



**TEST REPORT NO.: 24 -0533B**

**Report Date:** 6<sup>th</sup> September 2024

**Client:** [REDACTED]

**Address:** [REDACTED]  
[REDACTED]

**Attention:** [REDACTED]

**By Email:** [REDACTED]

**Sample(s):** 1 of 'Smoke Soap' for investigation into its effectiveness in removing PAHs from clothes.

**Lab Number(s):** 24/A/3334

**Date Received:** 23<sup>rd</sup> August 2024

**Analysis:** As detailed in report.

**Notes:**

*This laboratory was not involved with, consulted, or requested to undertake sampling of the specimens provided, and testing of those test specimens has been conducted as received in the laboratory.*

*Accordingly, no responsibility is taken for the integrity, authenticity, appropriateness, or representativeness, of any of the test specimens provided and this must be taken into account when reviewing, comparing or checking the test results published in this report.*

*Unless otherwise notified, all samples will be disposed of in three months from reporting date.*

Yours faithfully,

**Sharp and Howells Pty. Ltd.**

Michael Wright  
D.App.Sc. (App. Chem.), MRACI, C.Chem  
**Senior Scientist**

## **INTRODUCTION**

We were provided with a bottle of liquid soap containing activated charcoal referred to as "Smoke Soap"  
The sample was assigned a laboratory number for internal identification throughout the laboratory as follows:-

Sample Identification.	Laboratory Number
Smoke Soap (Activated Charcoal) Liquid Soap	24/A/3334

## **Sample Images.**



## **BACKGROUND AND OUR INSTRUCTIONS:**

Firefighters are exposed to a wide variety of chemicals including polycyclic aromatic hydrocarbons (PAHs) while attending fire scenes. Studies show that these PAHs tend to remain on the exposed skin (particularly the neck and hands); as well as on the clothes of the firefighters.

The purpose of this study is to assess the effectiveness of soap containing activated charcoal in removing the PAHs from clothes.

We were requested to test the smoke soap for its effectiveness in removing Polycyclic Aromatic Hydrocarbons (PAH's) from clothes.

## **LABORATORY QUALIFICATIONS:**

Sharp & Howells Pty Ltd is Australia's oldest privately-owned NATA accredited chemical laboratory having been established in 1922.

Sharp & Howells are considered to be experts in the fields of material testing and chemical analysis and provide chemical, forensic and expert witness support as required.

All analytical staff are scientifically qualified and are members of the Royal Australian Chemical Institute (RACI). Michael Wright is a Chartered Chemist (C.Chem) and has more than 40 years' experience as a chemical analyst and laboratory manager, who also acts as an independent expert witness in matters of forensic investigation involving chemical analysis.

## **METHODOLOGY:**

In order to test the effectiveness of the 'smoke soap' in removing PAHs from clothes, the following protocol was adopted.

Two pieces of cloth 15cm X 15cm were obtained and placed in separate sealed containers and were labelled as RA-1 and RW-1.

A PAH mix containing the following PAHs, each at a concentration of 2000 µg/ml in dichloromethane was obtained.

Naphthalene  
Acenaphthylene  
2-Bromonaphthalene  
Acenaphthene  
Fluorene  
Phenanthrene  
Anthracene  
Fluoranthene  
Pyrene  
Benzo(a)anthracene  
Chrysene  
Benzo(b)fluoranthene  
Benzo(a)pyrene  
Indeno(1,2,3-cd)pyrene  
Dibenz(a,h)anthracene  
Benzo(g,h,i) perylene

The 2000 µg/ml PAH mixture was diluted with dichloromethane to obtain a solution with each PAH at a concentration of 4 µg/ml. 50ml of this solution was prepared.

Both pieces of cloth were fortified with known amounts of PAHs. The fortification was achieved by adding 5ml of the 4 µg/ml PAH mix to each cloth sample.

The two cloth samples were then allowed to sit in ambient conditions in a fume cupboard overnight to allow the dichloromethane/PAH mix to penetrate the fabric and for the dichloromethane to evaporate.

The two cloth samples were then placed in an oven at 40 °C for a further 12 hours to ensure all traces of dichloromethane were removed from the fabrics.

Cloth sample RW-1 was then subject to washing with Smoke Soap. The soap was smeared over the cloth sample to completely coat it. Warm water was added and it was allowed to soak for 5 minutes with frequent agitation. The cloth sample was then rinsed to remove all traces of soap, and allowed to dry.

The washed (RW-1) and unwashed (RA-1) cloth samples were then analysed for PAHs.

Each sample was extracted with dichloromethane using ultrasonic extraction techniques and the dichloromethane extracts that resulted were concentrated by evaporation under a stream of nitrogen.

