



TEICHMANN TEST : ASSESSMENT OF HEMOGLOBIN CRYSTALS ON BLOOD SPOTS EXPOSED TO POWDER DETERGENT

Istiana Firqah Abid*¹, Erik Rezakola², Imam Yusuf Hanura²

¹Sekolah Pascasarjana Universitas Airlangga

²Bidang Laboratorium Forensik Polda Riau

*¹e-mail : Istianafirqahabid27@gmail.com

Abstrak

Barang bukti yang ditemukan di tempat kejadian perkara (TKP) berupa bercak darah perlu dilakukan pemeriksaan untuk memastikan bahwa barang bukti tersebut benar adalah darah sehingga dapat membantu proses penyelidikan. Akan tetapi dalam beberapa kasus, pelaku tindak kriminal dapat menghapus atau menghilangkan bercak darah menggunakan deterjen yang biasa digunakan sehari-hari yang mengandung surfaktan. Adapun tujuan dari penelitian ini adalah untuk mengetahui cara pemeriksaan dan gambaran kristal hemoglobin pada bercak darah yang terpapar beberapa deterjen bubuk menggunakan tes Teichmann. Penelitian ini menggunakan metode eksperimental dengan menggunakan 3 merek deterjen yang berbeda dengan 2 kontrol kontrol yaitu kontrol positif dengan adanya bercak darah dan kontrol negatif tanpa bercak darah. Hasil pemeriksaan didapatkan hasil kontrol positif pada semua percobaan sebanyak 100% masih memberikan gambaran kristal hemoglobin berbentuk belah ketupat berwarna coklat seperti jarum meskipun bercak darah sudah dipaparkan deterjen bubuk.

Kata Kunci: Bercak darah, Deterjen, Hemoglobin, Tes Teichmann

Abstract

Evidence found at the crime scene (TKP) in the form of bloodstains needs to be examined to ensure that the evidence is really blood so that it can assist the investigation process. However, in some cases, criminals can remove or remove bloodstains using detergents that are used daily which contain surfactants. The purpose of this study was to find out how to examine and describe hemoglobin crystals in blood spots exposed to several powder detergents using the Teichmann test. This study used an experimental method using 3 different brands of detergent with 2 controls, namely a positive control with the presence of blood spots and a negative control without blood spots. The examination results obtained positive control results in all experiments as much as 100% still giving a brown rhombus-shaped appearance of hemoglobin crystals like needles even though the blood spots had been exposed to powder detergent.

Keywords: Blood spot, Detergent, Hemoglobin, Teichmann test

1. INTRODUCTION

In the field of forensic science, evidence found at the crime scene (TKP) is very important for examination in handling criminal cases (Jonatan et al., 2005). Evidence that is often found at crime scenes (TKP) can be in the form of semen, saliva, urine, hair, other body tissues, and blood or bloodstains (Elpia et al., 2016).

Bloodstains can be found at crime scenes (TKP) such as on the floor, tables, chairs, walls, in some conditions that are not fresh (dry) so that further examination is needed to determine whether the spots are blood (Sari et al., 2015). In some cases, criminals can remove bloodstains using soap,

hand sanitizer, antiseptic liquid, floor cleaning fluid, and detergent.

Detergent is a chemical that is often found in everyday life and is most widely used, detergent is used as a cleaning agent because it contains surfactants which are able to clean dirt stains so that the dirt can dissolve in water (Pratiwi et al., 2015).

Several blood spot examination tests consist of presumptive tests, confirmative tests and specific tests with DNA testing. Confirmative tests were carried out with the Teichmann test and Takayama test. These two tests can help prove the formation of hemoglobin crystals or prove that a blood spot found at a crime scene is actually a blood spot (Probowowati et al., 2013).



Based on research conducted by Marselica (2015), it was found that the results of examination of blood spots exposed to several powder detergents by flowing them on the Teichmann test examination still gave an appearance of hemin crystals in the form of brown rhombuses and needle-like. This is because the surfactants contained in detergents have the ability to affect the permeability of the erythrocyte cell membrane where the erythrocytes undergo lysis so that hemoglobin will come out and accelerate crystal formation (Pata et al., 2004).

Based on the above background, examination of hemoglobin crystals in blood spots exposed to powder detergents using the Teichmann test is necessary so that it is necessary to observe the appearance of hemoglobin crystals in blood spots exposed to powdered detergents using the Teichmann test.

