

The Analysis of Ceftezole sodium and Cefpiramide sodium by Capillary Zone Electrophoresis

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Abstract. In this paper, capillary zone electrophoresis method was used for the analysis of ceftezole sodium and cefpiramide sodium. 20 mmol/L borax solution, 16 kV voltage, 254 nm UV detection wavelength was chosen for electrophoretic analysis.

1. Introduction

The cefpiramide sodium was the third-generation semi-synthetic cephalosporin antibiotic with a wide antimicrobial and bactericidal power, having strong antibacterial activity on Gram-positive and Gram-negative bacteria and anaerobic bacteria. It was very stable on β -lactamase. It was used for the treatment of pharyngitis, tonsillitis, acute and chronic bronchitis, pneumonia, suppurative lung disease, pyelonephritis, cystitis, prostatitis, meningitis and gynecological infections by susceptible strains in clinical [1]. An HPLC method was built by Han for the determination of cefpiramide sodium in mice plasma [2]. A method based on HPLC with UV detection system was developed by Zhao and validated aiming at the determination of related substance and content cefpiramide sodium for injection. The proposed method includes C8 (5 μ m, 250 \times 4.6mm) column, the mobile phase was phosphate salt buffer solution-methanol (75:25), the detection wavelength was set at 254nm and flow rate was 1.0 ml \bullet min⁻¹ [3]. Li Hong-tao established a method for determination of five residual organic solvents in cefpiramide sodium. The residual solvents in cefpiramide sodium are methanol, ethanol, acetone, acetonitrile, N,N-dimethylacetamide which were quantitatively determined by headspace solid-phase microextraction (SPME) GC on OV-1301 column, with FID detector, nitrogen as the carrier. The SPME silica fiber was coated with a 95 μ m of polymethylphenylvinylsiloxane/hydroxy-terminated silicone oil [A4]. The ceftezole sodium was semi-synthetic cephalosporin derivatives and the first generation injection cephalosporin. Its mechanism was to kill bacteria by interfering with bacterial cell wall synthesis. It had antibacterial activity for aerobic gram positive bacteria and negative bacterium mainly. It was mainly used for the clinical treatment of respiratory system infection, urinary tract infection, septicemia and peritonitis. Its adverse reactions were slight [5]. Du Xu established an HPLC method for the determination of ceftezole and its related substances [6]. The C18 columns (YMC-Pack ODS-A etc, 150mm \times 4.6mm, 5 μ m) were used. The mobile phase, citral solution:acetonitrile(90:10). The detection wavelength was 254nm. An RP-HPLC method was developed by Zhang Qi for the determination of injection ceftezole sodium and its related substances [7]. The Xterra C18 column (250mm \times 4.6mm, 5 μ m) was used, the mobile phase consisted of acetonitrile-water (adjusted pH to 2.4, with citric acid) (15:85), the UV detection was 254nm. Chen Xing established a HPLC method for the determination of Ceftezole Sodium [8]. Using ODS column, pH3.6 buffer-acetonitrile(88:12) as the mobile phase a flow rate of 1.0 ml \bullet min⁻¹, the detection wavelength was 254nm. An HPLC method was established by Yu he for the determination of the content of ceftezole sodium [9]. The chromatographic column was YMC Pack ODS-A, and mobile phase was made up of sodium citrate solution and acetonitrile(9:1). Detection wavelength was at 254 nm. In this paper, the method for the meanwhile analysis of ceftezole sodium and cefpiramide sodium was built by capillary zone electrophoresis.

2. Experimental section

2.1 Instruments and Reagents

Experimental instruments: CL-1030-type high performance capillary electrophoresis (Beijing Cailu Scientific Instrument Co., Ltd.); HW2000-type chromatography workstation (Nanjing Qianpu Software Ltd.); Capillary (50 μm inner diameter, 55 cm overall length, 46 cm effective length) from Hebei Yongnian Ruifeng Chromatographic Devices Co., Ltd.); Precision pH meter(Shanghai Leici Instrument Factory).

ceftazole sodium was purchased from Shandong Yuandong Pharmaceutical Co., Ltd.; cefpiramide sodium (from Shandong Yuandong Pharmaceutical Co., Ltd.). Other reagents used in the experiments were all analytical grade. Double-distilled water.

2.2 Experimental Methods

Before the start of the experiment, capillary was successively washed with $0.5\text{mol}\cdot\text{L}^{-1}$ hydrochloric acid solution, double-distilled water, $0.5\text{mol}\cdot\text{L}^{-1}$ sodium hydroxide solution, double-distilled water, buffer solution, each for 8min. After four times running, capillary was cleaned again using the above method.

Measurements were carded out at 16kV voltage and 28 °C experimental temperature. UV detection wavelength was 254 nm. Injection time was 8s(7.5 cm height difference).

