Original Article

International Journal of Forensic Science
Volume 2 Number 1, January - June 2019

Decipherment of Ball Point Pen Writings on the Charred/Burnt Paper

Chetna Rajendra Tidke[1], K.P.S Kushwaha[2]

How to cite this article:

Chetna Rajendra Tidke, K.P.S Kushwaha. Decipherment of Ball Point Pen Writings on the Charred/Burnt Paper. International Journal of Forensic Science. 2019;2(1):21-24.

Abstract

Burning of documents is one of the methods used by the perpetrators to destroy the evidence. Three decades before, liquid inks of different colours were used for writing the documents, therefore, according to that the techniques were developed for deciphering the written matter on charred/burned documents written with these inks. Now, the liquid inks have been replaced by either viscous inks or gel based inks, which are used in ball point pens and gel pens respectively. Accordingly, present study has been undertaken to decipher the ball point pen writings on the papers charred at six different temperatures viz. 210ºC, 220ºC, 230ºC, 240ºC, 250ºC, 270ºC. The study involves the use of ammonia solution for deciphering the writing on the experimentally charred documents.

Keywords: Charred/Burnt Documents; Decipherment; Ammonia Solution; Forensic Document Examination.

Introduction

Sometimes, a document may catch fire accidently or a person involved in some clandestine activity may deliberately destroy the evidence by burning it. During burning, one or a few sheets of paper may get completely burnt whereas several sheets of paper stacked together may not burn completely because of limited supply of oxygen. In such cases, the decipherment of writing on charred/ burnt document becomes a challenge. Before the 20th century, writing inks contained of traces of metals like iron and copper as a tagging agent. Therefore, for deciphering the writing written with such inks, Davy (1821) developed a colour test method in which potassium ferrocyanide was used to decipher the written content. Blagden (1787) used potassium ferrocyanide to test nature of ink on ancient parchment. Davis (1922) developed the photographic plate development method to decipher content on the charred document. Mitchell (1925) used calcining method, which is a process of further burning of carbonized fragment to decipher the content written with pencil or some special inks, or typewritten or printed matter. Mitchell

Author's Affiliation: [1]Ex-Student, [2]Senior faculty, National Institute of Criminology and Forensic Science, Ministry of Home Affairs, Govt. of India, Rohini, Delhi 110 085, India.

Correspondence and Reprint Requests: K.P.S Kushwaha, Senior faculty at National Institute of Criminology and Forensic Science, Ministry of Home Affairs, Govt. of India, Rohini, Delhi 110 085, India.

E-mail: kpsingh11@yahoo.com

Recevied on 01.05.2019, **Accpeted on** 18.06.2019

(1935) used infrared light with filters and plates for enhancing the content on the charred documents. Radley and Grant (1940) used fluorescent oil and ultraviolet light to decipher the writing successfully on printed matter, photocopies, typescript and carbon copies. Taylor and Walls (1941) developed chloral hydrate method to decipher the printed matter and typescript. Gones (1941) enhanced the handwritten content using photographic method. Murray (1941) used 5% solution of silver nitrate to decipher the content on printed document specially letter press and ink containing metallic constituents. Black (1948) used alcohol-glycerin method to decipher the content on charred printed and typewritten documents.

Over the period of time, the composition of writing ink has changed because the iron content in it was corrosive to the nib of pens and was also responsible for damaging effect on the paper. Currently, the inks used in ball point pen contain dyes, pigments, glycerol, alcohols, resins, oil and fats without any traces of metals. Therefore, after burning the documents written with such inks, their contents like dyes, pigments, alcohol, resins etc. are burnt out, but the oils and fats which are used as lubricant in these inks remain on the charred paper because of their high boiling point.

The present study is an attempt to decipher the ball point writing on sheets of paper after charring up to 270°C. For this, ammonia solution was sprayed on the charred paper sheets because it vaporizes very quickly and has no damaging effect on the charred sheet.

Materials and Methods

Paper sheets of A4 size (century green make, 70g/m^2) were cut into pieces (15x8.5 cm). On these pieces, a text "Alice killed your mother and buried in the garden" was written using 45 different ball point pens. One ball point pen was used to prepare 6 different samples. Accordingly, 270 samples were prepared. The samples from each pen thus prepared, were subjected to heat at 6 different temperatures in furnace viz. 210°C, 220°C, 230°C, 240°C, 250°C, 270°C for 8 to 10 minutes.

The charred samples were placed gently on the white sheet of paper and were photographed. Thereafter, the charred documents were treated with ammonia solution using two different methods.

The charred samples were placed in fuming chamber containing 50 ml ammonia solution for 12 hours. The samples were observed intermittently. However, no appreciable development of the writing was observed even after 12 hours alternatively when the charred samples were gently sprayed with ammonia solution using finet spray pump, the writings on the charred samples were clearly deciphered. These were photographed in visible light immediately as the writing developed after spraying the ammonia solution disappears quickly due to evaporation of ammonia solution (Figs. 1 to 6).

Results and Discussion

In the present study, the sample writings on sheets of paper, written with different ball point pens, were charred at different temperatures ranging from 210°C to 270°C (Table 1).

Table 1: Observations after treating/spraying the charred paper with ammonia solution.

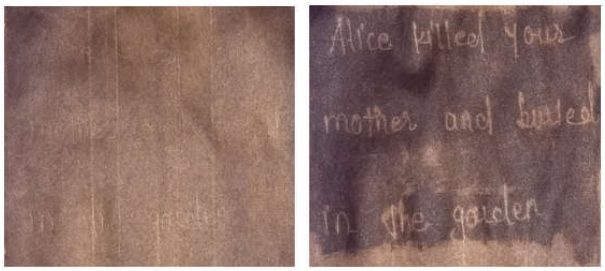
Temperature (°C)	Colour of paper after charring	Writings after spraying ammonia soln.
210°C	Light Brown	Visible
220°C	Light Brown	Visible
230°C	Brown	Faintly visible
240°C	Dark Brown	Faintly visible
250°C	Dark Brown to grey	Very faintly visible
270°C	Grey to Black	Not visible

It was observed that at 210°C and 220°C, the colour of papers changed from white to light brown and the ink on the paper was completely evaporated due to the action of heat as a result no writing was visible. However, on spraying the ammonia solution over the charred papers, the writings became visible as white strokes. At 230°C and 240°C, the paper colour changed to brown and dark brown, respectively, and on spraying the ammonia solution, faint writing appeared. At 250°C, the colour of paper became dark brown to grey and and on spraying ammonia solution,

a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (visible)

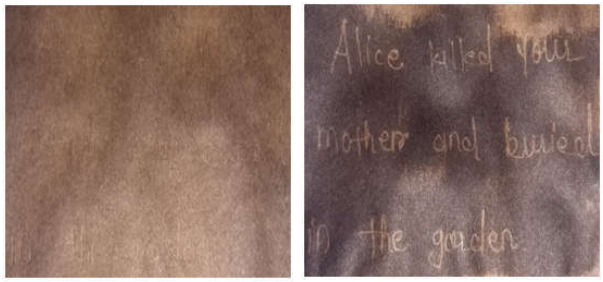
Fig. 1: Photographs of document charred at 210° C written using ball point pen.

very faint writing developed. Similarly, at 270°C, the document became grey to greyish black and on spraying ammonia solution nothing could be deciphered.



a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (visible).

Fig. 2: Photographs of document charred at 220°C written using ball point pen



a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (faintly visible).

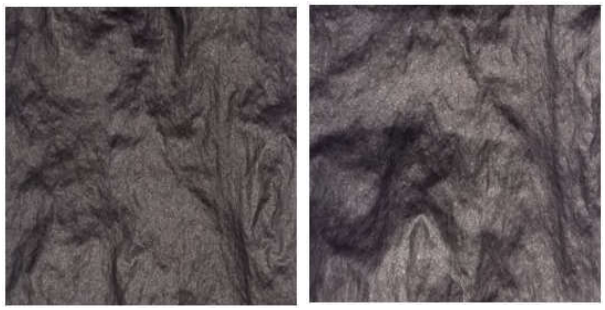
Fig. 3: Photographs of document charred at 230°C written using ball point pen.

a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (faintly visible).

Fig. 4: Photographs of document charred at 240°C written using ball point pen.

a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (very faintly visible).

Fig. 5: Photographs of document charred at 250°C written using ball point pen.



a) Sample writings after burning (not visible)
b) After spraying with ammonia solution (not visible).

Fig. 6: Photographs of document charred at 270°C written using ball point pen.

Conclusion

Ink of ball point pen contains oils and fats as lubricants and their traces remain on the paper after charring upto 250°C, because of their high boiling points. Due to difference in polarity of ammonia solution and oils and fats, the residual traces of oils and fats on the burnt paper act as repellant to the ammonia solution. Hence, the ammonia solution gets absorbed by the charred paper except on the writing, leading to the differentiation due to color contrast between writings and the background. As the ammonia is volatile in nature, it evaporates quickly and has less damaging effect on the charred paper. Therefore, the documents written with ball point pen if charred upto around 250°C, the writing can be deciphered and read easily by gently spraying the ammonia solution. The deciphered writing can be photographed immediately for record. Thus it is concluded that this method can be effectively used in deciphering the writings on paper written with ball point pen which have been charred between 220°C to 250°C.

References

1. Bartha A., & Duxbury N.W. Restoration and Preservation of Charred Documents. *Canadian Society of Forensic Science Journal*. 2013;2-5.
2. Black D.A. Decipherment of Charred Documents. *Journal of Criminal Law and Criminology*. 1948;38(5):542-46.
3. Doud D. Charred Documents, their handling and decipherment. *Journal of Criminal Law and Criminology*. 1953;43(6):812-26.
4. Grant J. Deciphering charred documents- some recent work and method. *Royal Society of Chemistry*. 1942;791:42-46.

5. Jones G.A. Decipherment of Charred Documents. *Nature: International Journal of Science*. 1941;147(3735): 676-77.
6. Mitchell C.A. The Examination of Charred Documents. *Analyst*. 1925;174-80.
7. Taylor W.D., & Walls H.J. . A New method for Decipherment of charred documents. *Nature International*. 1941;147:417.
8. Tyrrell J.F. Decipherment of Charred Documents. *Journal of Criminal Law and Criminology*. 1939;30(2):236-42.