

# Different blood stained clothes and their role in Forensic Serology to estimate the ABO blood groups

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## Abstract:-

Current study involves a vast majority of analysis that can be ultimately correlated to the different types of textiles. The blood stains (blood grouping antigens) on the clothes of the Deceased, Accused, Victim, Complainer, Injured or witness, reveals the specificity of particular blood group. This is carried out by a process called Absorption-Elution method, which is employed to measure the presence or absence of antigen or antibody. In this chapter we have studied eight different types of fabrics which are collected from the scene of crime by investigating agency, for blood grouping. And the variations in the results, after periodic time interval, are discussed. The problem increases when particular blood stain is found on various types of cloth articles which belong to the person who present at the crime scene. Hence a study was carried out to isolate the blood group from different types of cloth articles having different types of fibers.

**Keywords-** Absorption-Elution, Antigen-Antibody, ABO-Blood Grouping, Fibers

## Introduction-

In 1904, Sir Karl Landsteiner discovered the polymorphism in the form of blood group antigens. The blood groups discovered are 'A', 'B', 'AB' and 'O'. This ABO blood grouping system is the main stream blood group system applied in forensic serology. For the identification and investigation of criminal cases blood present on the clothes of individual or at the scene of crime has a key role to identify the criminal. The type of blood group within a system is very much important, as it contributes as valuable evidence.

After the breakage of RBC's the antigens on the surface get fixed on the evidence material. Hence proper preservation of the stained evidence material is an important job for the investigating agency, which is employed to measure the presence or absence of antigen or antibody<sup>(1)</sup>

In many criminal cases the clothes are received in the forensic science laboratories which are found many times in wet, or highly soaked in blood, deteriorated partly burnt conditions due to rain, blood, urine, beer, and are in decomposed conditions. Due to this autolysis, or foreign antigen borne by bacteria may lead to variation in results, and this occurs in very poor or negative results of blood group.

The absorption-Elution technique was devised in 1923. This method is used extensively to determine blood group from dried blood stains, Tissues etc.. in various Forensic Science laboratories<sup>(2)</sup>

## Steps in Blood grouping from dried blood stains

- I. Attachment of commercially available antibodies to antigens previously present on dried cloth fibers
- II. Washing of fibers with saline.
- III. Incubate with fresh samples containing cells
- IV. Note Down the observation and the method of absorption

Elution and its principle is utilized in all routine grouping of dried blood stains, for red cells antigen. The method is highly sensitive and more reliable than others for dried blood stains groupings. To detect ABO blood group antigens absorption elution is better suited as observed by Manu et al.<sup>(3-5)</sup>

The blood stained materials are exposed for a period to specific antisera, During this antigen-Antibody complex is formed, in the presence of corresponding antigen-antibody, following this the stained material is thoroughly washed in saline to remove all unbound antibody leaving only combined antigen-Antibody complex. Dissociation of antigen-Antibody is then carried out by raising the temp to 50-60°C, and testing the eluate with the indicator cells corresponding to the original test serum.<sup>(6-8)</sup>

### Material and Methods:

For the study purpose we choose following types of different fabrics due to their different nature of fibers.<sup>(9-21)</sup>

- 1) Cotton fabric - These fibers are mostly soft.
- 2) Silk Fabric:- These are natural fibers and are very strong.
- 3) Linen Fabric:- These fibers are very absorbents Light clothing and table cloth, the fibers are very absorbents.
- 4) Wool Fabric:- The wool fabrics have greater bulk than others and they hold air hence the heat is retained.
- 5) Jute Fabric :-These fabrics have low thermal properties, and have moderate moisture regain.
- 6) Ramie Fabric:-These fabrics are low in elasticity, Extremely absorbent, it is similar to linen in absorbency density, it is stiff and brittle.
- 7) Hemp Fabric:-These fibers are three times stronger than cotton naturally resistant to degradation, mold and rot.
- 8) Leather Fabric:-These fabrics high tensile strength contained great deal of air, permeability to water vapors, fibers will hold large quantities of water vapors hence it absorbs perspiration.

### Absorption-Elution Method:

In this method in a rack small glass tubes are arranged in three separate series and are labeled accordingly one series 'anti-A' the second as 'anti-B, and the third as anti -H . Fiber thread of optimum length from the blood stain (a Portion of stain equivalent to 3-4 mm square )and three control pieces of thread as, unknown, standard A, or B, or AB, or O blood group, unstained and the stain of fabric to be tested was taken in the above test tubes . Added suitable dilutions of antisera, into three separate series of tubes and the rack was left at 4°C for overnight.

Next day the unabsorbed serum was washed with chilled saline. The washed fiber was removed on glass slides and blot dry and add a drop of appropriate indicator cell suspension to each piece of thread ( As 'A'-cells to cells treated with anti-A, 'B'-cells to cells treated with anti-A, 'O'-cells to cells treated with anti-H). The fibers were kept in an incubator at 50°C and leave for 15 min. and the slides were read microscopically.

