

A comprehensive study and exploration of document frauds with assistance of erasable pens

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Abstract: *Background:* Today's time in document frauds is major issues in the public. Forensic document examination is most important branch in fraudulent document investigation. Erasable ink pen new weapon for fraudulent document preparation. Erasable ink pen strokes removed by rubbers which is incorporated with pen. This erasable ink pen written strokes manipulated using incorporated eraser and application of heat. Erasable ink pen erased writing deciphered and new erasable pen entry discovery using Video Spectral Comparator-6000/Hyperspectral instrument. Fraudulent document examination by forensic document expert in India this study was most helpful to identification and distinguish the erasable pen in document fraud.

Key Words: Document fraud, Forensic document examination, Erasable ink pen, Video Spectral Comparator-6000/Hyperspectral.

1. INTRODUCTION:

In the investigation of questioned documents, alteration is a standout amongst the most widely recognized kind of fraudulent cases encountered. It covers everything from addition, obliteration and deletion, to tampering of any security sorts on the document. Typical examination of questioned documents might be divided into non-destructive and destructive examination. Under most conditions, non-destructive visual microscopic examination and comparison against respective authentic samples are preferred to avoid any further damage on the disputed documents, which already stand as a display in the courtroom [1] [2]. Undoubtedly, the destructive methods, which involve various chromatography and spectroscopy methods, provide much detailed information but this also brings irreversible damage to the documents [3] [4]. In addition, extraction of ink from the questioned documents and the subsequent analysis may only a minute not yield promising results with consistent reproducibility [5]. This is mainly because only a minute amount of ink could be obtained from an available pen stroke while the deposition of ink by the writing instrument onto the surface may not be uniform throughout the entries [1].

Generally, the color of pen strokes originates from dyes or pigments in ink while other additive substances give the desired physical properties such as viscosity, opacity, and appearance [6]. There is a wide variety in ink compositions available in the market nowadays, which consist of various organic, inorganic, and synthetic materials with different properties and characteristics [1, 5]. However, the composition of ink normally remains secret to the manufacturers and its formula is often revised to achieve higher quality and economic profits. Hence, there will be the same manufacturer over years of production.

Frixon ink pen had been introduced in the UK as early as 2006 and it entered the India market in recent years [7]. The remarkable characteristics of Frixon ink pen is that the ink deposited on paper will gradually disappear when it is exposed to heat or friction [8] [9]. Upon purchase, the pen manufacturers alerted the users about the fading characteristic of ink to prevent any application in documents for official purposes [10-13]. However, this exceptional quality inevitably makes it a fitting tool for fraudulence crimes such as multiple entries on cheques, drafts, contracts, or other potential documents for legal purposes. But to the best knowledge of the authors, there is a dearth of publications in recent years that are related to multiple entries with Frixon ink pen [14-16]. Although there are no reported Frixon ink alteration cases in India yet, it is crucial to establish strategic procedures beforehand to tackle such cases and further highlight the existence of this issue among document examination in this region.

2. AIM OF THE STUDY:

The first part of study focused on the deciphering of erased handwriting of erasable ink pen. Second part of experiment aimed at distinguishing between erased and freshly written handwriting using erasable ink pen. This erasable pen's spectral analysis also revealed.

3. MATERIALS AND METHODS”

3.1. Materials and Instrument

3.1.1. Materials

Pens:

The Pilot Frixion Ball blue color and Pilot Frixion Ball Clicker black color erasable pen inks were used to be analyzed in this study. The Pilot Frixion pen manufactured by Luxor, Japan with 0.7 mm tip. The pens with a small eraser incorporated within the pens. It was obtained from local stationary market shop.

Paper example:

A plain white A4 size paper (office paper / 80 gm/m²)

3.1.2. Instrument

Video Spectral Comparator 6000/HS (VSC-6000/HS, Foster & Freeman Ltd.) is highly inclusive and classy instrument with digital imaging arrangement which include different light sources, filters and high resolution and magnifying camera facilities to forensic document examiner and law enforcement agencies.

3.2. Methods

The examination divided in two parts of study and used two colors of Pilot Ball Frixion ink pens, 1.Blue and 2.Black. The first part of study focused on the deciphering of erased handwriting of erasable ink pen. In the first part of experiment in written words ‘BLUE’ and ‘BLACK’ with assistance of Erasable Pen on a sheet of A4 size white office paper by first blue and second black colored erasable ink pen. After the write-up, paper was heated the word "Blue" by dryer for 3-5 minutes on specific place to allow the erasable ink pen strokes to fade away. Second set of samples was rubbed off the written words ‘BLUE’ and ‘BLACK’ by using the eraser which incorporated with pen. Second part of experiment aimed at distinguishing between erased and freshly written handwriting using erasable ink pen. Subsequent, for the second part of the experiment, new word "Expert" was added onto above-mentioned faded/erased specific word place handwriting in both sets of samples by using same pen, seeing that the similar type of pen is likely to be used repeatedly over the same document for fraudulent purposes.

