Supplementary Material

Methods

MALDI TOF MS/MS Analyses

The Ion mobility MS/MS spectrum performed on the *Condomi Max Love* condom extract was acquired with the IMS nitrogen gas flow set at 90 ml/min giving a pressure in the IMS cell of 3.4 mBar. Precursor ion selection at m/z 1493.8 was carried out with a quadrupole. The Precursor ion was then directed into the TRAP T-Wave collision cell with collision energy of 4 eV before being introduced into the IMS T-wave cell. Ions were then directed in the TRANSFER T-Wave collision cell where the collision energy was manually raised from 0 eV to 150 eV. Here precursor and fragment ions share the same drift time because the fragmentation occurred after ion mobility separation. The data were acquired at 1s per scan with a inter delay scan of 0.02 s. The ion mobility separation was optimized with a Wave height of 40 V and the Wave velocity starting from 500 m/s down to 150 m/s.

Condom contaminated fingermark preparation.

Aged condom contaminated fingermarks were deposited as previously described[9] but aged at 25°C and 60% relative Humidity (Hr) for a month or at 37°C for 10 min at 60% Hr prior to matrix coating.

For the experiments aimed to determining whether or not a fingermark showed presence of the lubricant as a result of handling a condom, a non-contaminated fingermark was deposited on an aluminium sheet which had been previously contaminated with *Trojan Enz*; in particular a swab was used to collect lubricant from a *Trojan-enz* condom and an even, thin coating was spread across the sheet. The aluminium sheet was left in a petri dish at room temperature for 3 hours before deposition of a 'chance' fingermark (i.e. not washed, not artificially loaded with sebum). The fingermark containing aluminium sheet was cut in half and stuck on a MALDI plate together with another half fingermark which was previously contaminated with the *Trojan Enz* condom and deposited on a clean aluminium sheet.

For the experiment aimed to couple ATR FTIR and MALDI MSI, a *Condomi Max Love* contaminated fingermark was lifted off a ceramic tile using a BVDA gelatine lifter (courtesy of the Home Office Centre for Applied Science and Technology, CAST) and then submitted for ATR FTIR analysis. Using the dry-wet method described elsewhere[13], the ceramic tile was dusted with α-CHCA; the fingermark was then tape lifted and sprayed with a 40:45:15 ACN/DCM/THF solution as described above, prior to submission to MALDI MSI.

