

PDMS Condom Lubricant: Persistence on the Penis and Presence in Personal Care Products

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PART 1: PDMS Persistence on the Penis

INTRODUCTION:

The detection of PDMS on penile swabs from a suspect can be used to indicate the use of a condom during a sexual assault. However, to date, no research has been published relating to the length of time that traces of PDMS can persist on the penis for.

METHODOLOGY:

Six volunteers participated in this study. They each applied a condom (Durex® Select) to their penis for a short period of time (sexual intercourse was not required) and then swabbed their penis' after specific time periods. Some volunteers carried out the swabbing multiple times after wearing a condom. Any activities and clothing worn during this time were noted.

The submitted swabs were extracted with hexane and the extracts analyzed by PyGC-MS.

RESULTS:

PDMS was detected on 13 of the 14 submitted swabs, up to a maximum time delay of 20 hours (Table 1). The one swab where PDMS was not detected was taken after 13 hours and was the third swab taken after wearing one condom. The D3 and D4 oligomers were detected in the extract from this swab.

A summary of the activities undertaken and clothing worn, as reported by the volunteers, is shown in Table 2. Figure 1 shows the MIC of swab 2 taken 11 hours after a condom was worn by volunteer 5.

DISCUSSION:

PDMS was detected on all but one of the penile swabs, up to a maximum time delay of 20 hours since a condom had been removed. From these findings we would recommend taking penile swabs from suspects within 24 hours of an alleged sexual assault. It should be noted that the volunteers carried out their own swabbing, and it is possible that a qualified medical examiner may perform a more thorough collection.

PDMS was detected on swabs from three volunteers after they had showered or bathed. In addition, PDMS was detected on swabs from two volunteers after they had exercised. While this is a relatively small number of observations it would suggest that cleaning and exercising does not accelerate the loss of PDMS from the penis.

TABLE 1: Results for PDMS detection on penile swabs

Volunteer	Swab number	Time delay (hours)	PDMS Detected?	Trace DMS Species
1	1st	0	Yes	
	2nd	6	Yes	
	3rd	13	No	D3, D4
1	1st	12.5	Yes	
	2nd	8	Yes	
2	1st	12	Yes	
	2nd	14	Yes	
	3rd	7	Yes	
3	1st	12	Yes	
	2nd	9.5	Yes	
4	1st	8	Yes	
	2nd	11	Yes	
5	1st	15.5	Yes	
	2nd	20	Yes	

FIGURE 1: MIC from swab 2, volunteer 5, 11 hours after condom removal (extracted ions: m/z 73, 133, 207, 281)

