RESEARCH PROPOSAL

A COMPARATIVE ANALYSIS OF INK COMPOSITION UNDER ACIDIC, BASIC, AND NEUTRAL HYDROLYSIS CONDITIONS USING TLC

ABSTRACT

This study investigates the chemical breakdown of ink composition under acidic, basic, and neutral hydrolysis conditions using thin-layer chromatography (TLC). The analysis revealed significant changes in the ink composition, with shifts in RF (retention factor) values and the appearance of new chromatographic spots, indicating chemical transformations caused by hydrolysis. TLC, a simple yet effective analytical technique, provides valuable insights into these changes. In TLC I use a silica gel plate as the stationary phase, and for a solvent mixture of ethanol and water, a ratio of 7:3 is used. In this study, three hydrolysis conditions were used: acidic (HCl), basic (NaOH), and neutral (distilled water). In this study, I measure the Rf values for each separated component from the TLC plates and compare the Rf values of standard ink (non-hydrolysed) with those of hydrolysed samples to detect changes in chemical composition. This research contributes to forensic science by enhancing the understanding of ink composition under various hydrolysis conditions, aiding in document authentication and forensic analysis.

Keywords: Acidic, basic and neutral hydrolysis, chemical breakdown of ink, Thin layer chromatography, Retention . factor

INTRODUCTION

- Ink hydrolysis refers to the chemical breakdown of ink components under specific conditions. This process occurs due to environmental factors such as exposure to acids, bases, or water.
- The hydrolysis of ink can be analysed using thin layer chromatography (TLC) by comparing the Rf values of standard ink with those of hydrolysed ink. TLC is a simple yet powerful technique for analysing ink compositions and identifying changes in their chemical structure.
- This research aims to investigate the effects of acidic, basic, and neutral conditions on ink hydrolysis and to determine the corresponding Rf values. By comparing the Rf values of standard ink with those of hydrolysed ink, the changes in ink composition resulting from a chemical breakdown can be identified.
- Understanding the hydrolysis of ink is particularly significant in the field of forensic science, as it provides valuable information about whether a suspected ink sample has been exposed to chemical agents. Or any chemical alterations were present in the sample.

FORENSIC SIGNIFICANCE

- This study can determine whether a document has been exposed to specific chemical agents, providing key evidence in forensic investigations.
- The application of thin layer chromatography (TLC) for analysing ink hydrolysis is a simple, rapid, and effective technique widely applicable in forensic science.
- TLC is a cost-effective and efficient method for identifying chemical alterations in documents.
- This study can help to determine whether there are any chemical alterations in the document.

Need for this study

- Understanding ink hydrolysis enables the identification of whether documents have been chemically altered or tampered with.
- This analysis plays a crucial role in detecting forgery and ensuring the authenticity of documents.

Uniqueness of the study

- By analysing the effects of acidic, basic, and neutral hydrolysis conditions, this study explores how different environmental and chemical factors impact ink.
- This research is particularly useful in forensic investigations involving altered, aged, or chemically treated documents.

Statement of the problem

The purpose of this study is to examine the chemical changes in ink composition under neutral, basic, and acidic hydrolysis conditions by comparing the Rf values of non-hydrolysed ink with those of hydrolysed ink using thin-layer chromatography (TLC). This research aims to provide a simple and effective technique for ink analysis in forensic science.

OBJECTIVES

1. To identify the changes in ink composition under the effects of acidic, basic, and neutral hydrolysis.
2. To measure the Rf values for various hydrolysed ink samples.
3. To compare the Rf values of standard ink with those of hydrolysed ink samples.

RESEARCH QUESTIONS:

1. What chemical changes occur in ink composition under acidic, basic, and neutral hydrolysis conditions?
2. What are the Rf values of the various components in hydrolysed ink samples under different hydrolysis conditions?
3. How do the Rf values of hydrolysed ink samples compare to those of non-hydrolysed (standard) ink?

Sample Preparation :

Ink Selection: Use commercially available ballpoint pen ink for consistency.

Paper: standardized paper.

Chemical Exposure:

For acidic hydrolysis: Use hydrochloric acid (HCL).

For basic hydrolysis: Use sodium hydroxide (NaOH) or ammonium hydroxide (NH4OH).

For neutral hydrolysis: Use distilled water.

Thin Layer Chromatography (TLC) Analysis

TLC Plate: Use silica gel plates as the stationary phase.

Solvent System: Prepare a mixture of ethanol and water in a 7:3 ratio to serve as the mobile phase.

Data collection and analysis :

Measure the Rf values for each separated component from the TLC plates.

Compare the Rf values of standard ink (non-hydrolysed) with those of hydrolysed samples to detect changes in chemical composition.

EXPECTED OUTCOME

- Changes in Rf Values:

Acidic Hydrolysis: The Rf values may either increase or decrease compared to the standard (non-hydrolysed) ink, indicating chemical alterations.

Basic Hydrolysis: There is a likelihood of new chromatographic spots appearing, accompanied by changes in Rf values, reflecting significant chemical transformations.

Neutral Hydrolysis: Minimal changes in Rf values are expected, as neutral conditions are less reactive.

- A clear distinction between the non-hydrolysed ink and the hydrolysed ink will be demonstrated, highlighting the impact of hydrolysis on ink composition.

TIME PLAN

- 6/11/24 – 14/11/24 : litrature review
- 15/11/24 – 5/12/24 : Proposal writing
- 6/12/24 – 10/01/25 : Data collection
- 11/01/25 – 02/02/25 : Analysis and finding
- 03/02/25 – 20/02/25 : final submission

THANK YOU

By

S. Deve Bharathi

Reg no : 233462101014

Msc criminology and forensic science