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Determination of Allantoin Content in Children's Wheat Jujube Chewing Tablets by Capillary Electrophoresis

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Haixing Liu's contribution equals that of the first author

Abstract. The paper investigated the determination of allantoin content in Children's wheat jujube chewing tablets using capillary electrophoresis. The buffer was 30 mmol/L borax solution. The voltage was 16 kV and UV detection wavelength was 224 nm. The allantoin content in Children's wheat jujube chewing tablets was 0.0324 mg/g(RSD=8.56%)(n=6). The recovery of allantoin in Children's wheat jujube chewing tablets sample was in the range of 82.9%-115.1% (n=7). The average recovery was 101.5%(n=7). The new method is fit for the determination of allantoin content in Children's wheat jujube chewing tablets.

Keywords: Capillary Electrophoresis; Wheat Jujube Chewing Tablets; Allantoin; content.

1. Introduction

Xiao'er Maizao chewable tablet is mainly composed of malt, stir fried yam, hawthorn, jujube, and has the effect of invigorating the spleen, reducing appetite, and improving children's appetite. The content of its components can directly affect the efficacy and safety. Allantoin, as one of its key active ingredients, has anti-inflammatory and cell repair promoting effects. Allantoin is a non-toxic, odorless, and non irritating product. It is relatively stable in the air and widely used in cosmetics, medicine, agriculture and other fields. At present, the detection methods for allantoin include high-performance liquid chromatography, ultraviolet spectrophotometry, etc. However, these two methods are not only costly and time-consuming, but also have insufficient selectivity. Capillary electrophoresis (CE) technology has gradually become a research hotspot in the field of drug analysis due to its advantages of high efficiency, low energy consumption, and environmental friendliness. The CE method can quickly separate the complex components in children's wheat jujube chewable tablets, avoiding the problem of matrix interference. The content of allantoin is relatively low, and the CE method requires nano upgraded samples with high sensitivity, which is suitable for the quantification of trace components.

Wu rong et al [1] determined the content of citric acid in Xiao'er maizao chewable tablets by HPLC method. The chromatographic column was C_{18} column(250 mm × 4.6 mm,5 μm)，the mobile phase was methanol-0.5% NH4H2PO4(pH 2.8) solution (5:95,V/V),the flow rate was 0.8 mL/min, the column temperature was 25℃ ， the detection wavelength was 210 nm and the sample size was 10 μL.

Dai Xin [2] used capillary zone electrophoresis to accurately determine the caffeine content in tea. By carefully adjusting parameters such as electrophoresis buffer, voltage, and temperature, efficient separation and accurate detection of caffeine in tea were successfully achieved. Wei Xiaoxiao et al [3] determined the 16 polycyclic aromatic hydrocarbons in textile and food plastic packaging by affinity capillary electrophoresis. The background electrolyte contains 30 mmol/L carboxymethyl-β-cyclodextrin, 20 mmol/L dimethyl-β=cyclodextrin and 40 mmol/L boron mixed solution (pH 5.0), fluorescence detection wavelength is 325 nm. Guo Ailin et al [4] established the micellar capillary electrophoresis method for the separation and analysis of four kinds of

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triterpenoids in Centella Asiatica and its preparations. The electrolyte solution was 40% methanol-16 mmol/L SDS-20 mmol/L borax solution (pH=9.72). The separation voltage was 25 kV, and the detection wavelength was 214nm. Zhang Chunli et al [5] proposed new micellar capillary electrophoresis method for the simultaneous separation and

detection of puerarin, daidzin, 3'-methoxypuerarin, 3'-hydroxypuerarin, and 4'-methoxypuerarin in Paeonia Lactiflora Radix and its preparations. The buffer solution included 40 mmol/L $Na_2B_4O_7$, 4 mmol/L NaOH（pH 9.62），5%（V/V） methanol and 14 mmol/L sodium dodecyl sulfate（SDS）. The detection wavelength was 250 nm. Meng Fang et al [6] establised the capillary electrophoresis chemiluminescence competitive immunoassay method for the determination of testosterone in human serum. The buffer solution consisted of 20 mmol/L $Na_2B_4O_7$ (pH 9.4), with 40 mmol/L sodium dodecyl sulfate （SDS）and 1 mmol/L Luminol. The separation voltage was 16 kV. Huang Duanhua et al [7] determined the five plant hormones (indole-3-acetic acid, indole-3-propionic acid, naphthalene acetic acid, 6-benzylaminopurine, abscisic acid) by capillary electrophoresis-electrospray ionization mass spectrometry. The buffer solution included 15 mmoL/L ammonium acetate-acetic acid(pH 6.0) and 2% acetonitrile (v/v). The separation voltage was 2.2 kV. Zheng Meiling et al [8] developed a method for the determination of 6 synthetic colorants (acid orange 7, allura red, acid blue 74, amaranth, lemon yellow, ponceau 4R) in children's medicine by capillary zone electrophoresis. The buffer contained 10 mmol/L borate, 20 mmol/L polyethylene glycol and 20 mmol/L hydroxypropyl-β-cyclodextrin(pH 8.0). The detection wavelength was 210 nm and the voltage was 20 kV. Daniel et al. [9] developed a rapid method for detecting biogenic amines of wine and beer by capillary electrophoresis mass spectrometry (CE-MS/MS). The electrophoretic separation was carried out in polyvinyl alcohol coated capillary tubes, 0.5 mmoL/L acetic acid electrolyte solution, and detected by electrospray ionization tandem mass spectrometry. Zhang Lichun et al [10] developed a rapid method for detecting seven preservatives (Benzoic acid, sorbic acid, dehydroacetic acid, methyl p-hydroxybenzoate, ethyl p-hydroxybenzoate, propyl-p-hydroxybenzoate, butyl p-hydroxybenzoate) in beverages by capillary electrophoresis. The electrolyte solution was 40 mmol/L borax solution (pH=9.35). The separation voltage was 25 kV, and the detection wavelength was 200nm. Guo Ailin et al [11] analyzed triterpenoid saponins and flavonoids (glycyrrhetinic acid, glycyrrhizin, isoglyliquiritin, glycyrrhizidine, glycyrrhizin, glycyrrhizin A, glycyrrhizin, isogliquiritin) in Licorice and its preparations by capillary electrophoresis. The buffer solution was 20mmol/L $Na_2B_4O_7$ (pH 11.34). The detection wavelength was 254nm and the running voltage was 25kV.

This experiment is to determine the content of allantoin in children's wheat jujube chewable tablets by CE method and provide new ideas for quality control of traditional Chinese medicine compound preparations.

2. Experimental Section

2.1 Instruments and Reagents

Instruments: CL 1030 capillary electrophoresis instrument (Beijing cailu company); The capillary (75 μm, 52/44 cm length (overall/effective) from Hebei Yongnian Ruifeng company.

Allantoin comes from Chinese Drugs and Biological Products; Children's wheat jujube chewing tablets (Kuihua medicine company (jiamusi))(No. 202304009).

2.2 Experimental Methods

At first, the capillary tube is rinsed in sequence using 1 $mol \cdot L^{-1}$ hydrochloric acid, purified water, 1 $mol \cdot L^{-1}$ sodium hydroxide, purified water and buffer for 5 min each. After three injections, the capillary was handled using the above method again.

The voltage was chosen 16 kV and UV detection wavelength was 224 nm. Sample injection (7.5 cm height) time was 10s.

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2.3 Sample Preparation

Children's wheat jujube chewing tablets sample solution: Accurate children's wheat jujube chewing tablets 2.7046 g was put in 40 mL water and extracted 24h at 19°C. The sample solution was obtained by filtering and fixing volume 50 mL.

Allantoin standard solution: Allantoin was accurately weighed 0.0024 g, added 2 mL purified water.

3. Results and Discussion

3.1 Selection Electrophoresis Conditions

The experiment voltage was selected 16 kV. The UV wavelength was 224 nm.

The experiment buffer was 30 mmol/L borax solution by trial.

3.2 Quantitative Analysis

3.2.1 Standard curve.

The allantoin standard solution was prepared and the concentrations were 1.2, 0.6, 0.3, 0.15, 0.075, 0.0375, 0.01875, 0.009375 mg/mL. Each standard solution was tested three times. The allantoin linear equation (x: mg/mL) and linear range was as follows: $Y=11261+10^6X$ (r=0.999), 0.009375-1.2 mg/mL.

3.2.2 Precision test.

The allantoin standard solution was continuous injected 7 times. The RSD of migration time and peak area were 2.76% and 5.69% for allantoin.

3.2.3 Determination of sample content.

The Children's wheat jujube chewing tablets sample solution was operated using the separation conditions. The Children's wheat jujube chewing tablets sample solution chromatogram was showed in Figure 1. The content of allantoin in Children's wheat jujube chewing tablets was 0.0324 mg/g(RSD=8.56%)(n=6).

