

# Application solution of ion chromatography in food analysis and determination

- various phosphate

## Foreword

Phosphate is a widely used food additive and plays an important role in improving food quality. At present, food phosphates mainly include sodium salt, potassium salt, calcium salt, iron salt, zinc salt and so on. Phosphate is mainly used as water retainer, bulking agent, acidity regulator, stabilizer, coagulant and potassium ferrocyanide in food. Current national standard GB 2760-2014 "national food safety standard-Standards for the use of food additives" clearly points out the types of phosphate additives that can be used in food and the maximum use requirements. A total of 19 kinds of phosphate are allowed to use.

Among them, trisodium phosphate anhydrous, sodium hexametaphosphate, sodium pyrophosphate, sodium Tripolyphosphate, sodium trimetaphosphate and so on can be added into the specified food types in accordance with the specified amount. Calcium hydrogen phosphate and sodium dihydrogen phosphate are only used in infant formula food and infant supplementary food, and The maximum dosage of single or mixed use is 1.0g/kg with  $\text{PO}_4^{3-}$ .

## Implementation standard

The determination methods of various phosphates in foods are

specified in National standard GB5009.256-2016 "national food safety standard-the determination of various phosphate in food".It is specified that ion chromatography combined with gradient elution is used for the determination of phosphate,pyrophosphate,hexametaphosphate, sodium trimetaphosphate,sodium Tripolyphosphate in food in the standard.

It is also pointed out that ion chromatography can be used for the analysis and determination of various phosphates in Entry-Exit Inspection and Quarantine Industry Standard SN/T 4590-2016 "The content determination of pyrophosphate, sodium Tripolyphosphate,trimetaphosphate in export aquatic products by ion chromatography".

## **Reagents and standards**

- 1.Sodium hydroxide(NaOH),GR
- 2.Methanol(CH<sub>3</sub>OH),chromatographic pure
- 3.Trisodium phosphate anhydrous(Na<sub>3</sub>PO<sub>4</sub>)standard solution(1000mg/L,water matrix)
- 4.Sodium pyrophosphate(Na<sub>4</sub>P<sub>2</sub>O<sub>7</sub>)standard solution(1000mg/L,water matrix)
- 5.Sodium trimetaphosphate[(NaPO<sub>3</sub>)<sub>3</sub>]standard:purity ≥ 98%
- 6.Sodium Tripolyphosphate(Na<sub>5</sub>P<sub>3</sub>O<sub>10</sub>)standard:purity ≥ 98%

Configuration and chromatographic conditions:

- IC type:CIC-D160(Built-in eluent generator)
- IC column:SH-AC-16(Analysis column for polyphosphate)
- Guard column:SH-G-1
- Eluent:KOH gradient elution
- Flow rate:1.0mL/min
- Sample size:25  $\mu$  L
- Detection method: Suppressed conductivity method
- Pretreatment:C18 column, H column ,Na column

Time(min)	Concentration(mM)
0.0-9.0	30.0
9.1-11.0	30.0-50.0
11.1-28.0	50.0
28.1-31.0	30.0
30.0-40.0	30.0

Table1 Gradient elution concentration settings reference

## Pretreatment

Sample pretreatment refers to the method which is specified in National standard GB5009.256-2016 "national food safety standard-the determination of various phosphate in food".

