EFFECT OF PLASMA TREATMENT ON VAT DYED COTTON BAMBOO TERRY FABRIC

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ABSTRACT

The plasma is an ionized gas with equal density of positive and negative charges which exist over an extremely wide range of temperature and pressure. The plasma gas particles etch on the fabric surface in nano scale so as to modify the functional properties of the fabric. Unlike conventional wet processes, which penetrate deeply into fibers, plasma only react with the fabric surface that will not affect the internal structure of the fibers. The functionality of textile materials can be improved by the plasma technology such as Wettability, Hydrophobic finishing, Adhesion, Product quality. Main advantage is it is applicable to most of textile materials for surface treatment and Optimization of surface properties of textile materials without any alternation of the inherent properties of the textile materials.

Keyword: *Ionized gas, Etch, Functionality, Hydrophobic finishing, Adhesion, Optimization, Inherent-Properties.*

1.INTRODUCTION:

Since the introduction of plasma technology in the 1960s, the industrial applications of low-pressure and low-temperature plasma were mainly in microelectronic etching. In the 1980s, plasma technology also applied to other material surface treatment, especially in metals and chemical polymers. Due to high restriction in the control of chemical finishing on textile materials, the new and innovative textile treatments are demanded. In this regard, plasma technology shows distinct merits due to its environmentally friendly and better treatment results. Presently, research institutions are applying plasma technology in textile processing. The plasma is an ionized gas with equal density of positive and negative charges which exist over an extremely wide range of temperature and pressure. The plasma consists of free electrons, ions, radicals UV-radiation and other particles depending upon the gas used. The plasma gas particles etch on the fabric surface in nano scale so as to modify the functional properties of the fabric. Unlike conventional wet processes, which penetrate deeply into fibres, plasma only react with the fabric surface that will not affect the

internal structure of the fibres. Plasma technology is to modify the chemical structure as well as the topography of the textile material surface. In conclusion, plasma can modify the surface properties of textile materials, deposit chemical materials (plasma polymerization) to add up functionality, or remove substances (plasma etching) from the textile materials.

2. BENEFITS OF PLASMA TREATMENT:

1. *It is applicable to most of textile materials for surface treatment.*
2. *Optimization of surface properties of textile materials without any alternation of the inherent proper ties of the textile materials.*
3. *It is dry textile treatment processing without any expenses on effluent treatment.*
4. *It is a green process without generation of chemicals, solvents or harmful substances. The consumption of chemicals is very low due to the physical process.*
5. *It is applied for different kinds of textile treatment to generate more novel products to satisfy customer's need and requirement.*
6. *It is a simple process which could be easily automated and perfect parameter control.*

3. METHODOLOGY:

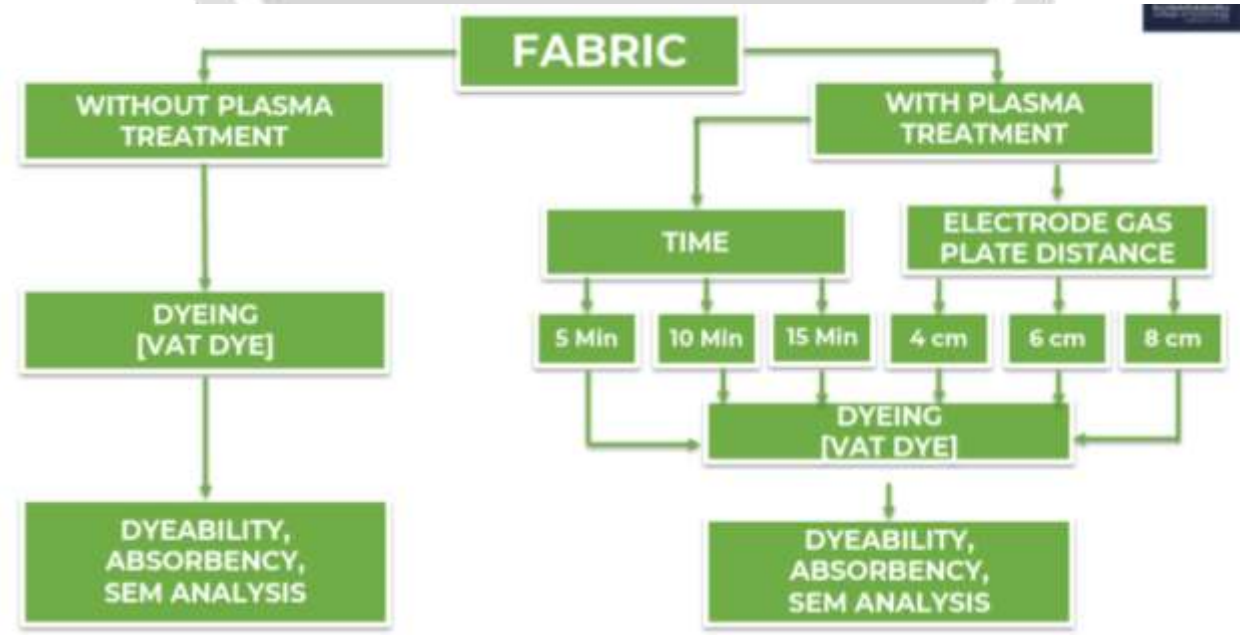

Fig: 3.1 (Methodology of plasma treatment)

4. MATERIALS:

We have been used Cotton Bamboo blend terry towel of Fabric GSM: 400 and dyed with VAT dye and to be plasma treated with Oxygen gas.

5. EXPERIMENT:

PLASMA TREATMENT:

1) The samples are given oxygen plasma treatment with varying parameters such as time and electrode distance for having the accurate results.

2) Time has varied in the form of 5 minutes, 10 minutes, 15 minutes and the distance of electrode plate has set up as 4 cm, 6cm, 8 cm.

DYEING:

1)Both samples with and without plasma treatment has been dyed using vat dye.
2) Time – 60 Minutes

3) Temperature – 80℃

From the collected data K/S values and values for SEM analysis can be found out.

6. OBSERVATION:

6.1.K/S VALUE:

K/S values, at the wavelength of maximum absorbance (max), that is at the reflectance minimum, are used conventionally to describe the buildup behavior of dyes on textile substrates. And the K/S values for the samples are found.

WITHOUT PLASMA TREATMENT:

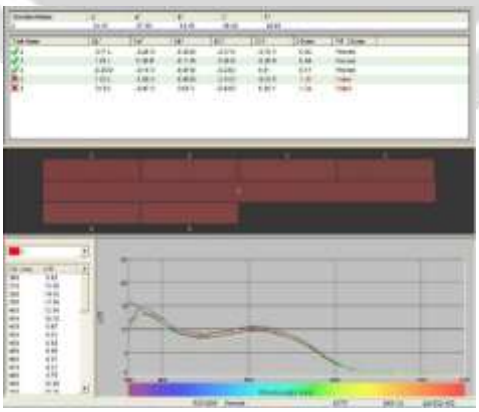

Fig:6.1.1 (K/S value of untreated fabric)

WITH PLASMA TREATMENT:

ELECTRODE DISTANCE: 4 CM / TIME: 5 MINS

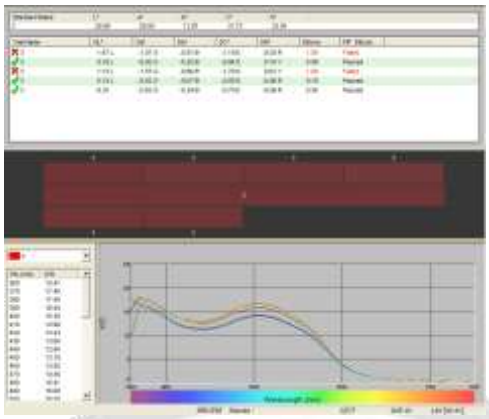

Fig:6.1.2 (K/S value of plasma treated fabric of electrode distance 4cm for 5mins)

ELECTRODE DISTANCE: 4 CM / TIME: 15 MINS

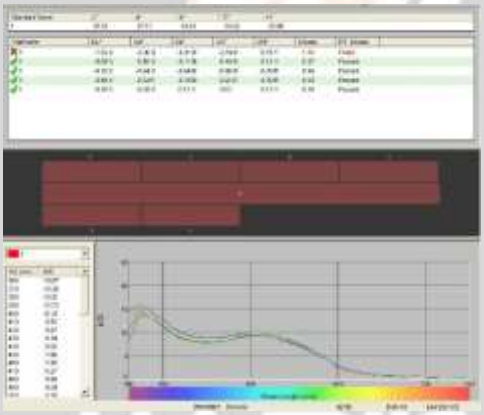

Fig:6.1.3 (K/S value of plasma treated fabric of electrode distance 4cm for 15mins)