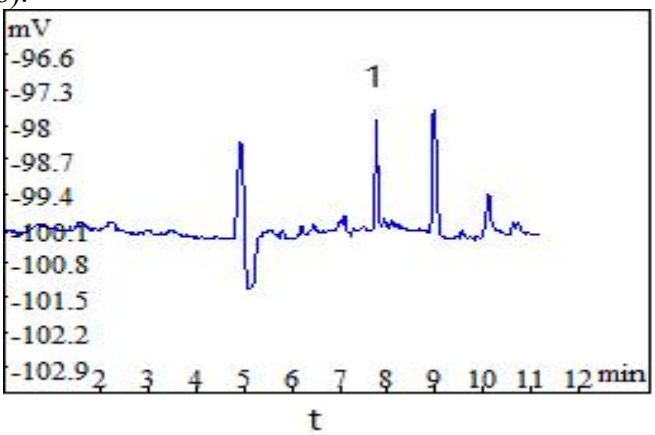


Fig.1 Electrophorogram of Children's wheat jujube chewing tablets sample solution
1- allantoin

3.2.4 Recovery.

The recovery of allantoin in Children's wheat jujube chewing tablets sample was in the range of 82.9%-115.1% (n=7) for seven times testing. The average recovery was 101.5%(n=7).

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4. Conclusion

The paper studied allantoin content in Children's wheat jujube chewing tablets using capillary electrophoresis. The content of allantoin in Children's wheat jujube chewing tablets was 0.0324 mg/g(RSD=8.56%)(n=6).

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References

[1] Wu Rong, Fan Shenglian. Content Determination of Citric Acid in Fructus Crataegi and Xiao'er Maizao Chewable

[2] Tablets by HPLC, China Pharmaceuticals, 2019, 28(20): 20-22

[3] Dai Xin. Capillary electrophoresis for the separation and detection of effective components in tea leaves Application, Southern Agriculture, 2016,10(6):174-175

[4] Wei Xiaoxiao, Zhou Jian, Bai Lu. Simultaneous determination of 16 polycyclic aromatic hydrocarbons in textile and food plastic packaging by ultrasound extraction - affinity capillary electrophoresis = laser induced fluorescence method, Physical and Chemical Testing, 2024,60(2), 194-199

[5] Guo Ailin，Zhang Chunli，Cao Qiue，Li Fei. Separation and analysis of four kinds of triterpenoids in Centella Asiatica and its preparations by micellar capillary electrophoresis, Journal of Yunnan University, 2024, 46(4): 751-758

[6] Zhang Chunli, Guo Ailin, Cao Qiue. Simultaneous separation and determination of five isoflavones in Paeonia Lactiflora Radix and its preparations by micellar capillary electrophoresis. Chinese Journal of Analysis Laboratory, 2023, 24(12): 1673-1677

[7] Meng Fang, Mu Xiaomei. Competitive Immunoassay for Testosterone in Human Serum by CE with Chemiluminescence Detection, Scientific and Technological Innovation, 2025, 15: 55-58

[8] Huang Duanhua, Li Xin, Zhang Lan. Determination of 5 Plant Hormones by Capillary Electrophoresis – Electrospray Ionization Mass Spectrometry, Physical and Chemical Testing, 2023, 59(12): 1448-1452

[9] Zheng Meiling, Liu Tao, Li Danfeng, Wang Li, Zhang Mingli, Li Renqiao, Lin Liming, Shi Xiaoguang. Determination of 6 synthetic colorants in children's medicine by capillary zone electrophoresis, Chemical Analysis and Meterage, 2024, 33(9): 33-37

[10] Daniel D, DOS Santos V B, Vidal D T R, et al. Determination of biogenic amines in beer and wine by capillary electrophoresis-tandem mass spectrometry. Journal of Chromatography A,2015,1416:121-128

[11] Zhang Chunli, Zeng Kai, Gao Ke et al. Simultaneous determination of seven preservatives in beverages by high-performance capillary electrophoresis, Chinese Journal of Analysis Laboratory,2015,34(1):77-80

[12] Guo Ai-lin, Zhang Chun-li,Zhang Jia-yao Cao Qiu-e, Li Fei. Simultaneous separation and determination of triterpenoid saponins and flavonoids in Licorice and its preparations by zonal capillary electrophoresis. Journal of Yunnan Minzu University, 2024-8-16(Online debut)