2. HEADING

2.1 Blood

Blood is a source of DNA that is often used as evidence in forensics. The condition of blood as evidence in the field (TKP) can be found in various media including iron, wood, cloth, walls, floors, paper and scissors which can affect the results of DNA extraction and analysis. In forensic science, the results of DNA analysis are very decisive evidence in solving several criminal cases (Putri & Junitha, 2015).

Fresh blood has a more important value than dry blood, because from the test results for the quality of fresh blood better results can be obtained. In conjunction with forensics, the speed of handling a case involving blood as evidence becomes very important. They are responsible for testing (analyzing) various types of evidence obtained at the TKP, identifying, quantifying and documenting evidence. The results of the analysis are then evaluated, interpreted and a report is prepared based on expert information for legal or judicial purposes (Putri & Junitha, 2015).

The blood will dry after contact with outside air within 3-5 minutes. As soon as the blood dries, the blood will change color from red to blackish brown. Blood in a criminal case can be in the form of a pool of blood, droplets, swabs or crusts. From a pool of blood, better DNA results will be obtained because it is fresh blood (Darmono, 2001). Blood found at the TKP needs to be subjected to a confirmatory examination to find out that the blood or bloodstains found at the TKP are genuine blood originating from a human, victim, or suspect so that further DNA analysis can be carried out to examine blood type and DNA chain from evidence of blood or the bloodstains.

2.2. Hemoglobin

Hemoglobin consists of the word "haem" and the word "globin", where haem is Fe and protoporphyrin is mitochondria, globin is a chain of amino acids (1 pair of α chains and 1 pair of non- α). Hemoglobin is a globular protein that contains iron. It is formed from 4 polypeptide chains (amino acid chains), consisting of 2 alpha chains and 2 beta chains (Isnati, 2008). Hemoglobin is a protein compound with Fe which is called a protein conjugate. The Fe core and protoporphyrin and globin (tetra phirin) skeletons give blood its red color. Hb binds to carbon dioxide to form carboxyhemoglobin and the color is dark red. Arterial blood contains oxygen and venous blood contains carbon dioxide (Sudikno & Sandjaja, 2016).

2.3 Teichmann Test

The Teichmann test was first described by Teichmann (1853), the test consists of heating dried blood with glacial acetic acid and a halide (usually a chloride) to form a hematin derivative. The crystals formed are observed microscopically, usually in the form of rhombuses and brownish in color. The age of the stain is no obstacle for experienced testers, and the test has even appeared in basic biochemistry student lab manuals. Crystals are formed by placing a blood sample of the suspect on a microscope slide and adding a small amount of chloride



containing glacial acetic acid followed by heating. The Teichmann examination is one of the confirmative examinations that uses acetic acid and halide (chloride) reagents which will form crystals, the formation of these crystals is probably due to Fe electrons being compounds that are easily oxidized so that they will bind to chlorides and form chemical bonds so that on microscopic examination heme crystals appear (Pangaribuan 2012). The bond that may be formed from glacial acetic acid and chlorine when it binds to oxidized Fe is a covalent bond. Covalent bonds can be formed due to the use of shared electron pairs of chloride atoms from Teichmann's reagent with Fe contained in heme. The bond that is formed is a strong bond that requires a strong chemical reaction to separate the atoms in the covalent bond.

Research conducted by Adair, Rebecca and Shaw (2005) using presumptive luminol and LCV tests on blood spots exposed to detergents still yielded positive results. On examination using a powder detergent containing sodium alkylbenzen sulfonate anionic surfactant and containing an alkaline protease enzyme which is a serine enzyme derivative, this positive result indicates that this surfactant does not affect the formation of hemoglobin crystals because the surfactant only affects the erythrocyte membrane but does not affect the heme group. on hemoglobin.

3. RESEARCH METHOD

This research is experimental by using 3 different detergent brands with 2 controls, namely the positive control with blood spots and the negative control without blood spots. Practical work is carried out at the Riau Regional Police Forensic Laboratory which is located at Sisingamangaraja Street, Rintis, Lima Puluh Kota, Pekanbaru City, Riau Province.

3.1 Making Bloodstain Slides

A total of six glass slides were cleaned of adhering dirt using a tissue, three of the six slides were dripped with 0.1 ml of

blood from the EDTA tube which was taken with a dropper dropper which was dropped vertically to a height of 2 cm and dried for 1 hour at room temperature ($\pm 25^{\circ}\text{C}$).