3. Results and discussions

3.1 Selection electrophoresis conditions

Preparation the concentration of 10, 20, 30, 40, 50 mmol/L borax buffer solution, running the ceftazole sodium and cefpiramide sodium standard solution (16 kV). The ceftazole sodium migration time were 4.737, 5.429, 6.379, 6.854, 7.310 min. The cefpiramide sodium migration time were 4.806, 5.621, 6.624, 7.221, 7.845 min. It is suggested that with the increase of the concentration of borax, ceftazole sodium and cefpiramide sodium migration time were increased.

In 20 mmol/L borax solution, the influence of voltage on sample separation was investigated. When the voltage were 14, 16, 18, 20, 22 kV, the ceftazole sodium migration time were 4.720, 5.429, 4.774, 4.174, 3.683 min, the cefpiramide sodium migration time were 4.793, 5.621, 4.907, 4.302, 3.806 min.

Considering and analysis these factor, 20 mmol/L borax solution, 16 kV voltage, 254 nm UV detection wavelength was chosen for electrophoretic analysis condition.

3.2 Standard curve

First, ceftazole sodium and cefpiramide sodium standard solution were prepared. The ceftazole sodium concentration was 1.74, 0.87, 0.435, 0.2175, 0.1088, 0.0544, 0.0272 mg/mL. The cefpiramide sodium concentration was 1.88, 0.94, 0.47, 0.235, 0.1175, 0.0587, 0.0294 mg/mL. Each standard solution was run for three times under the above electrophoresis conditions and the results averaged. Taking concentration as the abscissa and peak area as the ordinate, the standard curve was drew.

Linear regression equation of ceftazole sodium (peak area: y $\mu\text{V}\cdot\text{s}$, density: x mg/mL) and the linear range were as follows: $y = -4646.9 + 237007 x$ ($r = 0.999$), 0.027~ 1.740 mg/mL.

The same test method, Linear regression equation of cefpiramide sodium (peak area: y $\mu\text{V}\cdot\text{s}$, density: x mg/mL) and the linear range were as follows: $y = -3754.2 + 259916.9 x$ ($r = 0.999$), 0.029~ 1.880 mg/mL.

Under selected electrophoresis conditions, the solution were run. Separation chromatogram of the ceftazole sodium and cefpiramide sodium solution was showed in Figure 1.

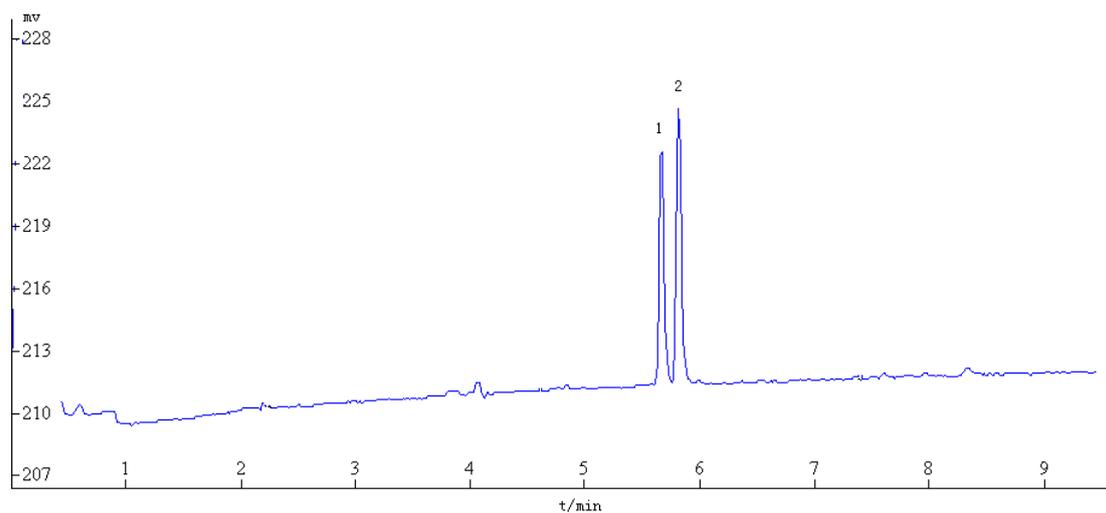


Fig.1 Electrophorogram of the ceftazole sodium and cefpiramide sodium solution
1- ceftazole sodium 2- cefpiramide sodium

3.3 Precision test

The ceftazole sodium and cefpiramide sodium standard solution precisely drew and continuously injected for five times in one day under electrophoretic separation conditions, the RSD of ceftazole sodium and cefpiramide sodium peak area were 4.77% and 5.28%, indicating good precision.

The solution was injected a time in one day of six days. The RSD of ceftazole sodium and cefpiramide sodium peak area were 7.05% and 4.81% (n=6).

3.4 Recovery

After determination for five times, the recoveries of ceftazole sodium were in the range of 104.4% - 120.9% (n=5), the recoveries of cefpiramide sodium were in the range of 93.9% - 111.9% (n=5).

4. Conclusion

A capillary zone electrophoresis method was built for the meanwhile analysis of ceftazole sodium and cefpiramide sodium.

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