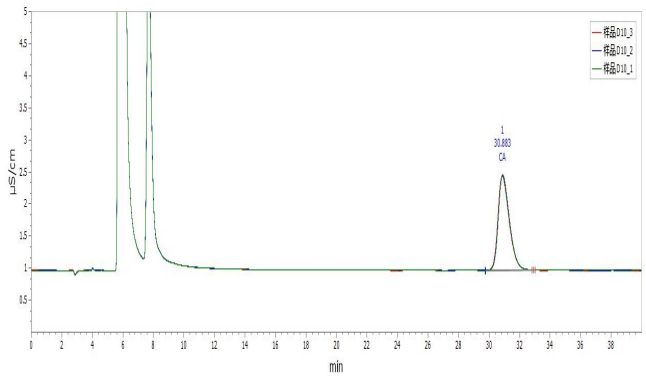

Figure 3. Chromatogram of anion(dilute 10 times).

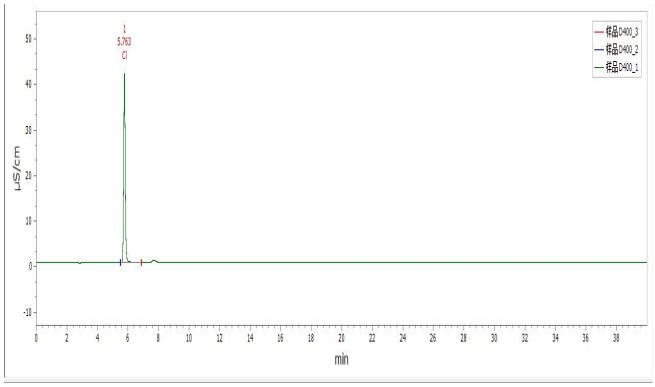

Figure 4. Chromatogram of anion(dilute 400 times).

Chromatography conditions

Table 4: Analysis conditions (Cations)

Instrument	CIC-D300⁺ A Channel
Eluent	6mM MSA
Flow rate	1.0 mL/min
Injection volume	25 μL
Analytical column	SH-CC-3L
Column oven temperature	35℃
Conductivity detector temperature	35℃
Suppressor current	18mA

Standard chromatogram

Standard chromatogram, As shown in below:

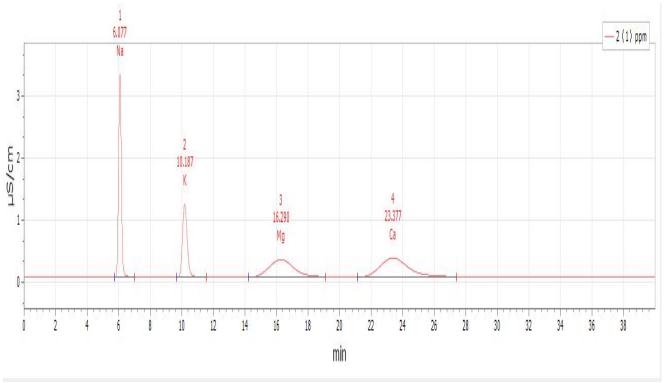

Figure 5. Chromatogram of standard (Cations).

Blank chromatogram

Blank chromatogram, As shown in below:

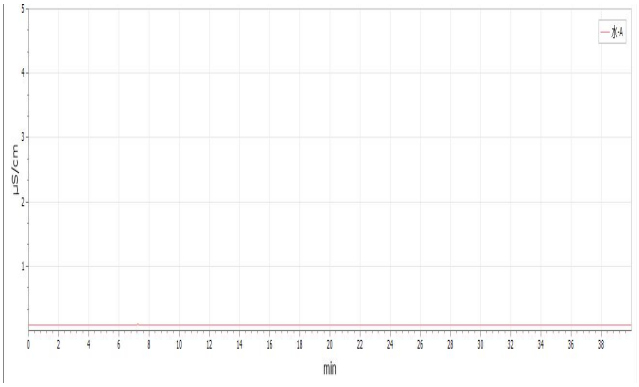

Figure 6. Chromatogram of blank (Cations).

Sample chromatogram

Sample chromatogram, As shown in below:

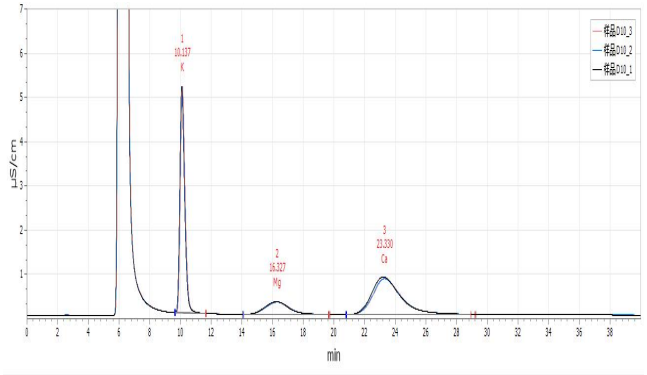

Figure 7. Chromatogram of cation(dilute 10 times).

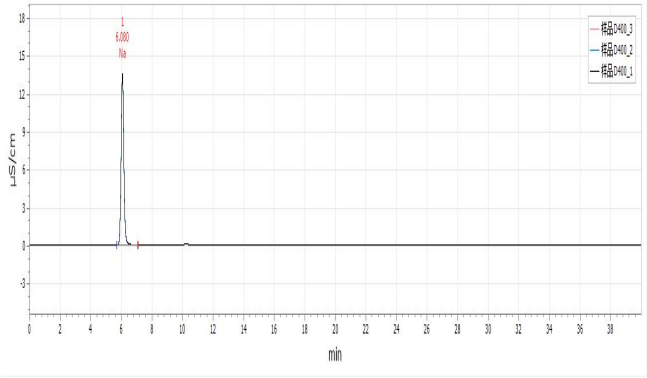

Figure 8. Chromatogram of cation(dilute 400 times).

Results and calculations

Table 5: Anions test result (Unit: mg/L)

Sample	Cl^-	CA^{3-}
Anions	4128.28	113.55

Table 6: Cations test result (Unit: mg/kg)

Sample	Na^+	K^+	Mg^{2+}	Ca^{2+}
Cations	3337.32	87.18	10.10	52.33

Remarks: ① Errors in the preparation process and standard solution may result in differences in the results, which are for reference only; ② The measured value does not deduct the blank value; ③ It is best to use plastic volumetric flasks for testing cation dilution samples.

Feasibility analysis and conclusion

The above experiments prove that the detection method has good resolution and is suitable for the determination of the content of the components to be measured in the sample.