Determination of residual cyclopropane in carboxymethyl cross-linked starch hemostatic granules

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Abstract: This study established a headspace gas chromatography method for determining the residual amount of epichlorohydrin in carboxymethyl cross-linked starch hemostatic granules. Using Agilent DB-624 (30 m x 530 μ m x 3.0 μ m) capillary chromatography column, the column temperature is programmed heating (50 ℃ for 2 minutes; 50 ℃/min for 180 ℃ for 5 minutes), the inlet temperature is 200 ℃, the detector temperature is 250 ℃, the carrier gas is N2, the flow rate is 3 mL/min, and the separation ratio is 3:1. The relative standard deviation of precision is 1.22%; The concentration of epichlorohydrin is 0.84~6.72 μ g/mL, and its peak area has a good linear relationship with concentration, with a correlation coefficient of 0.9997; The detection limit is 0.336 μ g/mL, and the quantification limit is 0.84 μ g/mL; The average recovery rate is 101.7% (n=9). This method has good reproducibility, high sensitivity, and is simple and accurate.

Keywords: carboxymethyl cross-linked starch; Hemostatic granules; Gas chromatography method; Residual epichlorohydrin; testing.

1.Introduction

At present, the newly developed wound hemostatic materials at home and abroad mainly include gelatin protein, fibrin glue, soluble hemostatic gauze, and absorbable hemostatic powder. With the development of science and processing technology, hemostatic materials prepared from starch or its derivatives have been widely studied due to their excellent hemostatic effects and biological safety. Some products have been applied in clinical practice, such as Arista hemostatic devices and instant composite microporous polysaccharide hemostatic powders. We have developed a carboxymethyl cross-linked starch hemostatic particle, which was prepared using epichlorohydrin as the crosslinking agent. Epichlorohydrin, also known as epichlorohydrin, is commonly used as a crosslinking agent in material reactions and has certain toxicity. At present, the Chinese Pharmacopoeia stipulates a residual limit of 0.05% for epichlorohydrin. This study established a gas chromatography method for the determination of residual epichlorohydrin in carboxymethyl cross-linked starch hemostatic granules.

2 Instruments and reagents

Gas chromatograph, Agilent 6890N Network GC System ; Headspace sampler, Agilent7697A Headspace Sampler ; Electronic analytical balance, sensitivity 0.0001 g, Shanghai Precision Electronics Co., Ltd.

Carboxymethyl cross-linked starch hemostatic granules, self-made (180820180821180822); Dimethyl sulfoxide, chromatographically pure, Tianjin Kemio Chemical Reagent Co., Ltd; Epoxychloropropane, analytical grade, Tianjin Damao Chemical Reagent Factory.

3 Experimental Methods and Results

3.1 Chromatographic conditions

Using Agilent125-1334: DB-624 (30 m x 530 μ m x 3.0 μ m) capillary chromatography column; Injection port temperature 200 ℃; The detector temperature is 250 ℃; Split ratio 3: 1; The carrier gas is N2; Flow rate of 3 mL/min; Program heating: The initial temperature is 50 ℃, maintained for 2 minutes, and the temperature is raised at 50 ℃/min to 180 ℃, maintained for 5

minutes. Headspace sampler conditions: the equilibrium temperature of the heating box is 100 ℃, and the equilibrium is 20 minutes; The temperature of the quantitative valve is 110 ℃; The temperature of the heat transfer tube is 120 ℃. Under this chromatographic condition, the retention time Rt of epichlorohydrin is 5.17.

This study established a headspace gas chromatography method for the determination of residual cyclopropane in carboxymethyl cross-linked starch hemostatic granules, with a precision of 1.22%, a minimum detection limit of 0.336 μ g/mL, and a minimum quantification limit of 0 When the mass concentration of epichlorohydrin is between 0.84 and 6.72 μ g/mL at 84 μ g/mL, there is a good linear relationship between peak area and concentration. Under the determined chromatographic conditions in this study, the residual amount of epichlorohydrin in carboxymethyl cross-linked starch hemostatic granules can be analyzed simply and accurately. This method has high measurement accuracy and precision.