4. RESULT AND DISCUSSION:

Two sets of erased and heated samples for two colors blue and black erasable ink pen. Both colors pen showed the same, consistent results throughout this study. The erased/faded handwriting under both appliance could still be observed directly on the paper with the aid of the Video Spectral Comparator-6000/HS. Successful reading of erased/faded entries on paper. The first part of study in word ‘BLUE’ is shows erased in fig.1. VSC-6000/HS examination under fluorescent light decipher the erased word ‘BLUE’ show in fig.2 is clearly readable form on paper.

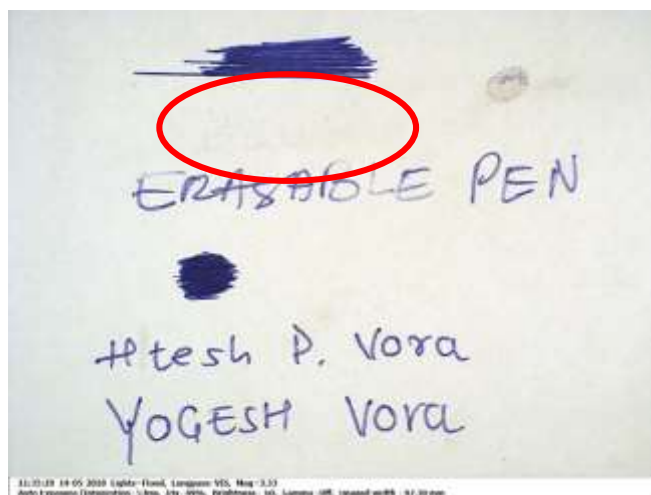


Figure 1 Blue Erasable ink pen written of word 'BLUE' is erased.

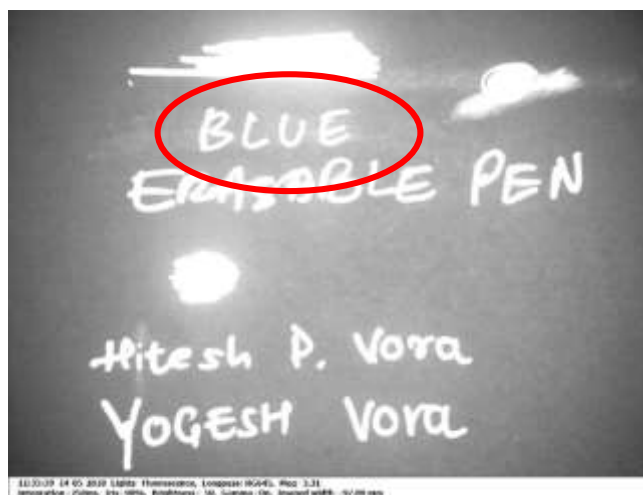


Figure 2 Blue Erasable ink pen of erased word 'BLUE' decipher under fluorescent light.

Below black erasable ink pen also same consistent result show in word 'BLACK' fig.3 and fig.4.

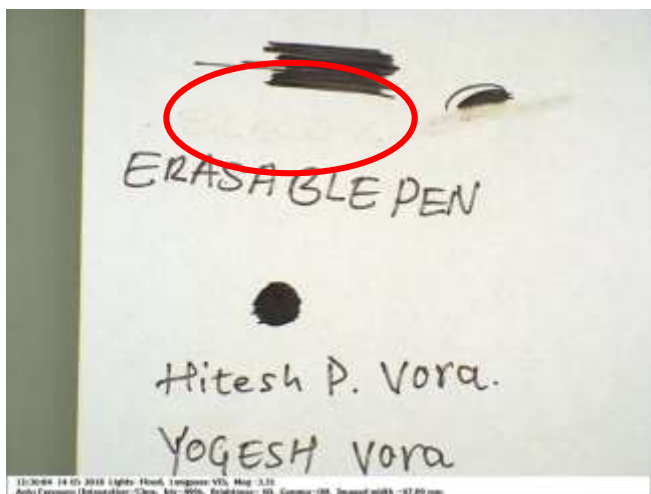


Figure 3 Black Erasable ink pen written of word 'BLACK' is erased.

Figure 4 Black Erasable ink pen of erased word 'BLACK' decipher under fluorescent light.

Second part of the study was distinguish between erased and freshly written handwriting of erasable ink pen. In this experiment erased word place show in fig.1 above new word written was 'EXPERT' is show on fig.5 and fig.6

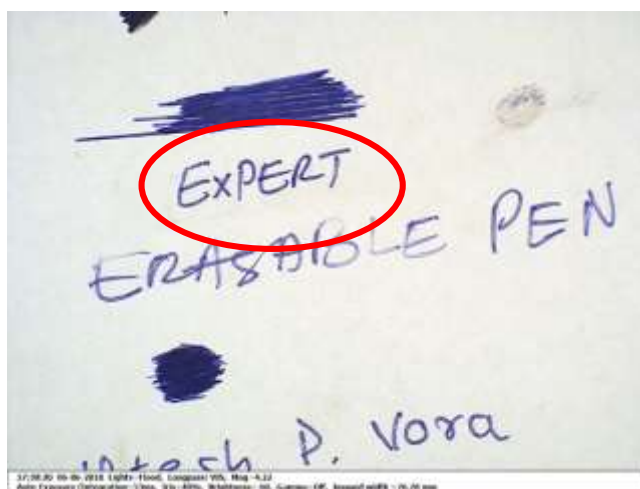


Figure 5 new word 'EXPERT' write over erased spot using blue erasable pen.

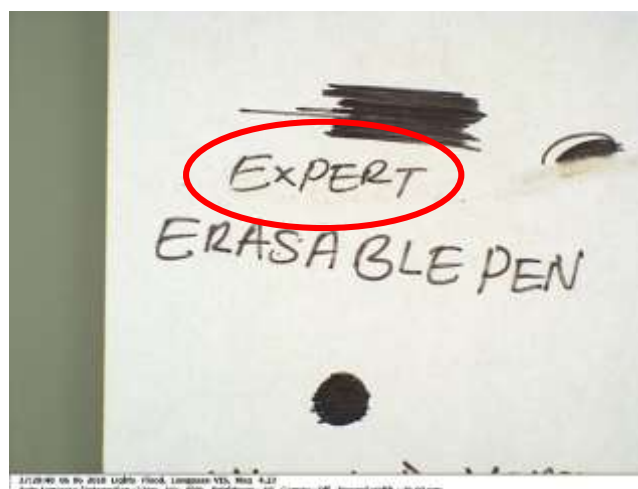


Figure 6 new word 'EXPERT' write over erased spot using black erasable pen.

In this experiment examination in VSC-6000/HS observation found that is writing of blue erasable pen decipherment of erased and fresh written under Ultraviolet 312nm. Whereas black erasable erased and fresh written decipherment under fluorescent light condition.