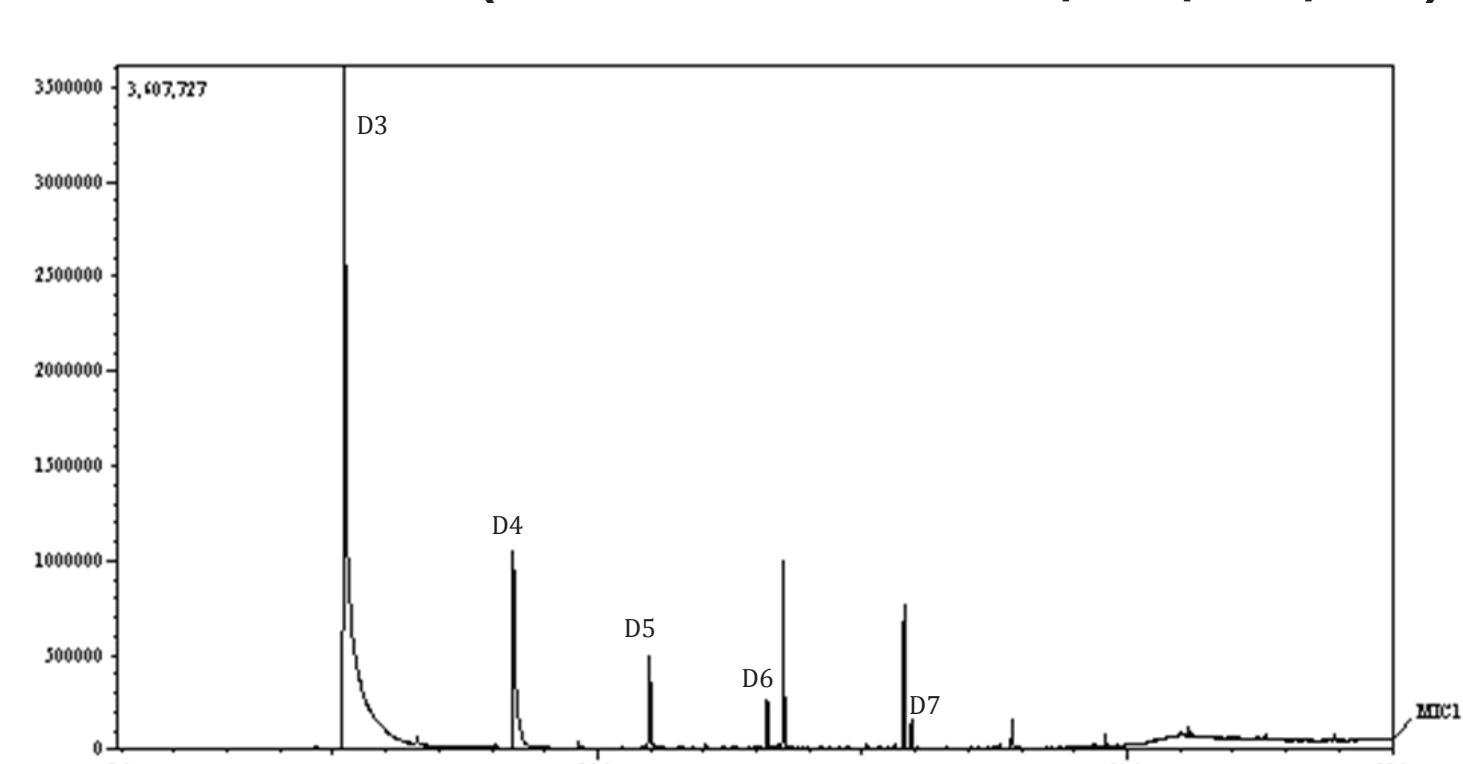


TABLE 2: Volunteer-reported activities and clothing worn

Volunteer	Swab Number	Activities Before Swabbing	Clothing Worn
1	1st	Taken immediately after condom removal;	Wore boxer shorts
	2nd	Urinated 3 times;	
	3rd	Urinated 5 times.	
2	1st	Sexual intercourse occurred	Wore boxer shorts
	2nd	No sexual intercourse occurred	No clothes worn
	3rd	Worked and urinated twice	Wore trousers, no briefs
3	1st	Showered (washed with soap and water), urinated once	
	2nd	No sexual intercourse occurred	Wore boxer shorts
	3rd	Exercised (running) and showered (washed with soap and water)	
4	1st	No information provided	No information provided
	2nd	No sexual intercourse occurred	
	3rd	Bathed, no urination	Wore boxer shorts
5	1st	Urinated once	
	2nd	No sexual intercourse occurred	
	3rd	Exercised (gym), urinated once, slept	Shorts and sweatpants (while exercising), wore boxer shorts (sleeping)
6	1st	Urinated once	Wore boxer shorts and jeans
	2nd	Urinated	

PYGC-MS INSTRUMENTAL CONDITIONS

The pyrolysis apparatus used was a PY-2020iD Double-Shot Pyrolyzer (Frontier Laboratories Ltd., Japan). The PY-2020iD Double-Shot Pyrolyzer was directly coupled to the injection port of a GCMS-QP2010 Gas Chromatograph Mass Spectrometer (Shimadzu Corporation, Japan). The GCMS utilised a 5% diphenyl ultra alloy capillary column, 30.0m x 0.25 mm internal diameter, with 0.25 µm film thickness (Frontier Laboratories Ltd., Japan).

TABLE 3: PyGC-MS Instrumental Conditions

Pyrolysis temperature:	600°C
Inlet temperature:	300°C
Split Ratio:	100:1
Column:	Flow: 1.00 mL/min Carrier Gas: Helium
GCMS parameters:	Interface temperature: 200°C Ion source temperature: 280°C
MS Settings:	Electron impact: 70eV Scan range: m/z 29.0 – 550.0

Both the TIC and MIC (m/z 73, 133, 207 and 281) were examined for each sample. PDMS was deemed to be detected when cyclotrisiloxane (D3) and at least two additional cyclic species within the cyclotetrasiloxane (D4) to cycloheptasiloxane (D7) range were detected.

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PART 2: Presence of PDMS in Personal Care Products

INTRODUCTION:

When PDMS is detected on an intimate swab (e.g. vaginal, anal) it can suggest the use of a condom during a sexual assault. However, the defence may allege that the PDMS has come from a personal care product that the complainant has used. A large range of personal care products were examined to determine if PDMS was detectable and what other compounds could be used to distinguish personal care-PDMS from condom-PDMS.

METHODOLOGY:

A range of personal care products were obtained and analysed by PyGC-MS (Table 4).

