How to Measure Fluorescent Whitening Agents in Face Masks?CHROMAI UHPLC + Fluorescence Detector Offers an Efficient Solution

1. Introduction

Fluorescent whitening agents (FWAs) are organic compounds used for whitening cotton, fibers, viscose fibers, paper, etc. People with sensitive skin or low immunity—especially pregnant women, nursing mothers, infants, and the elderly—may experience allergic reactions such as redness and irritation from prolonged exposure. Since FWAs can penetrate the body through the skin and are not easily decomposed, they may enter the liver via the bloodstream, placing additional burden on organs. The main components of FWAs include benzoyl peroxide and stilbene derivatives, some of which have shown carcinogenic potential in animal studies. Long-term exposure could pose health risks.

In short, excessive or long-term exposure to FWAs may have various adverse effects on human health. To minimize potential health risks, the public should raise health awareness and choose products with little or no FWA content. Thus, it is necessary to develop a method capable of simultaneously detecting multiple FWAs.

This solution is based on the Chinese Textile Industry Standard FZ/T 01137-2016, establishing an HPLC-fluorescence detection method for simultaneous quantification of six FWAs.

2. Experimental Section

2.1 Instrument System: Leaps UHPLC System:

P60 High-Pressure Pump

A50CV Autosampler

C10V2 Column Oven

D50 Fluorescence Detector

2.2 Standards Used:

2.2.1 Fluorescent Whitening Agent (FWA) 220, 85, 71, 162, 199, and 135 standards.

2.2.2 Preparation of Standard Solutions:

- FWA 220, 85, and 71: Dissolved in 1:1 acetonitrile and diluted to 1 mg/mL.
- FWA 162: Dissolved in acetonitrile and diluted to 1 mg/mL.
- FWA 199: Dissolved in acetonitrile and diluted to 125 μg/mL.
- FWA 135: Dissolved in acetonitrile and diluted to 250 μg/mL.

2.3 Sample Pretreatment:

Cut mask into ~5 mm × 5 mm pieces and mix. Accurately weigh 1.00 g (±0.01 g) of the mixed sample into a 50 mL glass-stoppered flask. Add 20 mL of 70% dimethylformamide-water solution. Ultrasonically extract at 50 °C for 40 minutes. Cool to room temperature, centrifuge at 5000 rpm for 5 minutes, and filter the supernatant through a 0.45 μm organic filter membrane for HPLC analysis.

3. Chromatographic Conditions:

3.1 Column: Lotus C18 (4.6 mm × 150 mm, 3 μm)

3.2 Column Temperature: 40° C

3.3 Injection Volume: 5 μL

3.4 Detection Wavelengths:

- Excitation wavelength: 365 nm
- Emission wavelength: 430 nm

3.5 Mobile Phase:

A: 20 mmol/L ammonium acetate solution

B: Acetonitrile : Methanol = 4:1

3.6 Gradient Elution:

Time（min）	Flow rate（mL/min）	A%
0.0	0.8	95
0.6	0.8	95
3	0.8	70
12	0.8	50
17	0.8	10
21	0.8	10
21.01	0.8	95
27	0.8	95

Experimental Results

1. Standard Chromatogram:

All six FWAs showed good peak shape, baseline separation, and stable retention times.

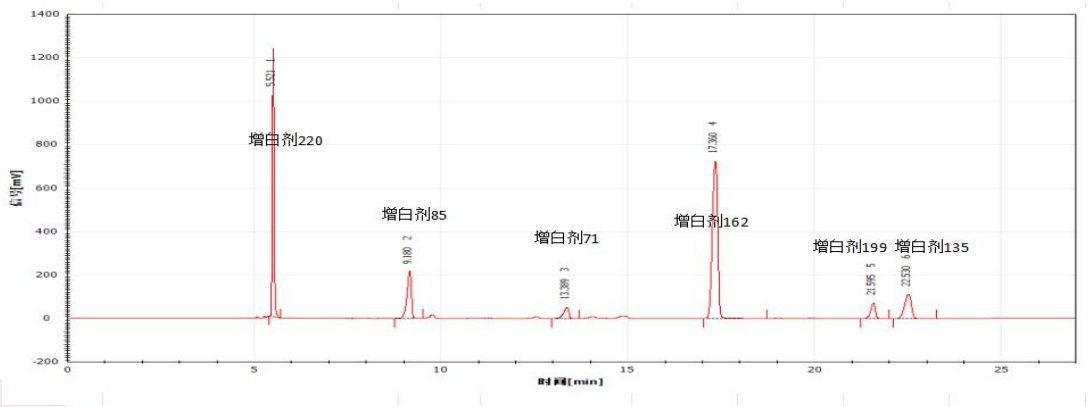

Figure 1: Chromatogram of standard solution

2. Linearity:

Calibration curves were plotted using peak areas (y-axis) vs. concentrations (x-axis). Each compound showed good linearity (R > 0.999):

序号 No.	化合物 Compound	线性范围 Linear Range (μg/mL)	线性方程 Linear Equation	相关系数 R
1	荧光增白剂 FWA 220	0.35~2.80	Y=2214.9X+178.07	r=0.9993
2	荧光增白剂 FWA 85	0.20~2.00	Y=1710.0X+93.78	r=0.9994
3	荧光增白剂	0.10~1.00	Y=923.46X+24.938	r=0.9996

	FWA 71			
4	荧光增白剂 FWA 162	0.05~0.50	Y=28017.0X+267.52	r=0.9996
5	荧光增白剂 FWA 199	0.01~0.10	Y=12473.0X−7.2285	r=0.9995
6	荧光增白剂 FWA 135	0.005~0.04	Y=61519.0X−133.33	r=0.9992

Table 1. Results of Standard Curves for Six Kinds of FWA s

1. Repeatability:

1.1 Six injections of each standard solution showed:

- Retention time RSD% < 0.05%
- Peak area RSD% < 0.9%

Table 2. Repeatability Results of Six FWA s

化合物 Compound	保留时间 RSD% Retention Time RSD%	峰面积 RSD% Peak Area RSD%
荧光增白剂 FWA 220	0.032	0.740
荧光增白剂 FWA 85	0.050	0.708
荧光增白剂 FWA 71	0.035	0.619
荧光增白剂 FWA 162	0.003	0.959
荧光增白剂 FWA 199	0.008	0.688

荧光增白剂 FWA 135	0.002	0.853

2. Detection Limits, Quantitation Limits, Recovery Rates:

Spiked blank samples were used to calculate recoveries, which ranged from 90.3% to 112.8%.

Table 3. Results Table of Detection Limits, Quantitation Limits and Recovery Rates of Six Kinds of FWA s

序号	化合物	检出限(mg/kg)	定量限(mg/kg)	回收率%
1	荧光增白剂 FWA 220	14.0	46.2	103.6%
2	荧光增白剂 FWA 85	8.0	26.4	93.3%
3	荧光增白剂 FWA 71	4.0	13.2	90.3%
4	荧光增白剂 FWA 162	2.0	6.6	95.3%
5	荧光增白剂 FWA 199	0.4	1.3	98.2%
6	荧光增白剂 FWA 135	0.2	0.7	112.8%

3. Conclusion

This method uses the CHROMAI Leaps UHPLC - Fluorescence Detector to simultaneously determine the content of six FWAs (220, 85, 71, 162, 199, 135) in face masks. All compounds achieved baseline separation with good linearity (R > 0.999), and the recovery rate in actual spiked samples ranged from 90.3% to 112.8%. This method provides a fast, efficient, and reliable solution for detecting FWAs in masks and other textile products.