The Study was carried with two different ways –

- 1) Blood stains obtained from absorbent materials was recovered or cut from surface in portion of about 4-5mm or extracted as much completely as possible by swabs (If the surface is non absorbent) , which are collected as a biological evidence at the scene of crime. As explained in the table-1

**Table 1 Exhibits received and analysed in lab:**

| Sr. No. | Types of Fabric | Exhibits   | Analysis within 1 Week- 4Week | Analysis After 12Week | Analysis After 24Week | Analysis After 48Week |
|---------|-----------------|--|-------------------------------|-----------------------|-----------------------|-----------------------|
| 1       | Cotton fabric   | Sandow baniyan, cotton cloth,                            | +++                           | +++                   | ++                    | ++                    |
| 2       | Silk Fabric     | Sari, blouse, rugs, bedding                              | ++                            | ++                    | +                     | +                     |
| 3       | Linen Fabric    | Table Cloth, Curtains                                    | ++                            | ++                    | +                     | +                     |
| 4       | Wool Fabric     | Sweater , rag, gloves                                    | ++                            | ++                    | +                     | +                     |
| 5       | Jute Fabric     | Sacks, Bags  | ++                            | +                     | +                     | +                     |
| 6       | Ramie Fabric    | Canvas, Parachute, Filter cloth, curtains , fishing nets | ++                            | +                     | -                     | -                     |
| 7       | Hemp Fabric     | Shoes, rags , Cigarette Papers, hemp rope                | +++                           | +                     | -                     | -                     |
| 8       | Leather Fabric  | Belt   | ++                            | +                     | -                     | -                     |

2) The Second way is exact known quantity of blood was stained on known control fabric was stained. The ability to give exact blood group by using of Absorption-Elution method was evaluated by depositing 8-10 µlit of fresh human blood with different dilutions on different types of cloth fibers as explained in the table-2

**Table 2- Blood grouping by taking stains prepared in lab on standard fabrics**

| Sr. No | Types Of Fabric | Exhibits   | Analysis within 1 Week- 4Week | Analysis After 12Week | Analysis After 24Week | Analysis After 48Week |
|--------|-----------------|--|-------------------------------|-----------------------|-----------------------|-----------------------|
| 1      | Cotton fabric   | Sandow baniyan, cotton cloth,                            | +++                           | +++                   | +++                   | +++                   |
| 2      | Silk Fabric     | Sari, blouse, rugs, bedding                              | +++                           | +++                   | ++                    | ++                    |
| 3      | Linen Fabric    | Table Cloth, Curtains                                    | +++                           | ++                    | +                     | +                     |
| 4      | Wool Fabric     | Sweater , rag, gloves                                    | +++                           | ++                    | +                     | +                     |
| 5      | Jute Fabric     | Sacks, Bags  | +++                           | ++                    | +                     | +                     |
| 6      | Ramie Fabric    | Canvas, Parachute, Filter cloth, curtains , fishing nets | +++                           | ++                    | +                     | -                     |
| 7      | Hemp Fabric     | Shoes, rags , Cigarette Papers, hemp rope                | +++                           | ++                    | -                     | -                     |
| 8      | Leather Fabric  | Belt   | +++                           | +                     | -                     | -                     |

+++:- Strongly Positive– Shows clearly visible results for blood group

++:- Moderate Positive – Shows clearly visible results for blood group

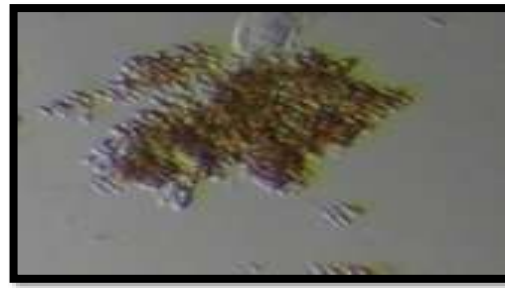
+ :- Very weak Positive – Difficult to conclude the exact blood group

- :- Negative – No results were observed

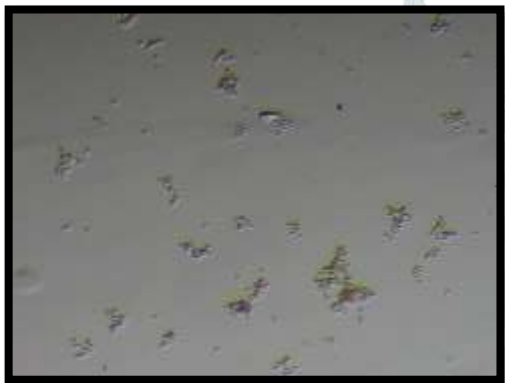
**Fig-1: Strongly Positive (+++)**



**Figure-2:- Moderate Positive (++)**



**Figure 3:- Very Weak Positive (+)**



**Figure 4:- Negative**



### **Results and Discussion:-**

In ABO system the control reactions from the, unknown, standard A, B, AB and O blood group, unstained cloth are fairly common and shows good results.