3.2 Dilution of Powder Detergent

As much as 10 grams of powder detergent is dissolved with 400 ml of water, stirred homogeneously using a stir bar until the mixture between the detergent and water is homogeneous.

3.3 Exposure of Powder Detergent to Bloodstains

The method of exposure of bloodstain samples to powder detergent solution is carried out by holding the bloodstain samples using a wooden holder and the sample is tilted at an angle of 45° , pouring 50 ml of detergent solution and then examining it using the Teichmann test.

3.4 The Teichmann method

Dried blood stains are placed on a glass object, add 1 drop of distilled water, 1 drop of glacial acetic acid and 1 drop of 0.9% NaCl (Sodium chloride), then heat over a Bunsen 65°C until it dries slightly. Add 1 drop of glacial acetic acid and cover with a coverslip. Heat the slide above 65°C Bunsen for 15 seconds, then cool. After cooling, observe the formation of crystals under a microscope with a magnification of 400x.

3.5. Data analysis

The results of observations of the hemoglobin crystals will be processed manually, then the images formed will be documented and then included in a frequency table containing positive (+) and negative (-) results, as well as a table depicting the results of the hemoglobin crystals formed.

4. RESULTS AND DISCUSSION

Examination of blood spots exposed to detergent used 6 slides of glass objects where 3 slides were positive controls (given 1 drop of blood which was allowed to dry) and 3 slides as negative controls then a confirmatory examination was carried out



using the Teichmann test. Teichmann test results obtained by microscopic observation with 400x magnification. Observational data obtained as many as 100% positive results or

Hemoglobin Crystals could be found in blood spots exposed to powder detergent as shown in Table 4.1.

Table 4.1. Teichmaan test results on blood spots exposed to some powder detergent.

No.	Detergent	Teichmann Test Results	
		Positive Control	Negative Control
1	A (Brand Boom)	+	-
2	B (Brand Daia)	+	-
3	C (Brand Rinso)	+	-
Total		3 (100%)	0

Hemin crystals have a rhombus-like shape that is elongated and brown in color which can be seen using a microscope with a total magnification of 400x. The inspection results can be seen in Figure 4.1.

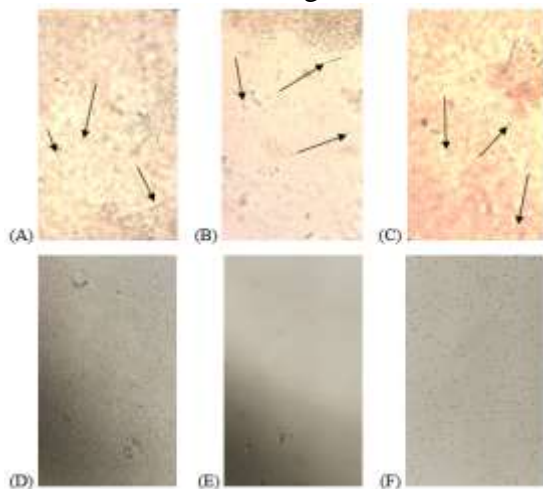


Figure 4.1. Teichmann test results; (A) brand A positive control, (B) brand B positive control, (C) brand C positive control, (D) brand A negative control, (E) brand B negative control, and (F) brand C negative control.

In examining the blood spots exposed to 3 different detergents, the exposure was carried out by flowing them with a powder detergent solution which did not result in the blood spots on the slide disappearing. This shows that the blood spots exposed to the Teichmann test powder detergent still give positive results (+). The positive result of the Teichmann test is because the surfactant does not damage the

heme group and the reaction in the Teichmann test. Surfactants also do not damage the covalent bonds in the heme groups, it is possible that the surfactants contained in detergents only work on cell membranes (see Figure 4.2).

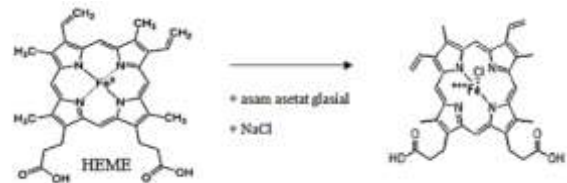


Figure 4.2. Hemoglobin Crystal Formation Reaction (Elpia *et al.*, 2016)

The enzymes contained in detergents are also unable to degrade proteins present in the blood so they do not have the potential to damage hemoglobin bonds. This examination is likely to give different results if more detergent concentrations are used and different exposure methods, so further research is needed (Marcelica *et al.*, 2015).

