

PAPER EXAMINATION: A Review

Rajinder Kumar ^{1*}

M.Sc Forensic Science and Toxicology, UIAHS, Chandigarh University, India

ABSTRACT

Paper is a fine material produced by pressing simultaneously the saturated fibers of cellulose pulp originated from wood, rags or grasses and drying them into flexible pages. There are different types of paper bond paper, glass coated paper, matt coated paper, recycled paper, silk coated paper, uncoated paper, watermarked paper etc. This review paper conclude that questioned document examiner examine the document by using analytical techniques include spectrometric technique and separation technique, video spectral comparator which is used to differentiate ink , detect alteration and decipher obliteration. This review paper recommends that the cellulose examination of paper may help in the paper examination of the documents in future.

INTRODUCTION

Paper is a fine material produced by pressing simultaneously the saturated fibers of cellulose pulp originated from wood, rags or grasses and drying them into flexible pages. It is a multipurpose material with many uses which include writing, printing, packaging, cleaning, and a number of industrial and construction processes.[1]

COMPOSITION OF PAPER:-

Cellulose fiber:- The primary raw material for manufacturing paper is cellulose fibers, which are short, threadlike structures. Cellulose fiber is the basic building block of plant matter, and large amounts of it can be achieved from wood. There are four main sources of cellulose fiber used in the production of paper; softwood trees, hardwood trees, recycled fiber, and rag (usually composed of textile cuttings and cotton). As a fifth option, synthetic fibers are sometimes used for specialty papers. Other plants, such as sugar cane or bamboo, are also used as fiber sources. Softwood and hardwood trees are the most commonly used sources of fiber for sheetfed offset papers. Each source produces fiber with a little difference in characteristics. Hardwood trees like poplar, birch, and maples produce shorter fibers, about 1mm in length. Softwood trees like spruce, pine, and fir produce longer fibers, about 3 mm in length. The longer softwood fibers have a tendency to give paper more potency due to better interlocking of the fibers. The shorter hardwood fibers provide paper with bulk and better surface smoothness.

Paper is manufactured by a variety of ingredients in addition to fiber, which includes sizing materials, mineral fillers, and coloring matter.

1. Sizing:-Sizing materials includes starch and rosin. These constituents may be added internally, externally, or both. Internal sizing is intended to give the paper water resistance, a key factor in papers used for lithography.

2. Fillers. Mineral fillers (finely divided, relatively insoluble inorganic materials or minerals) are added to the fiber before the sheet is formed to increase smoothness, opacity, and color. They also reduce strike-through, a condition whereby ink penetrates the paper and shows up on the other side. Fillers also improve the ink receptivity of offset papers.

3. Pigments. Colored paper need the addition of pigments and dyes. Colored papers are fairly common in sheeted offset lithography. The print designer should understand the unfavorable effect that colored papers will have on colored inks and images. [2]

Types of paper:-

Bond paper

This type of paper is stronger and more durable than the average sheet of paper. Instead of being made

from low grade wood pulp, it is mostly made up of scrap pulp. It's perfect for letterheads, typed reports and envelopes.

Gloss coated paper

Gloss paper is normally used for flyers and brochures as it has a high shine. As the ink dries well there is no need for a seal polish as the ink does not rub off.

Matt coated paper

Matt paper is the opposite to gloss – it is coated with a matt finish to produce a paper that isn't shiny, preventing glare. This type of paper is perfect for reports, flyers and leaflets.

Recycled paper

Made from re-used paper products, recycled paper is perfect for those who are trying to reduce their environmental impact. It can be used for most documents including reports, memo paper and forms.

Silk coated paper

The intervening between gloss and matt, silk coated paper has a smooth silky coating, leaving it smooth to the touch but without the shine of glass paper. This type of paper can be used for many things such as magazines, books and catalogues.

Uncoated paper

Typically found in most office printers, uncoated paper has no coating, making it superb for ink receptivity and absorbency. As it is uncoated it has the benefit of being used by both printer and pen, ideal for forms, letterheads and memo paper.

Watermarked paper

Used in high quality paper watermarked paper give a feel of luxury and high quality. To create its desired effect an impression is pressed into the paper by attaching a wire pattern. This type of paper is commonly used as a security feature for important documents, including exam certificates.[3]

Review of literature

1. **Calcerrada M¹, García-Ruiz C²** (2014) Emphasize about the analysis of ink from pens and printers , analysis of paper and other related questioned document by using analytical techniques. Analytical techniques includes spectrometric techniques and separation technique.[4]
2. **Sukalpa Chanda (2015)** Emphasize about the analysis of torn document is more challenging due to light data content and degree of difficulty will increases when large number of such documents are to be analyzed. A forensic expert might overlook evidences in this huge pool of data. scientific methodologies can narrow down the search space of a forensic expert. A forensic expert set criteria fragment analysis in which (1) text/graphics segmentation;(ii) segmentation of text type (printed/handwritten);(iii) script identification of text;(iv) identification of the writer; (v) identifying the font of the printed text [5]
3. **Jane.A.Lewis(2014):-** Describe about the forensic document examination which is a part of Forensic science in which. Forensic Document Examiner (FDE), Questioned Document Examiner, Document Analyst, Document Examiner, and Handwriting Expert use different analytical technique to solve cases. Cases submitted to FDEs include: forged checks, threatening letters, disputed signatures on wills, trusts, business documents, mortgage documents, typewritten documents, altered business documents, medical records, and photocopied documents.[6]
4. **Jane.A.Lewis(2014):-** Emphasize that a forensic document examiner depends on the special lab instruments. For the examination of uncertain signature or printing process examination the expert requires Magnifiers from 3.5–7× and Digital cameras and macro Stereo microscopes are vigorous instruments used in the forensic document examiner's laboratory. Video Spectral Comparators(VSC) used to differentiate inks, detect alterations, and decipher obliterations.[7]
5. **Drs. Sander Flight Dr. Cees Wiebes :-** Emphasize a study to evaluate the demand for questioned document examination for counter terrorism in the Netherlands and other countries. In addition, they want to find out how the need for these analyses develops and whether movement can be seen. They use three source of information in the research: literature review, registrations and interviews. The interviews proved to be the most useful source of information. They spoke with fifteen Dutch experts: 6 from the NFI, 3 questioned document examiners and 6 from organizations that use or could use questioned document examination. In addition, they communicate with sixteen foreign experts from eight different