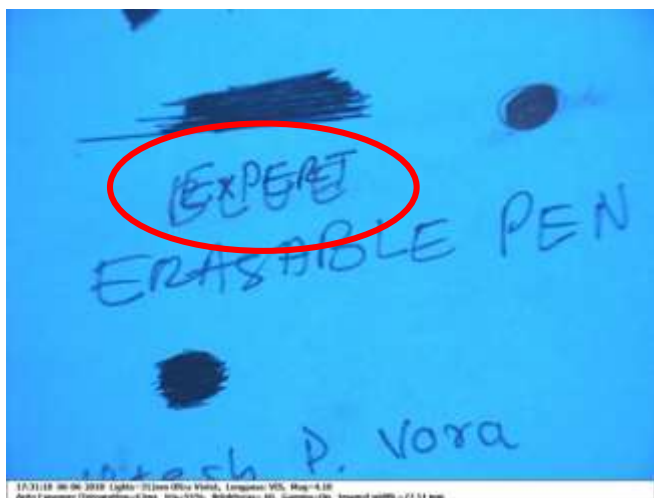


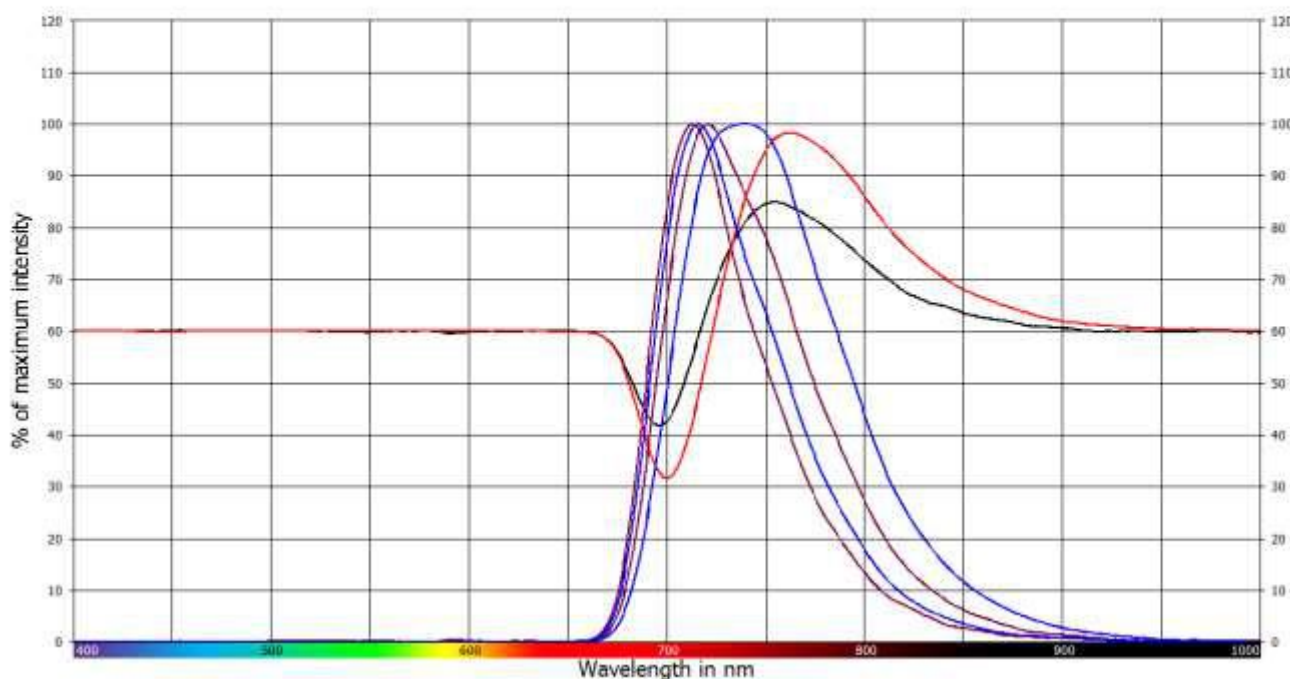
Figure 7 erased word 'BLUE' and new written word 'EXPERT' clearly deciphered in blue erasable ink pen.



Figure 8 erased word 'BLACK' and new written word 'EXPERT' clearly deciphered in black erasable ink pen.

Observation of erasable ink pen handwritten and erased/faded under fluorescent light condition ink reflex fluorescence. Further examination of this fluorescence must be measure. Fluorescence spectra measure using VSC-6000/HS. Fluorescence spectra of erased spot and freshly overwrite strokes in fig.5 Below fig.5 blue erasable pen in show that blue line fluorescence spectra 1 ((writing)blue erasable pen)spectra 2 ((erased writing)blue erasable pen). In spectra 3 (1-2) is difference of erased and freshly overwrite erasable ink fluorescence in red line. As same as in black erasable pen fluorescence spectra 4 and 5 show on violet line. Difference of fluorescence spectra 6 (4-5) is seen black line in fig.5

1	Flu	(WRITING)BLUE ERASABLE PEN	11		
2	Flu	(ERASED WRITING) BLUE ERASABLE PEN	12		
3	I-2		13		
4	Flu	(WRITING) BLACK ERASABLE PEN	14		
5	Flu	(ERASED WRITING) BLACK ERASABLE PEN	15		
6	I-5		16		
7			17		
8			18		
9			19		
10			20		



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Figure 9 Fluorescence spectra of erased and fresh written erasable ink (Blue & Black)

Conducted experiment in found that erasable ink pen decipherment of erased or faded written part from the document. Secondly erased part on new fake or fraudulent entry of handwriting distinguish under fluorescent and UV light in VSC-6000/HS. All fluorescence spectra taken and that clearly indicate different fluorescence of erased and freshly written new handwriting in prepared fraudulent document.

5. CONCLUSION:

In Questioned document examination, the ink examination is particular significant to fraud revealing. This new Erasable pen was available in stationary market and easy to hand of fraudulent person. In this study first decipher of erased portion of writing under fluorescent light. Secondly overwriting on erased part of document with same erasable pen visible under fluorescent. This erased and freshly written part distinguish by fluorescent spectra examination. The disappeared ink cannot be detected by normal light, infra-red illumination, or by the conventional methods of examination. This research paper signals the forensic experts to the existing erasable ball-point pens and describes a method in deciphering it. Detection of impression strokes under spot fluorescent light and specific UV range 312nm. The detection under Video spectral comparison-6000/HS given improved outcome in terms of other conventional destructive method detection.

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