

# Forensic examination of lipstick by the various physio-chemical and instrumental method.

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## Abstract

Stains play an important role for criminal identification in different type of cases such rape, murder, theft, burglary. Stains i.e. blood, semen, saliva, lipstick are the most common evidence found at the crime scene. Lipstick is one of the important type of evidence, which is mostly found on clothing's, papers, tissue-papers, cigarette-buts, skin or any other surface or thing. In the present study an attempt has been made to analyze the Lipstick stains using new solvent system [isopropyl alcohol: acetone: distil water: amino solution (35: 35: 25: 5)] by TLC and paper chromatography, they are one of the best, economical, easily handle technique which can be used for the identification of lipstick smear. The ultra violet light and photo colorimeter can also used for placing link between suspect and question samples. For this total 17 samples of branded and local brands of red shade lipsticks were taken from consumers and purchase from the local market of Allahabad, Questioned lipstick stains can be matched with the suspected one for the criminal identification by comparing Rf value and separated band of pigments in TLC and chromatography.

**Key words :** stains, crime, criminal, thin layer chromatography, paper chromatography, ultra violet light and photo colorimeter

## 2. Introduction

In the ongoing battle on with crime, law enforcement officials are regularly encounters different types of evidence at crime scenes. Evidence such as blood stains and pieces of clothing are of obvious benefits to investigators as they link subjects to crimes. But many crimes go unsolved due to the lack of evidence at the scene or, due to lack of technology. Recent advances in technology and improved analytical methods have allowed scientists to begin the use of evidences like cosmetic smear[1] which were earlier considered to be useless.

Lipstick is a type of physical evidence usually found in the cases of rape, murder, theft, burglary etc. It is found on the scene of occurrence on clothes's, papers, tissue-papers, cigarette-buts, skin or any other surface or material[2]. In certain cases trace amount of lipstick may get transferred to the clothing of the person who attacked the female. Lipstick was often found to be crucial in investigation of crime cases **Andrasko(1981)**[3]. The identification and determination of components in lipstick, samples have to be conducted with a rapid method, Usually the smear found on crime scene contain only trace amount of sample .however study conduct by **Russell and Welch (1984)**[4] showed that small quantity of

extracted lipstick could be compared with those sample by direct extracts of lipstick effectively by TLC and GC-MS technique .By comparing the composition of a lipstick smear with that of a victim, that we can demonstrate indirect proof of contact or a relationship between victim and suspect. Also, it is sometimes possible to extract saliva DNA from the print, **Webb et al. (2001)**[5] Suggest that lip cosmetics are an excellent source of DNA, with almost 80% of samples giving a result. Cosmetic evidence such as lipstick recovered from a crime scene can prove useful to link a suspect with the victim or crime scene and therefore need to be carefully analyzed during crime investigation[6-7]. The questioned sample found on the crime scene is matched with the standard sample. In the same way questioned lipstick stain found on the crime scene present on different thing is compared with standard lipstick stain collected from custody of suspect e.g. Handbags, drawers, bathroom cupboard, on dresser-tops & similar places where lipstick might be laid down, carried or stored. Then the examination of lipstick stain is conducted. types of techniques which are used for the analysis are mentioned below.

### 3.material and methods

#### 3.1 Materials

The lipsticks samples of 11 established brands and 6 local brands were collected from the shops and consumers from the local market of Allahabad . The samples were of different qualities and popular brands with different price ranges. For each brand same red color was taken because red colour is widely used . Collections of samples were done according to the use by the different societies of peoples. Some brands were used by the lower and middle class people and some were used by the upper class people.

**Table. 1 list of lipstick samples**

Sr.No	Lipstick brand	Code	Colour appearance
1	Lakme	L1	Pink red
2	Silver touch	S1	Red

3	Personi	P1	Red
4	Personi	P2	Blood red
5	Face it	F1	Red-orange
6	Color bar	C1	Red
7	Avon	A1	Cherry red
8	Revlon	R1	Berry red
9	Revlon	R2	Orange
10	Oriflamme	O1	Radiant red
11	Colorosene	Cs1	Dark red
12	Elle 18	E1	Red
13	Y2k	Y1	Red
14	Yash	Y2	Blood red
15	Rosi	Y3	Pink red
16	Tiannuo	T1	Red
17	French lady	Fr1	Orange red
18	Blue club	B1	Blood red

#### 3.2 Methods

##### 3.2.1 Collection

For the present study a total of 16 lipstick samples were collected from the local markets out of which 10 samples were from popular brands and 6 the rest samples were of local brands . TLC and paper chromatography techniques were used to examine the lipstick stains of same colour (red) of different brands .

##### 3.2.2 Extraction :-

Extraction of lipsticks was done from the tissue papers. Tissue papers which had the lipstick smear were taken; they were cut into 1 by 2 cm section of a lipstick sample by a scissor from the tissue paper and were placed in a test tube. Test tubes were labeled with the Lipstick brands. This was repeated for each tissue paper and was stored in separate test tubes. Acetone was used as an extracting solvent. 15-20 drops of acetone was added to each test tube.

### 3.2.3 Procedure for TLC and paper chromatography

That was used for separation of components and pigment of stain that were present in lipstick. TLC and paper chromatography was performed using appropriate solvent system. The sample solution, having lipstick dyes, was applied as a spot to the TLC plates and chromatography strips about 1cm from the base. Sample was the material which had to be analyzed. Sample was placed by capillary tube 1 cm apart. This each plate has 2 spots. plates were dried after spotting and then were placed into the development glass beaker containing a suitable solvent (mobile phase)

Isopropyl alcohol -35%

Acetone -35%

Distilled water-25%

Ammonia-5%

The developing solvent was placed into the chamber or glass beaker at a depth of 1cm. It was closed by a glass plate or Alumina foil, so that the saturation is take place. Then the solvent raised by the capillary action. The separation takes place with different components traveling different distance on the plate. The development takes place usually once. Once the development is finished (it takes 30 minutes), When the solvent front traveled a distance, which was marked by pencil (10 cm). It was taken out of the chamber. The plate was dried and the components was seen with naked eyes, The RF value and colour of spots were recorded.

### 3.2.4 Ultra violet light visualization

In present study by matching those spots or fluoresce on TLC plate while exposing in UV light **Ehara and Marumo (1998)** stated that it is a nondestructive analysis method for the identification of lipstick smears by fluorescence observation and purge-and-trap gas chromatography[7], we can also compare the suspect sample with question stain. Once a TLC had been developed, it is frequently necessary to aid in the visualization of the components of a reaction mixture. because most organic compounds are colorless. Frequently, the organic compounds of interest contain a chromospheres

which may be visualized by employing either a short or a long wave UV lamp.

### 3.2.5 Photo colorimeter examination

#### 3.2.5.1 Extraction

Tissue papers having the lipstick smear were taken, 2ml acetone was added in to each test tubes, The test tubes were shaken thoroughly and they were allowed to stand to extract the lipstick for 30 minutes. with the help of whattaman filter paper no. 2 in separate test tubes filtration was performed.

#### 3.2.5.2 Procedure

The present study explain the use of colorimeter to compare the standard sample with question sample, if we have a two or more than two stain at crime scene or suspect lipstick stain from users and from the crime scene at calculated amount. The Colorimeter is designed to determine the concentration of a solution by analyzing its color intensity. Monochromatic light from a LED light source passes through a cuvette containing a solution sample, Some of the incoming light is absorbed by the solution. The Colorimeter consists of LEDs for red (680 nm), for green (542 nm) and for violet (400 nm) light. The colorimeter work on the Transmittance and absorbance of the light by the sample to be determine. In present study we had used red lipstick for examination there for we had used wavelength of red (680nm) light for absorbance by solution.

## 4 Result and Discussion

### 4.1 Result of TLC

The data collected from the chromatograms were recorded, and the Fro values were calculated using distance travelled by the solute.

**Table 2 Rf value and colour spot of branded lipstick samples on TLC**

Sr.no.	Sample	Colour of spots	Rf value

1	L1	Orange	0.66
2	S1	Orange	0.52
3	P1	Orange and light pink	0.60
4	P2	Orange	0.54
5	F1	Pink	0.44
6	C1	Pink	0.50
7	Cs1	Orange and pink	0.63
8	R1	Orange	0.58
9	R2	Orange	0.56
10	O1	Orange	0.62
11	E 1	Red	0.55
12	A1	Orange	0.61

3	P1	Orange	0.60
4	P2	Orange and pink	0.50
5	F1	Pink	0.48
6	C1	Pink and blue	0.54
7	Cs1	Orange	0.3
8	R1	Pink and org	0.53
9	F1	Orange	0.74
10	O1	Orange	0.59
11	E 1	Pink ,orange and yellow	0.55
12	A1	Orange	0.53

**Table . 3 Rf value and colour spot of local brand lipstick samples on TLC**

Sr .no.	Sample	Colour of spots	Rf
1	Y1	Orange	0.59
2	Y2	Orange	0.61
3	Y3	Orange	0.62
4	T1	Pink	0.6
5	Fr1	Light pink	0.32
6	B1	Pink	0.53

**4.2 Result of paper chromatography**

**Table .4 Rf value and colour spot of branded lipstick sample on paper chromatography.**

Sr.no.	Sample	Colour of spots	Rf value
1	L1	Orange, blue and light red	0.63
2	S1	Orange,blue and pink	0.59

**4.3 Result of Ultraviolet light**

**Table .5 lipstick sample on TLC plate examine by ultraviolet light.**

sr.no.	Samples	fluorescence in Short UV $\lambda$	fluorescence in Long UV $\lambda$
1	L1	Absent	Absent
2	S1	Present*	Presnt*
3	P1	Absent	Present**
4	P2	Absent	Present*
5	F1	Absent	Present*
6	C1	Absent	Absent
7	Cs1	Absent	Present *
8	R1	Absent	Absent
9	R2	Absent	Present*
10	O1	Absent	Absent
11	Cs1	Absent	Present *
12	E 1	Present*	Present *
13	A1	Absent	Present**
14	Y1	Absent	Present*
15	Y2	Absent	Absent*
16	Y3	Absent	Present*
17	T1	Absent	Present **
18	B1	Present*	Present*

\*\* strong fluorescence \*weak fluorescence

Sr.no.	Sample	Absorbance	Transmittance
1	L1	0.25	0.75
2	S1	0.31	0.69
3	P1	0.47	0.53
4	P2	0.45	0.55
5	F1	0.28	0.72
6	C1	0.4	0.6
7	O1	0.11	0.89
8	Cs1	0.39	0.61
9	A1	0.33	0.67
10	R1	0.3	0.7
11	R2	0.31	0.69
12	E1	0.2	0.8
13	Y1	0.14	0.86
14	Y2	0.13	0.87
15	Y3	0.12	0.88
16	Fr	0.43	0.57
17	T1	0.63	0.37
18	B1	0.5	0.5

#### 4.4 Result of photo colorimeter

Table .6 absorbance and transmittance of light through sample in photo colorimeter



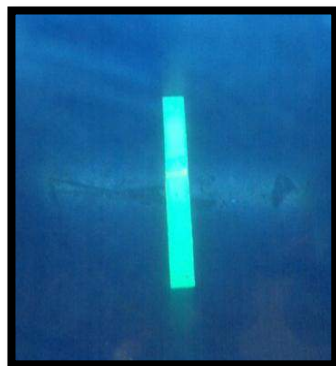
Figure.1 developed TLC plate through new solvent system



Figure 2 developed chromatograph paper through new solvent system



Figure 3 pigments or dyes were separates on paper chromatography



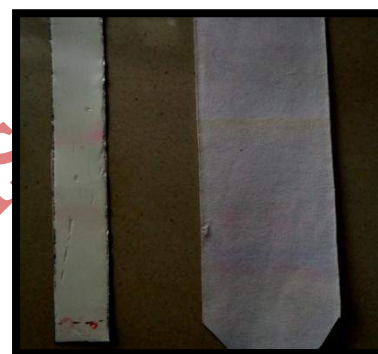
**Figure.4 Fluoresce under short UV light**



**Figure.6 separation through new solvent system.**



**Figure .5 Fluoresce under long UV light**



**figure.7 separation though suggested solvent system**

According to table. 2, 3 and 4 TLC plate and chromatograph paper were spotted with lipstick stain of different brands of same shades (red) and run under new solvent system isopropyl alcohol: acetone: D.W: ammonia (35: 35: 25: 5) after complete running of solvent system on TLC and chromatography paper were taken out and dried it. The colour spots were observed with distance travel by solute as shows in fig. 1 , 2 and 3 and it was found that above solvent system shows better result in both TLC and as well as paper chromatography.

According to table . 5 TLC plate were kept under UV chamber for observation of fluorescence of lipstick sample under short UV wavelength and long UV wavelength light for the comparison of suspect lipstick stain with question lipstick stain.

According to table. 6 study was done by observing the absorbance of light at 680 nm by the various lipstick stain .the result as represented in Table.6 shows significant variation among different sample which give a strong scientific reason that the stain can be differentiate by colorimetric technique the lipstick stain of the various brand can be compare on the basis of absorbance of light by the sample at known amount of question and suspect lipstick stain. According to present study the new solvent system were given better result on TLC as well as paper chromatography in comparison with the suggested solvent system. fig. 6 and 7 shows that clear and prominent colour of spots by new solvent system and dull colour of spots on chromatography paper in suggested solvent system respectively.

## Conclusion

Lipsticks which are available in the different varieties of colours due to presence of various dyes and their mixtures. Normally a lipstick can be differentiated in to colour appearance. But when two or more of same colour of lipstick smear is present on the crime scene, then it were identified by different techniques. The single shade of lipstick of different brand was chosen for the analysis in present study using different techniques like, TLC ,paper chromatography by using new solvent system [isopropyl alcohol: acetone: distill water: ammonia(35: 35: 25: 5)], photo colorimeter and UV light. The following conclusions were made for forensic consideration ;

- The new solvent system was given better result in both TLC and paper chromatography technique rather than other solvent system
- Paper chromatography was also good method for separation of lipstick stain and it was shows better separation than TLC because its better absorption property.
- The fluorescence and absorbance of light also play important role to place a link between question and suspect lipstick stain.

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