

# Enhancement of fingermarks on adhesive surfaces, using formulation based on Rhodamine 6G dye

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**Abstract**— The enhancement of latent prints on adhesive tape can provide the forensic scientist with undeniable information about who handled the tape. At the INCC/GN, the fingerprint department processes adhesive tapes in order to reveal latent prints for identification purpose. This treatment requires the use of two separate techniques on both sides of the tape. In addition, these different techniques used on both sides can interfere with each other, which require more time and resources.

Many studies attempt to reveal latent prints on adhesive tapes. One study proposed a Rhodamine 6G / Tween 20 staining solution that simultaneously revealed latent impressions on both sides of an adhesive tape after fumigation with cyanoacrylate [Maldonado et al, 2013].

In this work, we have tested, compared and evaluated this method for detection of fresh and old latent prints on six (06) types with different colors of adhesive tapes. This method gives results comparable to standard treatment methods (Sticky-Side Powder, Crystallized Violet and TapeGlo), while requiring less time, steps and materials.

**Index Terms**— SSP Sticky-Side Powder, VC Violet cristallisé, TG TapeGlo, Rh 6G Rhodamine 6G.

## I. INTRODUCTION

As part of a forensic science Master's project, this research work was carried out in the Digital Fingerprint Department. It focuses on the revealing of latent fingerprints on both sides of adhesive ribbons.

Certainly, adhesive tapes are often found at crime scenes. They are usually used to tie up victims in order to prevent them from screaming, packing drugs, assembling dynamite sticks, ... etc, however, separating treatment for each side of the adhesive tape has been an issue for experts, so the challenge was to find an appropriate method that can treat both sides of one tape at the same time.

US researchers have proposed a new formulation of "Rhodamine 6G/Tween 20" substance. Its use for detecting latent fingerprints has been demonstrated on a range of adhesive surfaces (both sides of a gray cloth adhesive tape).

In this study, a modified physicochemical method of revealing fingerprints, denoted "Rh 6G/Tween20", was applied on adhesive surfaces, using cyanoacrylate fumigation followed by a new formulation of a Rhodamine 6G dye, mixed with Tween 20 and distilled water. The study consists of:

- (1) Test the "Rh 6G / Tween 20" method in the detection of latent fingerprints on both sides of the adhesive tapes.
- (2) Compare this method with the methods of revealing fingerprints on the adhesive side of the ribbon, used at the National Institute of Criminalistics and Criminology of the National Gendarmerie (SSP, TG and VC).
- (3) Evaluation of this method on adhesive tape samples.

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## II. MATERIALS AND METHODS

The application of the method (revelation, observation and photography of the revealed fingerprints) was carried out in the same conditions as for the preliminary tests.

Six (06) types of adhesives were chosen from the Algerian markets, under different brands of different natures, colors and compositions. They were tested with three (03) donors (two males and one female). Then, the fingerprints placed on the adhesive side were cut in two (02) complementary halves in order to compare the revelation results of two different methods for the same deposit of a finger.

Each donor placed nine (09) fingerprints on the six (06) samples of the adhesive tapes, which were divided into two groups, fresh and old. The treatment of fresh fingerprints does not exceed 48 hours while the old ones were left for 45 days at room temperature (23° to 25° C).

The revealed fingerprints resulting from this research were evaluated, for five point Likert scale, based on ridge details obtained from different treatment techniques.

## III. RESULTS AND DISCUSSIONS

The taken fingerprint photographs were selected to illustrate the results of this study:

### A. Preliminary tests on non- adhesive and adhesive surfaces

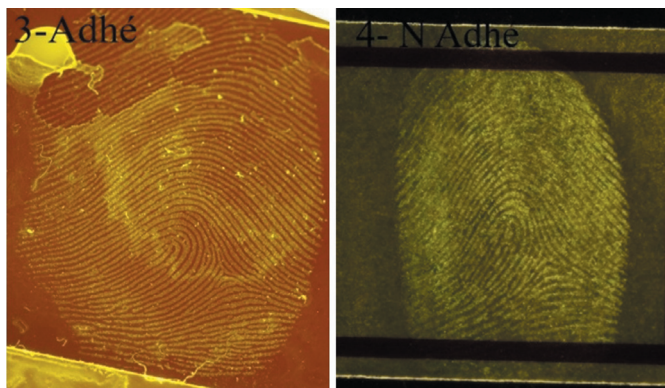


Fig. 1 Preliminary test results ("Rh 6G/Tween 20" method applied on the adhesive side).

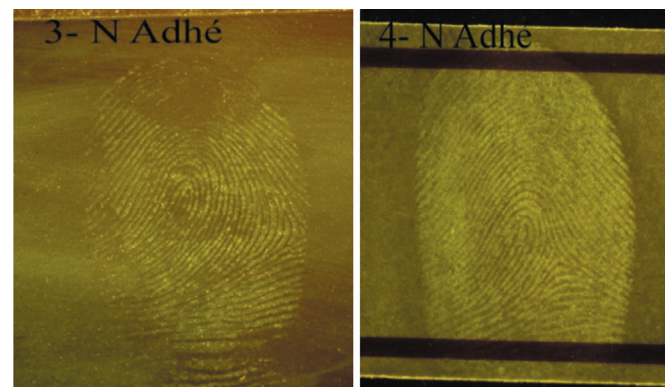
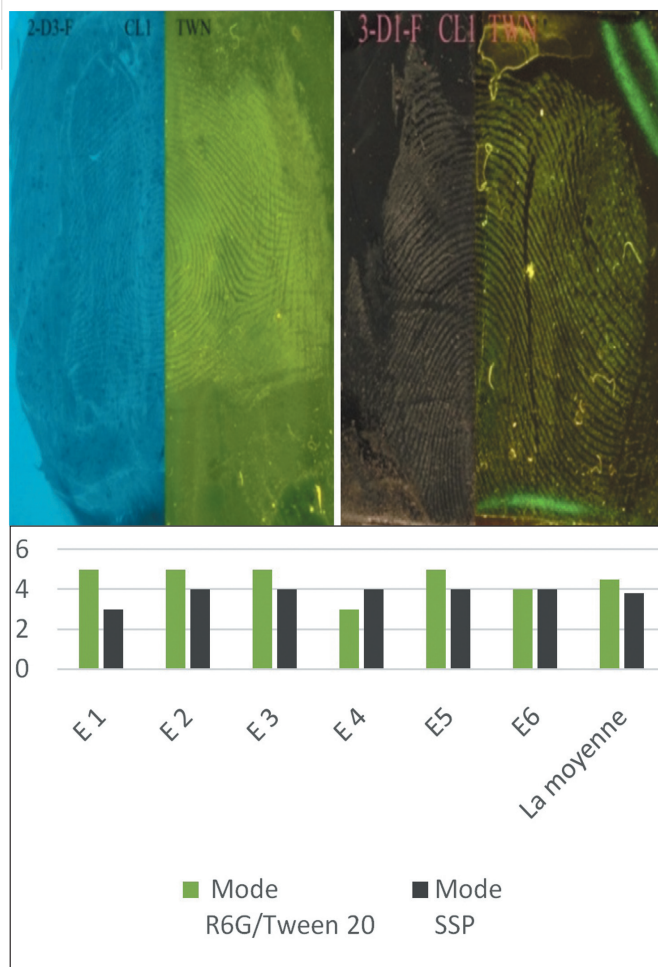


Fig. 2 Preliminary test results of the "Rh 6G/Tween 20" method applied on the non-adhesive side.

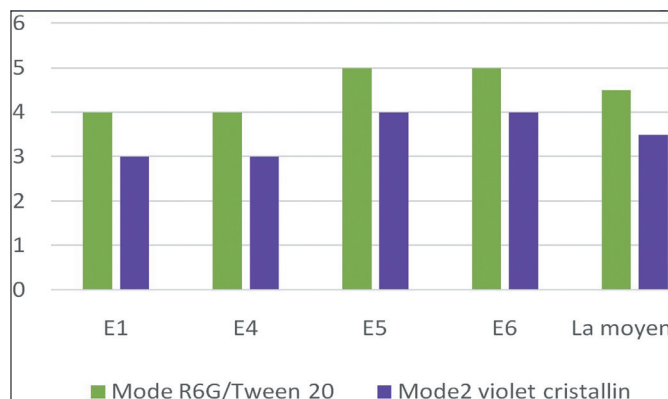
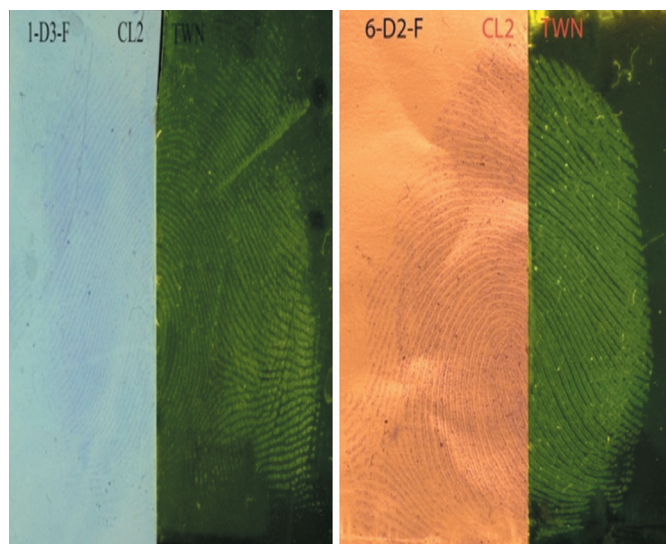
Figures 1 and 2 show the effectiveness of "Rh6G/Tween20" method for enhancing fingerprints on both sides of a sticky tape.

*B.Comparison between the Rh 6G /Tween 20"and the SSP (classical 1) methods:*



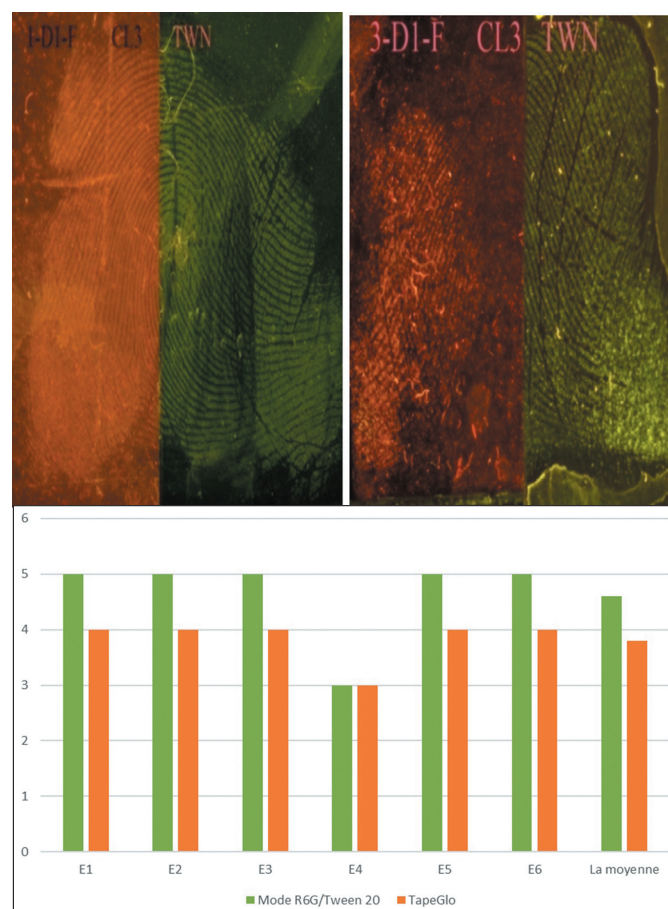
**Fig. 3** Comparison of fresh fingerprints revealed by the "Rh 6G/ Tween 20" (TWN) and the sticky-side Powder (classical 1) methods.

*C.Comparison between the Rh6G /Tween 20"and the CV (classical 2) methods:*



**Fig. 4** Comparison of the fresh fingerprints revealed by "Rh6G/ Tween 20" (TWN) and the crystallized violet (classical 2) methods.

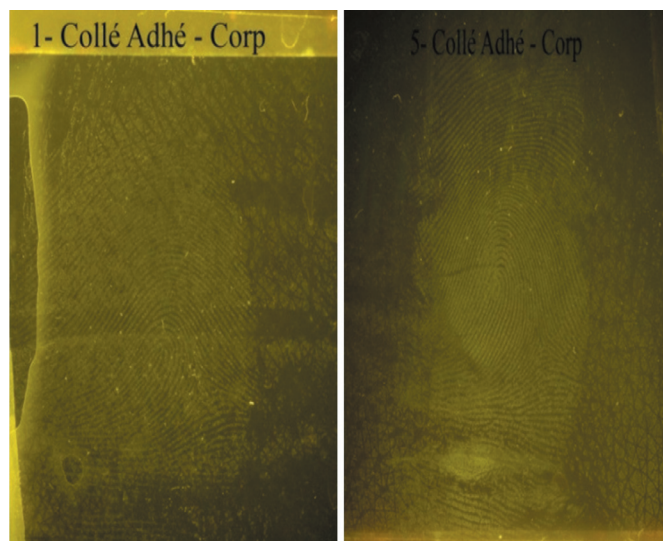
*D.Comparison between the Rh 6G /Tween 20"and TG (classical 3) methods:*