Each extract was then analysed by Gas Chromatography Mass Spectroscopy under the following conditions:-

## Instrument Parameters.

Instrument:	Perkin Elmer Clarus 680 Gas Chromatograph coupled to a Perkin Elmer Clarus 600S Mass Spectrometer
Detector:	Mass Spectrometer
Column:	PE Elite 5MS. 30-meter x 0.25mmID, 0.25um film thickness
Carrier:	Helium at 37.2 cm/sec
Flow Rate:	1.0ml/min
Split:	10:1
Injector:	280 °C
Oven Program:	Initial temp 60 °C; Initial Hold 3 min; Ramp 10 °C/ min to 280 °C; Final Hold 5min.
Injection Volume:	2 uL

## MS Parameters.

Interface Temperature:	280°C
Ion Source Temperature:	200°C
Ionization Mode:	EI
Ionization Voltage:	70V
Solvent Delay Time:	2.5 min
Scan Range:	Selected Ion Monitoring.

The instrument was calibrated for each PAH compound prior to running the samples. Calibration solutions were prepared in three concentrations: 2 µg/ml, 4 µg/ml, and 6 µg/ml, These were used to determine the concentration and total micrograms of each PAH in the samples. A summary of the results obtained is detailed below.

Copies of chromatograms are included as an appendix.

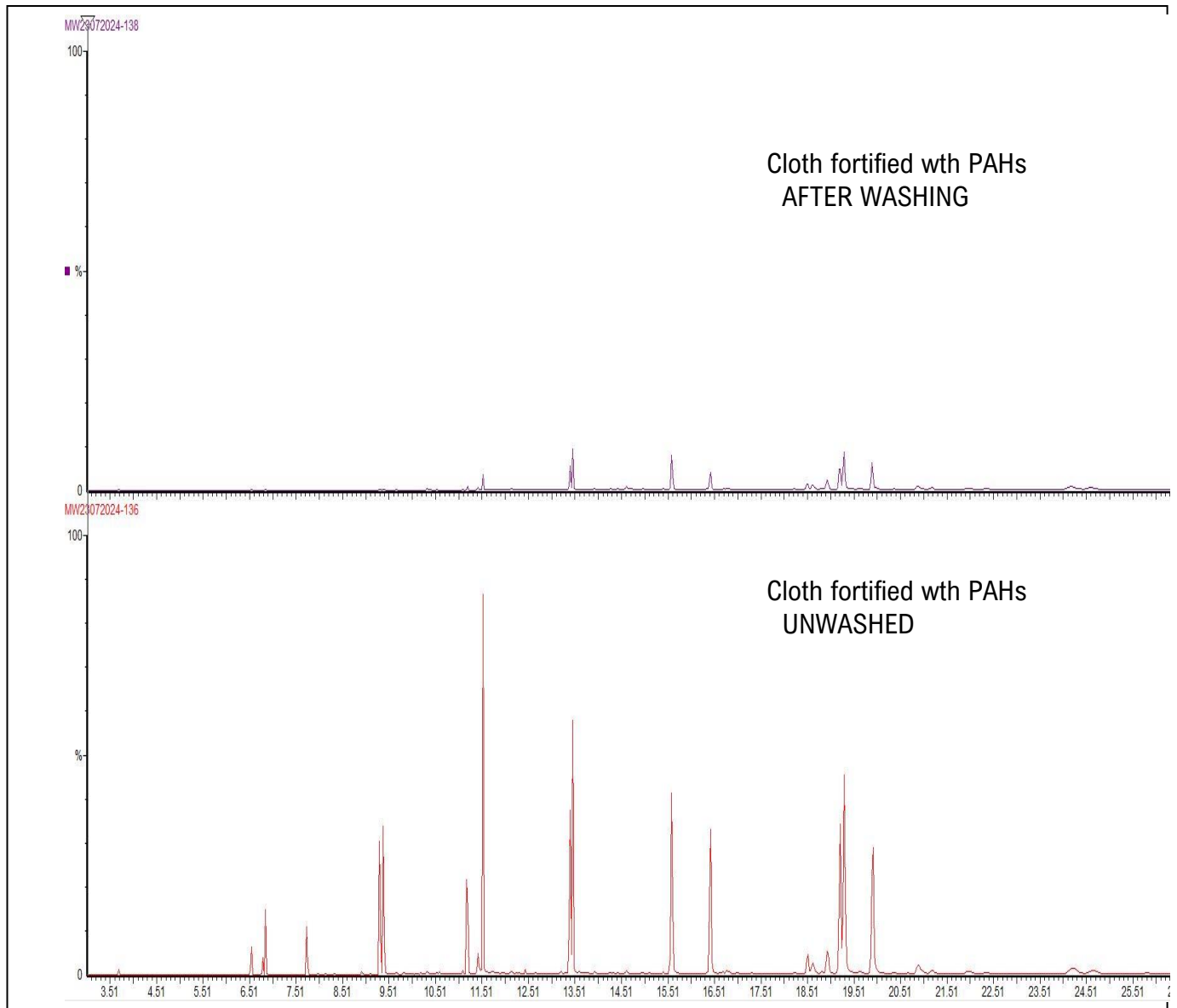
## RESULTS OF ANALYSIS:

Analyte	Sample RA-1 Amount of individual PAHs on cloth BEFORE washing	Sample RW-1 Amount of individual PAHs on cloth AFTER washing	% Reduction in PAHs due to Washing.
	(Total micrograms)	(Total micrograms)	
Naphthalene	2495	55	97.8 %
Acenaphthylene	1985	60	96.9 %
2-Bromonaphthalene	2995	65	97.8 %
Acenaphthene	2960	40	98.6 %
Fluorene	7065	40	99.4 %
Phenanthrene	11705	90	99.2 %
Anthracene	11205	75	99.3 %
Fluoranthene	14630	580	96.0 %
Pyrene	19630	875	95.5 %
Benzo(a)anthracene	19970	2645	86.8 %
Chrysene	18425	2490	86.5 %
Benzo(b)fluoranthene	17910	3540	80.2 %
Benzo(a)pyrene	18445	2395	87.0 %
Indeno(1,2,3-cd)pyrene	19570	3920	80.0 %
Dibenz(a,h)anthracene	20300	3550	82.5 %
Benzo(g,h,i)perylene	20000	3830	80.9 %
Total of all above PAHs	209290	24250	88.4 %

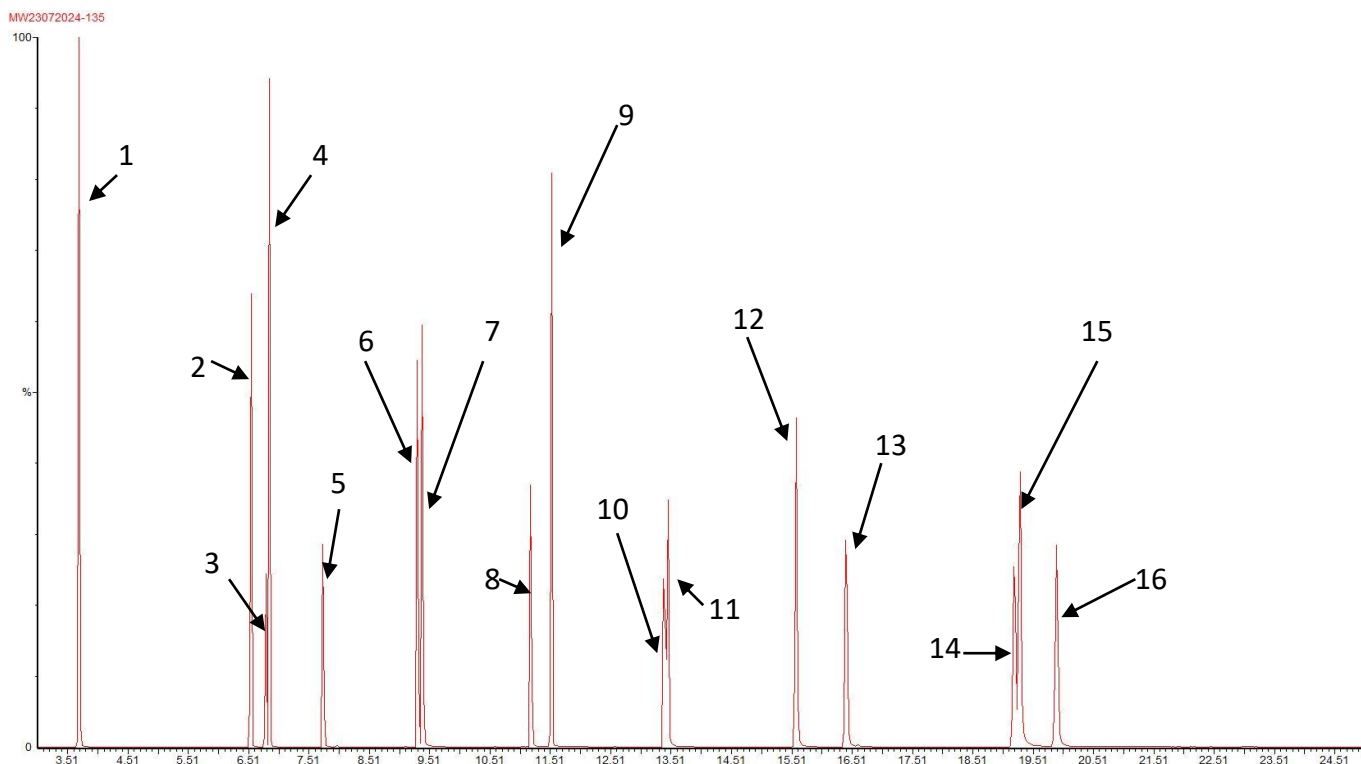
## CONCLUSION:

The use of 'Smoke Soap' has removed between 80% and 99.4% of individual PAHs from the cloth.

## APPENDIX: COPIES OF CHROMATOGRAMS



Mass Spectrum of Unwashed Cloth versus Washed Cloth on same scale.



Mass Spectrum of PAH Calibration Standard

1. Naphthalene
2. Acenaphthylene
3. 2-Bromonaphthalene
4. Acenaphthene
5. Fluorene
6. Phenanthrene
7. Anthracene
8. Fluoranthene
9. Pyrene
10. Benzo(a)anthracene
11. Chrysene
12. Benzo(b)fluoranthene
13. Benzo(a)pyrene
14. Indeno(1,2,3-cd)pyrene
15. Dibenzo(a,h)anthracene
16. Benzo(g,h,i) perylene