Determination of trace sulfate ion in liposome doxorubicin with capillary electrophoresis

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Abstract A capillary electrophoretic method for the determination of the trace sulfate ion in liposome doxorubicin has been developed with potassium nitrate as the background electrolyte. The components and pH of the buffer solution, the concentration of electroosmotic flow modifier, and the separation voltage on the capillary were studied in detail. The optimized electrophoretic conditions were as follows: capillary column diameter 50 μm, total length 60 cm and effective length 51.5 cm, 20 mmol/L potassium nitrate buffer solution, pH 7.0, containing 0.4 mmol/L cetyltrimethylammonium chloride CTAC, as the electroosmotic flow modifier, an applied voltage of −15 kV, reversed polarity, and a detection wavelength of 202 nm. Under the optimized capillary electrophoresis separation conditions, sulfate ion and chloride ion in the liposome doxorubicin breaking emulsion were separated successfully within 3 min, and the relative standard deviations of migration time and peak area of sulfate ion were less than 0.01% and 1.0%, respectively. The detection limit was 5 μg/L. This method has been proved to be simple, sensitive and accurate, and also has been applied to determine sulfate ion in liposome doxorubicin sample with satisfactory results.

Key words capillary electrophoresis CE indirect ultraviolet detection liposome doxorubicin sulfate ion
1.1 Agilent® Waldbronn Germany

Agilent ChemStation 1.2 Sartorius® 60 cm × 50 μm i.d. 370 μm o.d. 51.5 cm Polymicro Technologies AZ USA Millipore UV Millipore MA USA CTAC

1.2

20 mmol/L 5 min
1 mol/L NaOH 10 min
0.04 Pa 15 s 25 °C 202 nm 360 nm

2.1

NO₃⁻ SO₄²⁻ NO₃⁻ SO₄²⁻ NO₃⁻ 10 ~ 50 mmol/L 0.02 ~ 0.05 0.08 0.10 0.50 1.00 2.00 5.00 10.00 mg/L 3

SO₄²⁻ 0.02 ~ 10.00 mg/L

A = 2.419C + 0.764  r² 0.998 3
Fig. 1 Electropherograms for separation of \( SO_4^{2-} \) and \( Cl^- \) with \( NO_3^- \) as the background electrolyte

- a. standard solution
- b. emulsion breaking solution of liposome doxorubicin.

Conditions: fused silica capillary 50 μm i.d., 370 μm o.d. total length 60 cm, effective length 51.5 cm, background electrolyte 20 mmol/L potassium nitrate, pH 7.0 containing 0.4 mmol/L CTAC detection at 202 nm with reference wavelength of 360 nm.

2.5 0.05 mg/L \( SO_4^{2-} \) 0.5 mg/L \( Cl^- \) 6% RSD 0.1% RSD RSD 2.5% RSD

2.6 0.65 mg/L 0.64 mg/L 0.64 mg/L

Table 1 Repeatability of the method \( n=6 \)

<table>
<thead>
<tr>
<th>Ion</th>
<th>Migration time</th>
<th>Peak area</th>
<th>Peak height</th>
</tr>
</thead>
<tbody>
<tr>
<td>( SO_4^{2-} )</td>
<td>0.0077</td>
<td>0.39</td>
<td>2.12</td>
</tr>
<tr>
<td>( Cl^- )</td>
<td>0.0075</td>
<td>0.66</td>
<td>0.35</td>
</tr>
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References: