



Detection of semen and saliva with a maximum intensity UV detection system (Lumatec® Superlite 400)

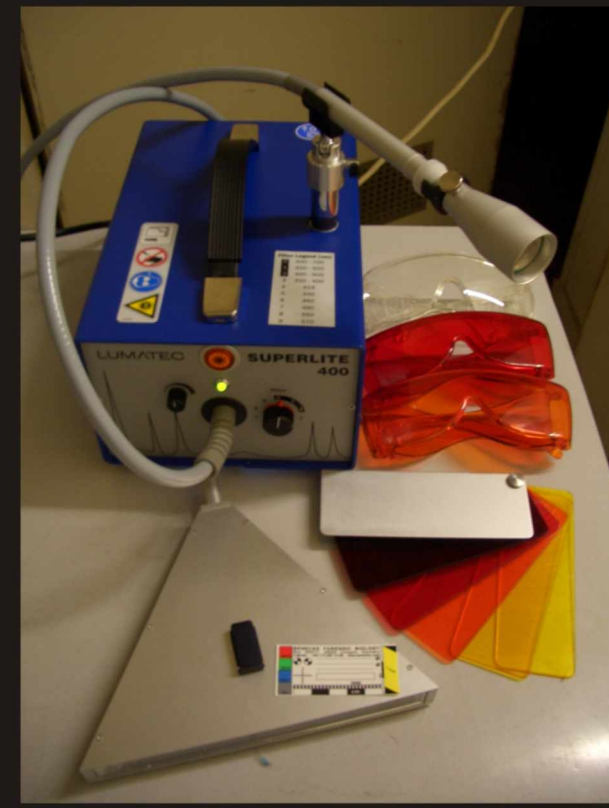


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Introduction

The efficiency and quality of detected semen and saliva stains on different types and colors of fabrics were tested using a newly developed UV detection system (Lumatec® Superlite 400). The system is characterized by a very high output intensity of light so that detection of biological stains even in daylight becomes possible. The apparatus provides ten excitation possibilities from 320 to 700 nm. A white (> 400 nm), orange (> 500 nm) and red (> 590 nm) goggle was used together with these excitations.



Lumatec® Superlite 400 and equipment.

Conclusion

The forensic light source Lumatec® Superlite 400 detects biological stains in darkness and daylight. The best results to detect semen and saliva are obtained using an excitation between 415-490 nm. Therefore, a broad excitation with filter position 2 (350-500 nm) is recommended. The fluorescence of the biological stains is detected best using the red high pass goggle (> 590 nm). The orange goggle (> 500 nm) also shows good results. For the unwashed samples semen could be detected in all cases, but saliva was successfully detected in 60% of the cases only. Dark colors of fabric, especially pure black, reduce the chance to detect biological traces dramatically. The type of fabric (cotton, polyester, polyamide) does not have remarkable influence on the fluorescence signal. Washing the stained clothes can remove the biological traces in approximately 75% of the cases.

Results

1. The fluorescence signal at daylight was as strong as in darkness in most cases.
2. The fluorescence signal and intensity was similar in samples that were stored three or five weeks.
3. In unwashed samples semen could be detected with appropriate goggles in 100% and saliva in only 60%. When detected, the red goggle visualized a signal for semen in 55% and for saliva in 67% of the cases. The yield of the orange goggle was 50% in both stains. The white goggle detected biological stains in only 10% (semen) and 20% (saliva), respectively.
4. Excitation wavelengths from 415 to 490 nm produced the highest number of detectable emission signals (fig. 2).
5. Washing effectively reduces the detectable fluorescence signal of biological stains ("full" washing powder 85% reduction, "soft" washing powder 90% reduction).
6. There was no remarkable difference in detection of biological stains between the fabric types. But, dark colors, especially pure black, reduce the chance to detect biological traces (fig. 1).
7. The fluorescence signal of boar semen was clearly weaker than that of human semen (although the amount of sperms / mm² is nearly the same).

Material and Methods



Clothes of different fabric types and colors used for semen and saliva detection :

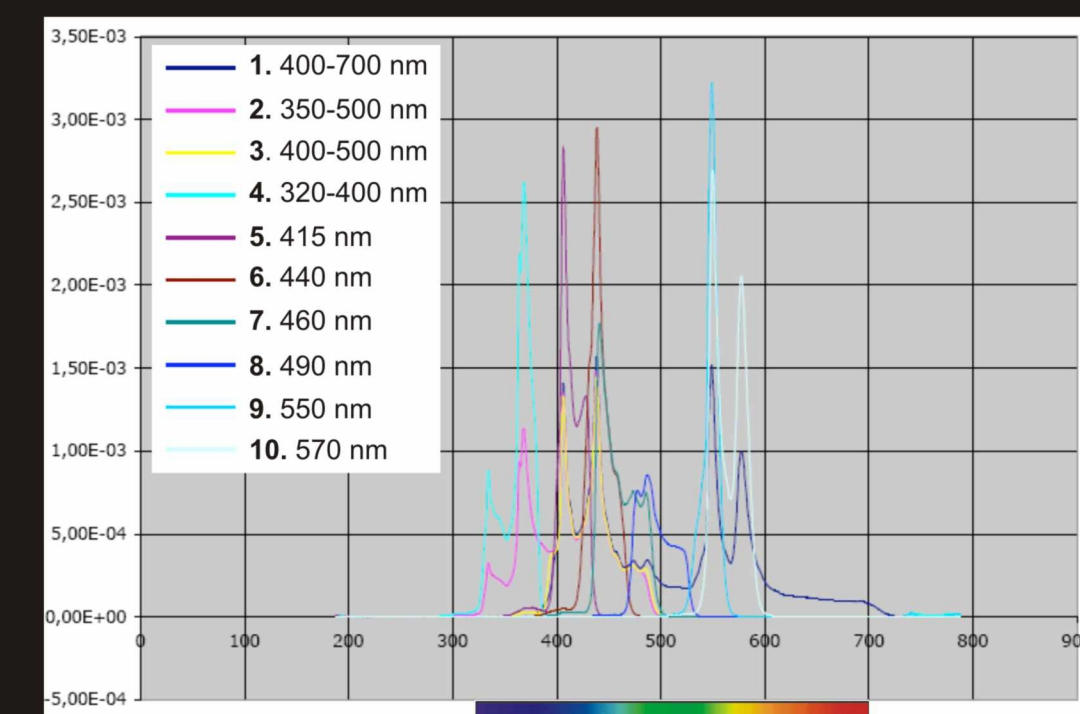
- 100% cotton (1-3)
- 100% polyamide (4-6)
- 100% polyester (7)
- 95% cotton, 5% elastane (8)
- 73% cotton, 24% polyamide, 3% elastane (9)
- 80% polyamide, 20% elastane (10)

Tested clothing was of different fabric types and colors (bright, medium, dark colors) including white and black fabric. Five and three weeks before the analysis, the fabric was stained with **biological stains**: fresh human and boar semen and fresh human saliva.

The clothing was then stored in a dark room at 17°C. After the storage time, a set of samples were washed at 30°C with "full" detergent (contains oxygen-based bleach) or "soft" detergent (free of bleach).

All tests for biological stains were carried out under blind conditions either in a dark room or in a room with mostly daylight and daylight-type artificial light.

Instrumentation



Excitation wavelength and intensity of ten filter positions of the Superlite 400.

The newly developed Superlite 400 light source manufactured by Lumatec® GmbH Germany was used. The portable detection system is designed for crime scene and laboratory use and enables the detection of biological stains even in daylight. A mercury lamp produces a very high output intensity of light from 320 to 700 nm wavelengths in ten adjustable filter positions. In combination with the ten excitation settings a white (> 400 nm), orange (> 500 nm) and red (> 590 nm) high pass goggle was used to block the excitation light and to visualize the fluorescence. An applicator at the end of the flexible light guide forms the beam to a spot or to a fan.

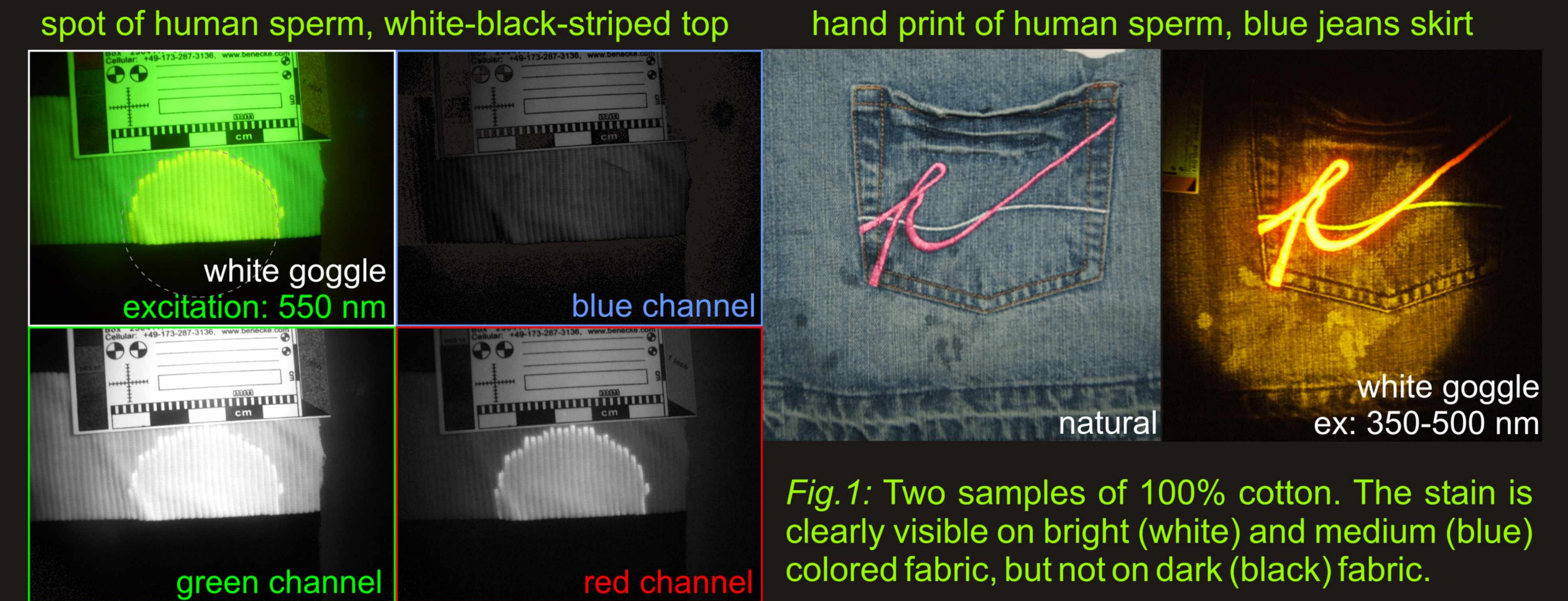


Fig. 1: Two samples of 100% cotton. The stain is clearly visible on bright (white) and medium (blue) colored fabric, but not on dark (black) fabric.

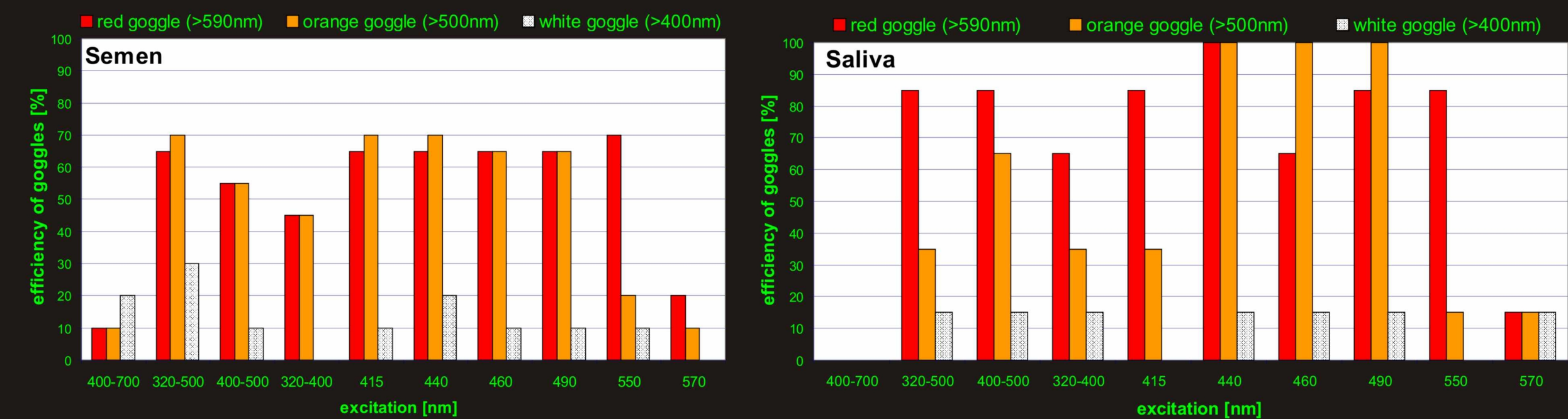


Fig. 2: Efficiency of goggles for unwashed fabric using different excitation wavelengths.