## Test spectrum

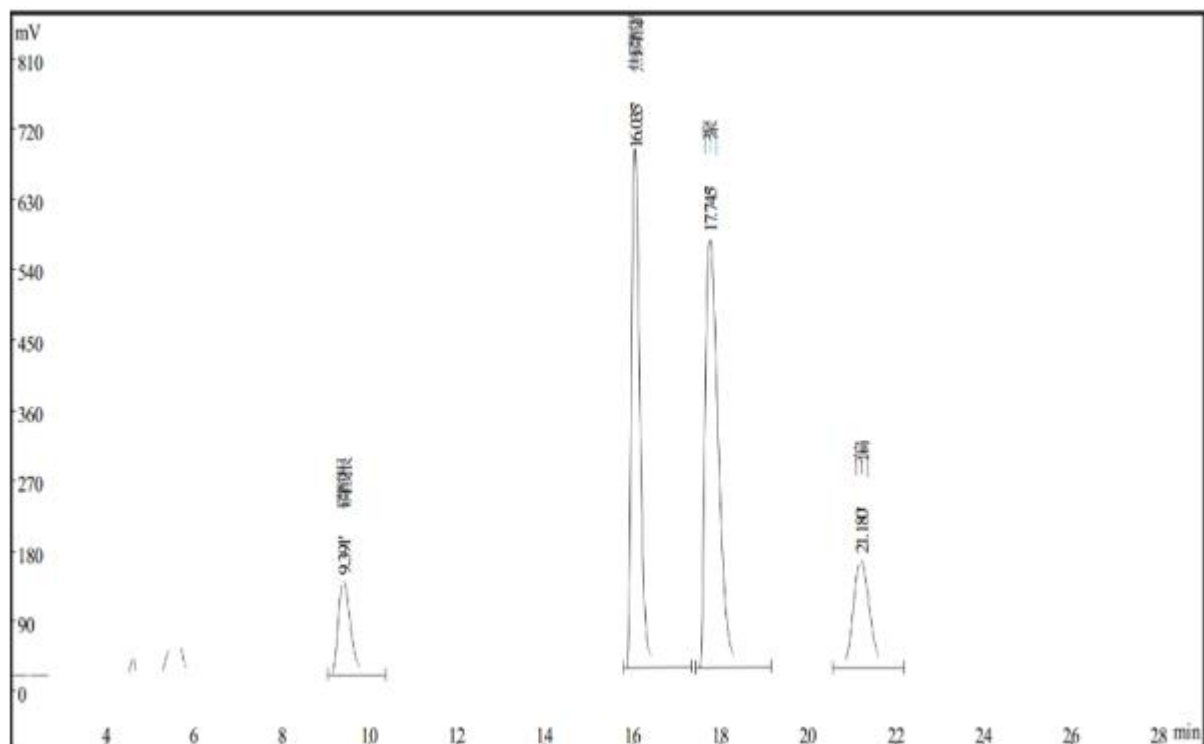


Table1 Spectrogram of mixed sample of phosphate radical, Pyrophosphoric acid radical, Tripolyphosphate radical and Trimetaphosphoric acid radical

### Qualitative repeatability

No.	Phosphate radical	Pyrophosphoric acid radical	Tripolyphosphate radical	Trimetaphosphoric acid radical
1	9.348	16.004	17.713	21.156
2	9.391	16.035	17.745	21.18
3	9.403	16.025	17.708	21.133
4	9.398	16.03	17.735	21.12
5	9.412	16.028	17.726	21.126
6	9.409	16.037	17.765	21.139
Average value	9.394	16.027	17.732	21.142
Standard deviations	0.024	0.012	0.021	0.022
Relative standard deviation%	0.251	0.074	0.119	0.105

### Quantitative repeatability

No.	Phosphate radical	Pyrophosphoric acid radical	Tripolyphosphate radical	Trimetaphosphoric acid radical
1	2223745	8304960	10872762	3421433

2	2239273	8335228	10890442	3413376
3	2231097	8272525	10840304	3392714
4	2232084	8306597	10853267	3400126
5	2233006	8308989	10859631	3401089
6	2233098	8310067	10856629	3401563
Average value	2232050.50	8306394.33	10862172.50	3405050.17
Standard deviations	4981.29	20004.16	17355.29	10411.50
Relative standard deviation%	0.22	0.24	0.16	0.31

## Conclusion

In this paper, ion chromatographic separation and combined with KOH gradient elution technique were used to separate perfectly phosphate radical, pyrophosphoric acid radical, tripolyphosphate radical, and trimetaphosphoric acid radical and can be used for qualitative and quantitative analysis of four phosphoric acid compounds. The method has the advantages of simple operation, high sensitivity, high precision and accuracy, and can be used for the determination of various phosphates in food.

## Product presentation



### CIC-D160 IC

CIC-D160 ion chromatograph is the first hydrogen-oxygen ion chromatograph made in China. It is equipped with bipolar conductance detector which greatly improves the detection ability, stability of the instrument, and brings the best usage experience to the users. Its built-in eluent generator can generate the required concentration of eluent on line by pure water and possesses the function of gradient elution which can determine complex samples which isocratic elution cannot. Now it is widely used in the environment, food, chemical industry, power, electronics, mining and metallurgy and other fields.

- Built-in eluent generator: No need to configure the eluent and possesses the function of gradient elution;
- Built-in circulating 3D constant temperature technology which ensures the accuracy and reliability of the experimental data;
- Built-in low-pressure degassing technology to eliminate bubble interference for more stability;
- Self-regenerating electrolytic micro-membrane suppressor which has high pressure resistance, small dead volume, and responsive signal is high;
- Equipped with intelligent automatic injection system for large sample volumes, which features automatic dilution to save labor and time;
- Observatory intelligent workstation which is configured with integrated control, compatibility for a variety of instruments, and customized images.
- Perfect after-sale support to solve the worries of users

### Ion Chromatographic Column



AS the first domestic developer and manufacturer of Ion chromatographic column, Sheng Han have the technology of the development and production of three kinds of Ion chromatographic column including ion exchange chromatographic column, ion exclusion chromatographic column and ion pair chromatographic column. At the same time, Sheng Han have also successfully developed and produced hydroxyl system of Ion chromatographic column in large scale ranking second in the world, which broken the monopoly of imported brands in the high-end ion chromatographic column field more than ten years. The use of domestic ion chromatography can reduce the cost of operation and maintenance of users by about 35%.