RESULTS AND DISCUSSION:

PDMS was detected in six of the sixteen personal care products analysed. These six samples included two shampoos, one conditioner, one shower gel, one lotion and one face cleanser. Additional chemical compounds were detected in all of these personal care products that could be used to suggest that the PDMS has come from a non-condom source. For example, figure 2 shows the MIC of Dove® Conditioner, displaying peaks due to the pyrolysis of PDMS and polyethylene glycol monododecyl ether, a surfactant.

PDMS was detected in four of the six products which listed silicone-containing ingredients on their labels. In addition, PDMS was detected in two products that did not list any silicone-containing ingredients on their labels. This finding suggests that while ingredient labels may be referred to, they should not be relied upon to establish the presence of PDMS in personal care products. In addition, for cases where a personal care product is indicated analysis of a control sample is highly recommended.

TABLE 4: Personal care products analysed

Brand	Product Type	Silicone-containing ingredients on the label	PDMS Detected?	Other Major Compounds Detected
Dove®	Shampoo – Daily Moisture Therapy	Dimethiconol	Yes	Polyethylene glycol monododecyl ether fragments
Garnier® Fructis	Shampoo – Normal Hair	Dimethicone	Yes	Polyethylene glycol monododecyl ether fragments
Dove®	Conditioner – Daily Moisture Therapy	Dimethiconol	Yes	Polyethylene glycol monododecyl ether fragments
Schwarzkopf	Conditioner – Hair Repair Liquid Silk Gloss for Brittle Dull Hair	Dimethicone Dimethiconol Cyclomethicone	No	Isopropyl myristate
Dove®	Shower Gel – Nectarine and White Ginger	–	No	Isopropyl palmitate Ethylene brassylate
The Body Shop	Shower Gel – Vitamin E Cream Cleanser	–	Yes	Vitamin E Acetate
Dove®	Antiperspirant – Cucumber and Green Tea Spray-On	Cyclopentasiloxane Dimethiconol	No	Butylated hydroxy toluene
Rexona®	Antiperspirant – Calming with Calendula Roll-On	–	No	Ethylene brassylate
St Ives®	Lotion – Renewing Collagen Elastin	Dimethicone	Yes	Long chain alkanes
Neutrogena®	Face Cleanser – Extra Gentle Cleanser	–	Yes	Butylated hydroxy toluene
Lynx®	Men's Anti-Hangover Shower Gel	–	No	Isopropyl palmitate Polyethylene glycol monododecyl ether fragments
Lynx®	Men's Fever Shower Gel	–	No	–
Dolce & Gabbana	Men's Shower Gel	–	No	Polyethylene glycol monododecyl ether fragments
Nivea	Men's Shaving Gel	–	No	–
Nivea	Men's Antiperspirant	–	No	Ethylene brassylate
Armani Code	Men's Cologne	–	No	Diethyl phthalate