countries: Australia, Canada, Denmark, Germany, France, Spain, United Kingdom and Sweden (8 questioned document examiners and 8 experts from the field of counter-terrorism within the police or within the intelligence- or security services). The research was managed by an recommended board consisting of experts from science and practice. [8]

6. **Olson, LA (1986):-** Give emphasize to the use of specific analytic instrument in Immigration & Naturalization Service Forensic Document Laboratory (INSFDL), is the *Nanometrics 10S Microspectrophotometer*, manufactured by Nanometrics, Inc., of Sunnyvale, CA. This pseudo-dual-beam spectrophotometer execute nondestructive color analysis of objects below the size of 2 micro-meter. Initially, the object which is examined (such as an ink line) is viewed through a microscope and the light reflected from object is measured over the visible spectrum. The reflected energy is then compared with a standard whose information already stored in the microprocessorsystem, and a spectral curve is provided which is characteristic of the color of the object examined. At INSFDL, the Nanospec 10S™ has been successfully used to differentiate like colored printing inks, stamp pad inks, and fibers found on various travel and identity documents.[9]
7. **Shigeru Sugawara M.S. used** a new nondestructive technique for passport examination in which linearly polarized light is used to measure Fourier transform infrared (FT- IR) reflectance spectra of films on the real data page. They examine Thirty genuine and thirty- five counterfeit Japanese passports and five marketed films pasted on name cards.The absorption spectra were obtained by the Kramers–Kronig transformations of reflectance spectra. The peak ratios were then calculated from the absorption spectra by adding the peak areas at 1126 and 1263 cm^{-1} and dividing the result by the peak area at 1727 cm^{-1} . When non-polarized light was used, the samples could not be differentiated by comparing the peak ratios. However, when polarized light was used, they were successfully differentiated by the comparison. Therefore, polarized light is useful for the forensic discrimination of passport films by the measurement of FT- IR spectra.[10]
8. **Shigeru Sugawara (2008) suggests** a nondestructive and highly accurate technique of measuring the thickness of a film pasted on a passport using a confocal-type laser profile microscope.Passport examination is confirmed by using this method . They used a confocal-type laser profile microscope to make profiles of the film surface and film–paper interface; these profiles are used to calculate the film thickness by using an algorithm developed. By using film thicknesses of the passport samples—35 genuine and 80 counterfeit Japanese passports—are measured nondestructively. The intra-sample standard deviation of the film thicknesses of the genuine and counterfeit Japanese passports was of the order of 1 μm The intersample standard deviations of the film thicknesses of passports forged using the same tools and techniques are estimated to be of the order of 1 μm . The thickness values of the films on the machine-readable genuine passports ranged between 31.95 μm and 36.95 μm . The likelihood ratio of this method in the authentication of machine-readable Japanese genuine passports is 11.7. Therefore, this method is applicable for the verification of genuine passports. [11]
9. **Throckmorton, GJ:-** studied the paper whose ink is erased by using different type of erasures. In the examination of questioned documents it is essential to identify the erasures or alterations have been made on a certain document or not. Recently its become easier for an individuals of normal skill to modify a document by using erasable ink. It is important for the document examiner to be able to identify if and when these inks have been used. By being conversant with the stability that these inks slowly attain on various types of paper, the probability of an erasure or alteration working unnoticed will be reduced. [12]
10. **R.L. van Renesse ;-** Emphasize the examination of documents and valuable products for genuineness can be divided into three categories: **first line inspection**-the inspection of the document or product with the human brain only without other apparatus ; **second line inspection**-the inspection of the document or product with the means of other tools like a magnifier, an ultra violet source, a bar code reader; **third line inspection**-the inspection of the document or product in laboratory conditions, using advanced know how, sophisticated means (spectrometers, microscopes, infrared radiation, etc.) and dedicated inspection services. It can be debated that first line inspection has a few psychological drawbacks and that machine

inspection grants considerably higher security. This may be true, but a major disadvantage of machine inspection is the current absence of setting and it cannot be considered how the many ingenious systems that have been invented can be put to general use. Obvious exceptions are the magnetic stripe and the chip card. However, there is little shelter in providing valuable documents and products with high tech and highly secure machine clear features if not, first of all, their first line public defence is sufficiently covered. First line security, therefore, is the main subject of the paper.[13]

Conclusion:-

This review paper concludes that questioned document examiners examine the document by using analytical techniques include spectrometric technique and separation technique, video spectral comparator which is used to differentiate ink, detect alteration and decipher obliteration. A new non-destructive technique for passport examination by using linear polarized light. When ink is erased from the paper, the cellulose surface of the paper is disturbed and color of the ink varies with the passage of time. This review paper recommends that the cellulose examination of paper may help to identify the age of the paper.

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