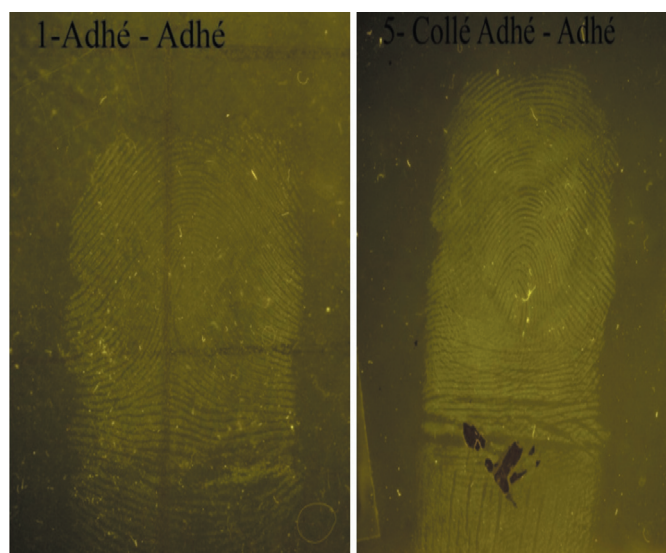
**Fig. 5** Comparison of the fresh fingerprints revealed by the method "Rh 6G / Tween 20" (TWN) and the tapeGlo (classical 3) methods.

Pictures 3, 4 and 5 represent the comparison of fingerprints developed using the "Rh6G/Tween20" method and those developed using traditional methods on the adhesive side of tape. It was presented by bar graphs according to the Likert's scale, where it shows that the rate obtained from the "Rh6G/ Tween20" method is higher than the one obtained by other methods, which demonstrated by the last two verticals.

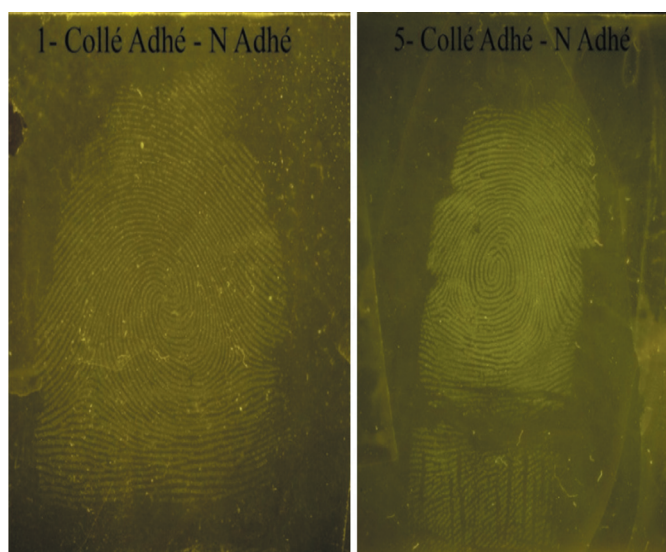
### 5. Evaluation of the Rh 6G / Tween 20 method on adhesive tape samples to simulate Physical evidences reflecting actual cases



**Fig. 6** Existing fingerprint simulation test results on the adhesive surface and then glued to another human body.



**Fig. 7** Existing fingerprint on an adhesive surface that glued on the adhesive side.



**Fig. 8** Existing fingerprint on an adhesive surface that glued on the non-adhesive side (smooth surface).

Pictures 6, 7 and 8 represent samples of adhesive tapes with fingerprints posed on it, then they have been faced with factors, which are similar to those existing at the crime scenes. Samples treated with the "Rh6G/Tween20" method gave positive results.

## IV. CONCLUSION

The "Rh 6G/Tween 20" method tested in this study is a reliable option for the simultaneous processing of latent prints on both sides of a ribbon, adhesive and non-adhesive. The processed fingerprints using this method were clear, identifiable and comparable to the ones treated with conventional methods, in addition, they require less processing time and chemicals use.

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