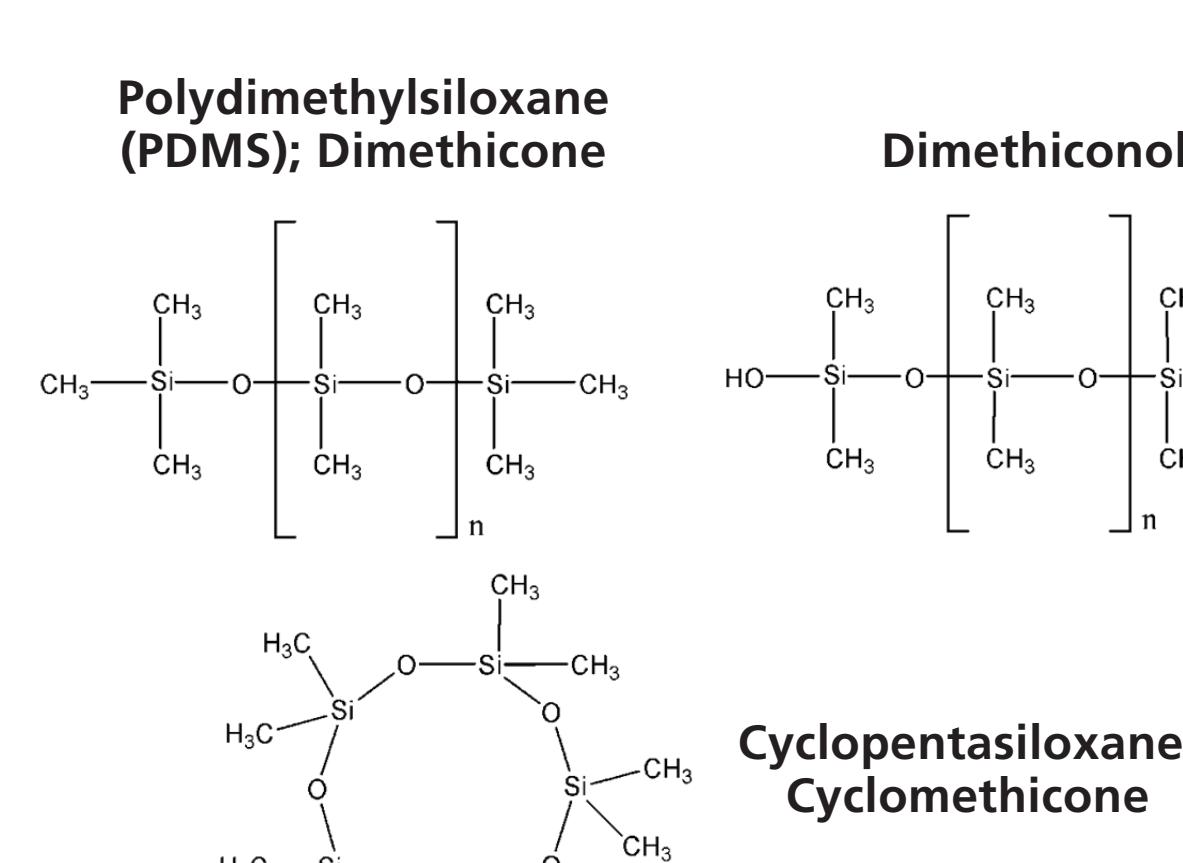
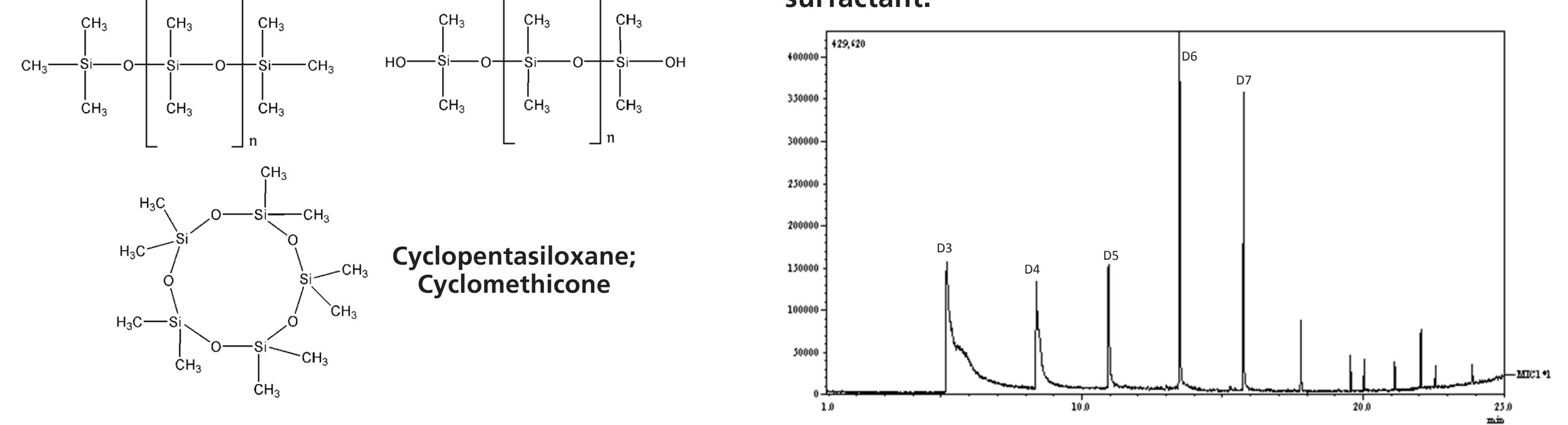


FIGURE 2: MIC of Dove® Conditioner (Extracted ions: m/z 73, 133, 207, 281). Peaks between ~18 – 24 minutes due to pyrolysis of polyethylene glycol monododecyl ether, a surfactant.



Conclusion:

PDMS can be detected on the penis up to 20 hours after a condom has been worn. In addition, PDMS residues were detectable after activities such as exercise and washing. This finding emphasises the need to take penile swabs in alleged sexual assault cases where the complainant nominates a suspect.

PDMS is present in a large range of personal care products and may be detected. The analyst needs to be aware of this potential alternative source and evaluate the findings relative to the case circumstances. The detection of additional chemical compounds may be useful in evaluating possible sources of PDMS detected on intimate swabs related to sexual assault cases.