Within the period of one –four week the all blood stains prepared in the lab and the stains from all different fabrics shows fairly good visible results for blood group.

After twelve weeks of period, for Jute, ramie, hemp and leather fabrics the results obtained are moderately positive incase of standard staining and poor positive in case of actual exhibits.

However after period of twenty four weeks negative results observed for Hemp fabric and leather fabric, in case of standard staining similar situation was observed in case of stains on actual exhibits.

Results from table I and table -II shows that, blood stains detected on cotton fabric gives very strong positive results.

However the blood stains from the leather gives great difficulty in getting blood group, and as the time period increases, some distortions of blood group reactions sometimes found on leather. However when the blood stained clothes which had been aged shows very weak result. After period of forty Eight weeks same condition observed as twenty four weeks .However the, the ABH antigens in the blood stains of cotton cloth could be detected even after 42



weeks of storage. After 48 weeks of storage the blood stains shows very poor results, this may be due to loss of antigenicity due to fungal growth or bacterial decomposition of exhibit. When there is contamination with sweat or other body fluids like saliva, the results get vary, In the ABO system it will be noted that “H” is detected in most of the stains, “H” is present on all cells. Also sometimes extremely diluted blood stain is checked also shows good results

### Conclusion:-

ABO typing from different clothes- In a series of study we have examined distribution of the ABH antigen, during the detection of ABH antigen of blood stains the fabric on which the stain is fixed also plays very important role.

Current study can contribute to determine and identify the surface properties of different fabrics, which can be further applied to characterize the how the analyst can categorize the stains by gathering the more information of fabrics.

### References:-

- 1) R.Li (Forensic Biology):- Identification and analysis of biological evidences. C.R.C. Press. Boca, Ratan FKL, USA-2008
- 2) “A comparison of absorption inhibition and absorption elution methods for the estimation of ABO blood groups in Saliva” Manu et al. Journal of medicine , Radiology, Pathology and surgery, Vol- 1;1, Jan-Feb-2015
- 3) Forensic science laboratory Biology and serology division manual, Mumbai, State of Maharashtra
- 4) Culliford, B.J.- “The examination and typing of blood stains in the crime laboratory,” U.S. Dept. of Justice, Washington D.C. (1971)
- 5) R.Li (Forensic Biology) :- Identification and analysis of biological evidences. C.R.C. Press. Boca, Ratan FKL, USA-2008
- 6) Kind S.S. “ Absorption – Elution grouping of dried blood stains on Fabrics “ Nature- 1960; 187:789-0
- 7)“Kaur G.Sharma VK, comparison of Absorption-inhibition , and absorption-elution methods in the detection of ABO(H) antigens in sweat stains, “Curr, Sci-1988; 57; 1221-
- 8) Aye Ut. Abo blood grouping of blood stains on sweaty garments by absorption-elution method, Forensic Science 1977; 16;8-12
- 9) “ Cotton “ the Columbia encyclopedia, Sixth Edition.,2001-07
- 10) Silk” The Free Dictionary by Farlex
- 11) Textiles,” Ninth Edition by Sara J. Kadolph and Anna L. Langf
- 12) Sheep and wool Technology”, NSW, University press , Kensington 1986
- 13) “The golden Fiber trade centre limited” (GFTCL)- Articles and information on Jute Kenaf and Roselle Hemp.
- 14) Hemp” The Free Dictionary by Farlex
- 15) “Physical chemistry of leather making “. Robert E. Krieger. Page-226. ISBN-0-89874-304-4
- 16) “Characreization of nanocomposite coatings on textiles; a brief review on microscopic technology” Mazeyar Gashti, et al. current microscopy contributions to advances in science and technology (A-Mendez-Vilas,Ed)
- 17) Su C, Li J, The friction property of super-hydrophobic cotton textiles. Applied Surface Science. 2010;256:4220–4225.
- 18) El-Rafie MH, Mohamed AA, Shaheen ThI, Hebeish A, Antimicrobial effect of silver nano particles produced by fungal process on cotton fabrics. Carbohydrate Polymers. 2010;80:779–782.
- 19) Ki HY, Kim JH, Kwon SC, Jeong SH, A study on multifunctional wool textiles treated with nano-sized silver. Journal of Material Sciene. 2007;42:8020–8024.

- 20) Cruthers N, Carr D, Niven B, Girvan E, Laing R, Methods For Characterizing Plant Fibers. Microscopy Research and Technique. 2005;67:260–264.
- 21) Zheng C, Chen G, Qi Z, Ultraviolet Resistant/Antiwrinkle Finishing of Cotton Fabrics by Sol-Gel Method. Journal of Applied Polymer Science. 2011;122:2090–2098.
- 22) Hegemann D, Hossain MM, Balazs DJ, Nanostructured plasma coatings to obtain multifunctional textile surfaces. Progress in Organic Coatings. 2007;58:237–240.