Legends

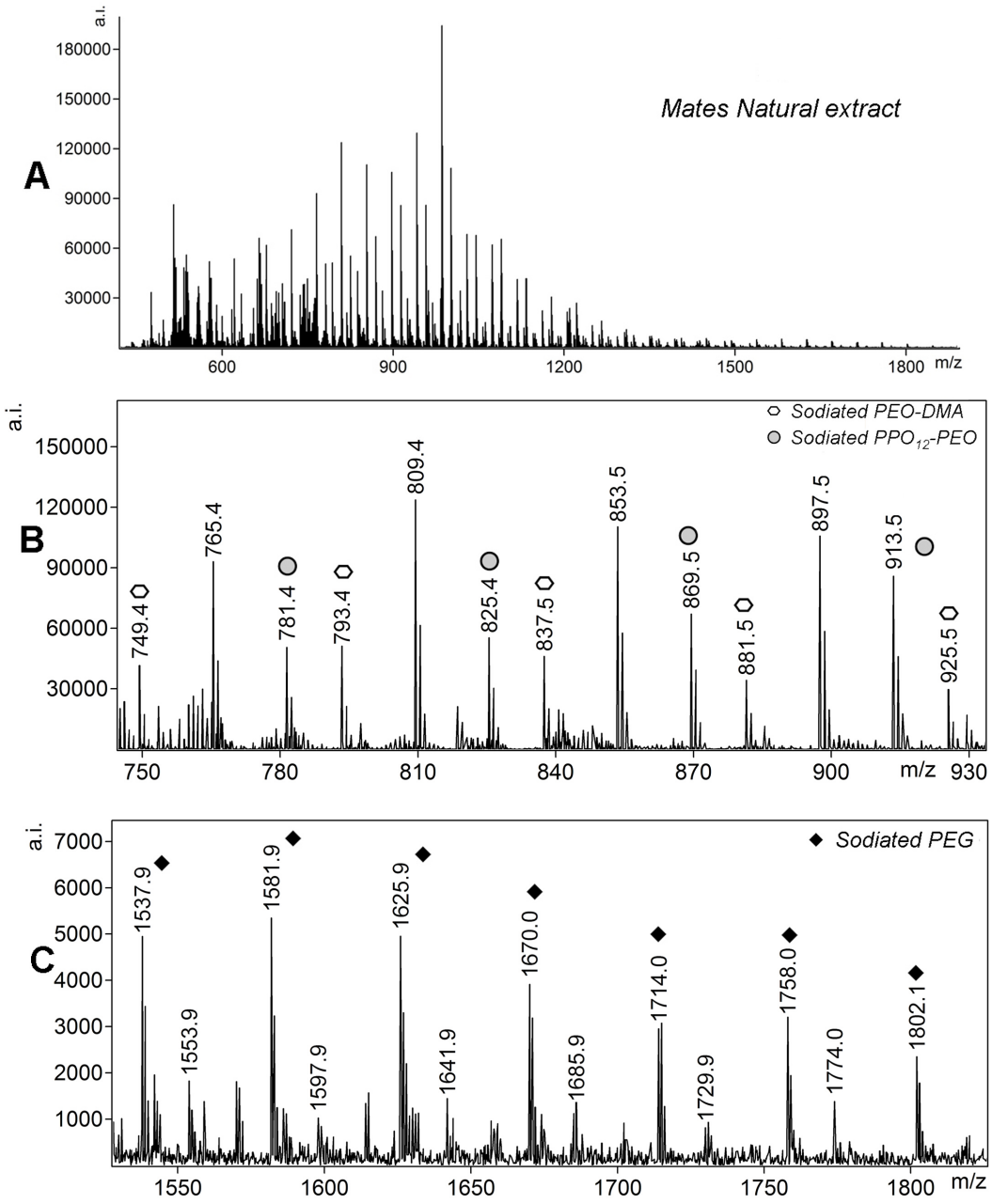

Figure S1. MALDI MSI analysis of *Trojan Enz* contaminated and non-contaminated fingermarks. The ion signal at m/z 639.5 (9-mer nonoxynol-9) is solely distributed on the ridges of a condom contaminated fingermark deposited on a non condom contaminated surface. The same ion signal is distributed both on the ridges and in the valleys of a non condom contaminated fingermark deposited on a condom contaminated surface. In this case, ridge detail can be obtained by imaging another species such as the endogenous fatty acid at m/z 311.2.

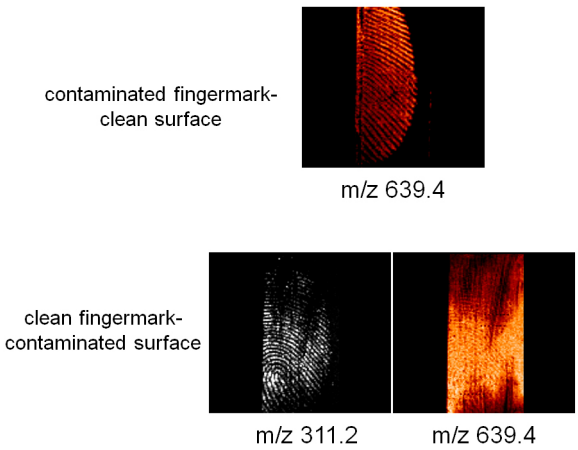

Figure S2. MALDI MS analysis of *Mates Natural* condom extract. Differently from the condom contaminated fingermark, the extract reveals a complex lubricant formulation (A). In particular, PEO-DMA and hydroxyl PEO-PPO_{12} polymers (B) and PEG (C) in their sodiated forms were tentatively identified.

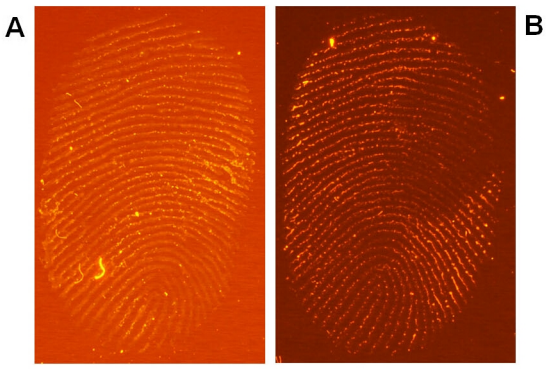

Figure S3. Laser irradiation and photography of condom contaminated fingermarks. The laser was shined at a wavelenght of 532 nm using an orange viewing filter (549 nm). A and B are *Trojan Enz* and *Condomi Max Love* contaminated fingermarks respectively.

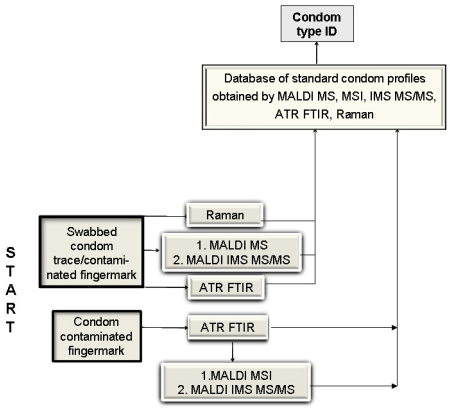

Figure S4. Potential forensic workflow for the comprehensive analysis of condom lubricants from condom contaminated fingermarks and condom traces.