

The Method Establishment and Considerations of Ion Chromatography for Determination

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Abstract

This paper provides some important technical points of ion chromatography for determination, including the necessity of simple operation, the choice of separating column and the importance of resolution, and so on. And the paper also introduces briefly the considerations and the problems how to deal with, such as eluent, tailing peak, precision, accuracy, and uncertainty. Thereby, it is necessary to develop new technologies for the application range of ion chromatography.

Keywords: Ion chromatography; Determination method; Attention

Introduction

As a form of high performance liquid chromatography (HPLC), ion chromatography (IC) is a liquid chromatography technique for the analysis of anions, cations and small molecules and polar organic compounds. Nowadays, IC has been widely used in many fields of analytical chemistry [1], such as environment, chemical engineering, agriculture, medical treatment and building materials and so on. In the process of establishing the determination method, follow the principles that the selectivity and reliability of the analysis method need be improved, and the service life of the analysis column and instrument should be prolonged, as well the analysis cost must be lowered. Hence, a number of researchers [2-4] have noted that automatization, miniaturization, and simplification were most important trends in analytical chemistry, so that we could solve practical problems which were encountered in the work. Based on the author's work experience, the problems encountered in the process of ion chromatography analysis are discussed in this paper.

Establishment of new determination method

a. The analysis and testing procedure should be as simple as possible, and easy to operate. So automatic sampling and automatic dilution are a good choice (Table 1).

b. The choice of separating column is very important. It is very difficult to separate the target compounds only by changing the composition or concentration of eluents.

c. The resolution is the primary factor in chromatographic separation and analysis.

d. When the experimental conditions are studied, the parameters must be changed one by one to optimize the detection conditions [5].

e. The general procedure for establishing a new method [6] is:

1. Select a suitable chromatographic column,
2. When the column pressure is moderate, the relatively high flow velocity is chosen,
3. Use standard products of high purity,
4. High strength eluent was used to change the retention value of the analytes by changing its concentration.

	Inject volume	Inject time	Workload
Manual determination	Irregular	Irregular	Burdensome
Automatization	3 mL	30 seconds	little

Table 1: Comparison of two treatment methods.

Considerations

In the process of chromatographic analysis, there are many points that should be paid attention to:

Eluent: The concentration of acid or its salt for the liquor should not be too high, otherwise it will be layered or precipitated, especially using gradient elution or a variety of eluent on-line mixing. We should pay attention to, in the replacement of eluent, the matching of the new eluent with the original one.

Gradient program: The gradient elution can be preserve many kinds of analysis which own various difference in the retention behavior for single sample introduction and simultaneous determination (Figure 1), but in the process of analysis and measurement, the reproducibility of the analysis of the retention time and results is poor. We should pay attention to that the separation column really reached equilibrium state by repeated analysis.

Tailing peak: The presence of tailing peaks can lead to variations in measurement accuracy as well as the detection limit, problems such as overlapping the proximity of target analytes in real samples and the rising cost of analysis (Figure 2). We should pay attention to using the separation column with weaker hydrophobicity, change the concentration of eluent, and add organic solvents to the eluent including acetonitrile and methanol.

Precision, accuracy, and uncertainty: Precision is the degree of consistency among measured values obtained from a homogeneous sample under controlled conditions by repeated analysis using a specific analytical procedure [7]. When analyzing the precision of the analysis method, three kinds of analytical samples are usually used: the standard solution (the concentration may be 0.1- 0.9 times the upper limit of the calibration curve), the actual water sample and water sample are added standard sample.

Accuracy is a comprehensive index which reflects the systematic error and random error of method [8]. The recovery rate of spiked

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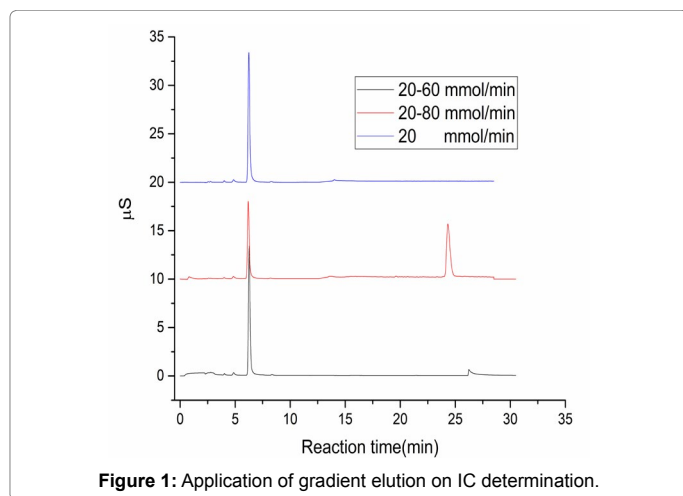


Figure 1: Application of gradient elution on IC determination.

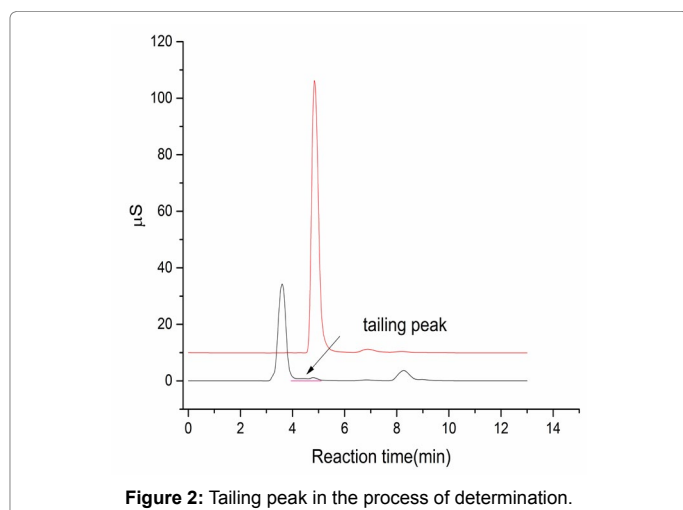


Figure 2: Tailing peak in the process of determination.

products should be between 80%-120%, by usually adding 0.5-2 times the amount of the sample, but the total concentration should not exceed the upper limit of concentration determined by analysis method.

The uncertainty is the parameter related to the measurement results and reasonably shows the dispersity of the analyte measurement value. We should pay attention to determining the uncertainty of vector caused by various influencing factors during sample analysis and detection.

Conclusion

With the development of nearly 30 years, ion chromatography has become a relatively mature analytical technique. Its advantages lie in the analysis of anions and cations, polar molecules and organic compounds without light absorption groups, which have become an irreplaceable method in many fields. To improve the ability to analyze the qualitative and quantitative, ion chromatography combined with mass spectrometry and the function of anion and cation exchange chromatography column mixed technology have been launched a series of theoretical and experimental studies. Therefore, new determination methods and new solid phase technology will expand the application range of ion chromatography.

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