The appearance of hemoglobin crystals on examination using a 400x magnification microscope is brown, shaped like long needles and rhombuses as shown in Figure 4.3.

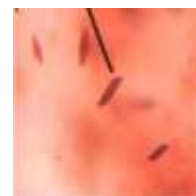


Figure 4.3. Hemoglobin crystal form (Elpia *et al.*, 2016)

5. CONCLUSIONS AND SUGGESTIONS



Based on the examination of the Teichmann test, it can be concluded that the results of examining blood spots exposed to several powder detergents by flowing them on the Teichmann test examination still give the appearance of hemin crystals in the form of brown rhombuses like needles so that they can prove that the blood spots are really blood.

THANK-YOU NOTE

The author would like to thank Bidang Laboratorium Forensik (Bidlabfor) Polda Riau who have assisted in the process of supervising data analysis in this study.

BIBLIOGRAPHY

- Adair T.W, Shaw R.L. 2005. Enhancement of bloodstains on washed clothing using luminol and LCV reagents. I.A.B.P.A News. 4-9.
- Darmono, 2001. Environment and Pollution (Relation with Toxicology of Metal Compounds). Universitas Indonesia Press. Jakarta.
- Elpia E.Y, Asni, Indrayana M.T. 2016. Hemoglobin Crystals in Blood Spots Exposed to Some Alcohol-Based Antiseptic Hand Sanitizing Gels Using the Teichmann Test and Takayama Test. Pekanbaru.
- Fakhrizal. 2004. Beware of Domestic Waste in Kali Mas. Institute for Ecological Studies and Wetland Conservation
- Isnaeni W. 2006. Animal physiology. Kanisius. Yogyakarta.
- Isnati (2008) Effects of Fe+ Deworming Tablet Supplementation on Hemoglobin Levels of Adolescents with Anemia at Pondok Pesantren Tarbiyah Islamiyah Pasir Kec. IV Lifting Bladder in 2008. Journal of Pharmaceutical Science and Technology, 13 (1). pp. 18-22. ISSN 1410- 0177. [5] Crosby, E., F
- James S.H, Kish P.E, Sutton T.P. 2005. Principles of bloodstain pattern analysis: theory and practice. Boca raton/Singapore : Taylor & Francis Group. pg. 14-367.
- Jonatan W, Allan J, Alan L, John D, Robr, David H. 2005. Practical skills in forensic science. pg. 407-409
- Mader, S.S. 2011. Human biology. New York: Mcgraww hill.
- Marcelisa S. 2015. Hemoglobin crystals in blood spots exposed to some powder detergents using the Teichmann test and Takayama test. Pekanbaru. Universitas Riau.
- Pangaribuan W.N. 2015. Imaging of hemoglobin crystals in blood spots exposed to several cream soaps using the Teichmann test and Takayama test. Pekanbaru.
- Passi N, Garg R.K, Yadav M, Singh R.S, Kharosha M.A. 2012. Effect of luminol and bleaching agent on the serological and DNA analysis from bloodstain. Egyptian Journal of Forensic Sciences.
- Pata V, Ahmed F, Discher D.E, Dan N. 2004. Membrane solubilization by detergent: Resistance coferred by thickness. Langmuir.
- Probowowati A. Giovanni P.C. Ikhsan D. 2013. Utilization of detergents in the household. Industrial chemical technology journal. vol.2. no.2.
- Putri P.E and Junitha I.K. 2015. The Quality And Quantity Of Dried Blood DNA On Iron And Wood Stored In Different Periods Of Time. Bali. Universitas Udayana.
- Rahmawati. 2014. The Effect of Detergent Giving on Hatchability of *Argulus japonicus* Eggs. Surabaya. Universitas Airlangga.
- Sadikin. 2001. Blood biochemistry. Jakarta. EGC. hal: 12-50.
- Sari Y.G, Asni E, Indrayana M.T. 2015. Description of Hemoglobin Crystals in Blood Spots Exposed to Several Non-Carbohic Domestic Floor Cleaning Agents. Pekanbaru.