ELECTRODE DISTANCE: 8 CM / TIME: 5 MINS

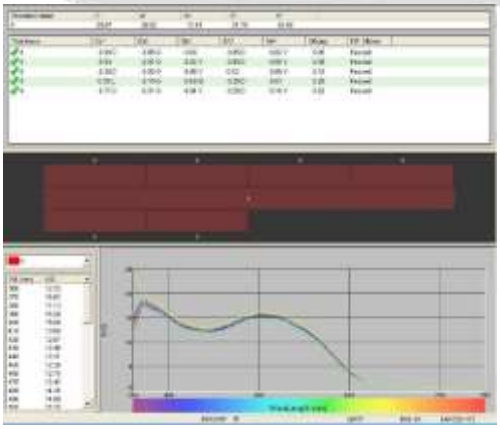

Fig:6.1.4 (K/S value of plasma treated fabric of electrode distance 8cm for 5mins)

ELECTRODE DISTANCE: 8 CM / TIME: 5 MINS

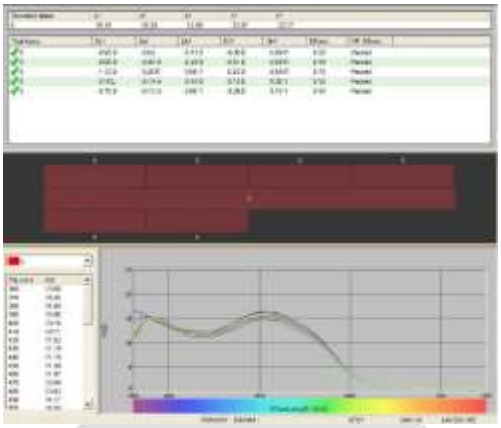

Fig:6.1.5 (K/S value of plasma treated fabric of electrode distance 8cm for 15mins)

6.2.SEM ANALYSIS:

SEM analysis is a powerful investigative tool which uses a focused beam of electrons to produce complex, high magnification images of a sample's surface topography.

WITHOUT PLASMA TREATMENT:

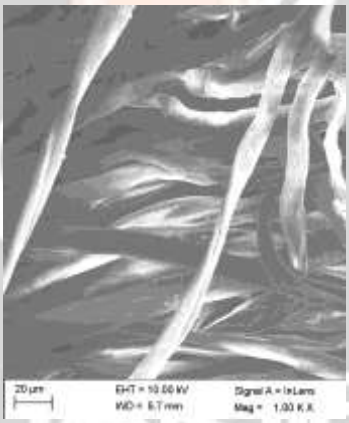

Fig:6.2.1 (SEM analysis of untreated fabric)

WITH PLASMA TREATMENT:

ELECTRODE DISTANCE: 4 CM / TIME:5 MINS

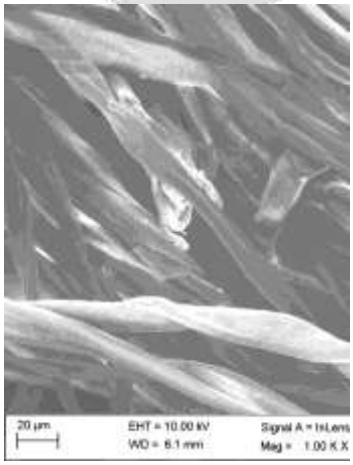

Fig:6.2.2 (SEM analysis of plasma treated fabric of electrode distance 4cm for 5mins)

ELECTRODE DISTANCE: 4 CM / TIME:15 MINS

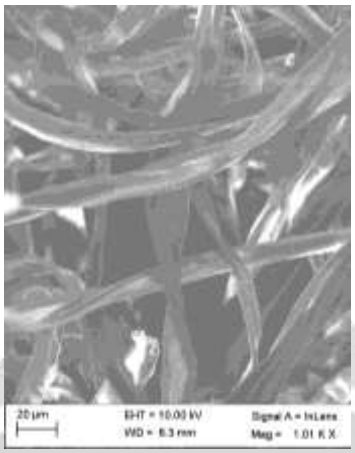

Fig:6.2.3 (SEM analysis of plasma treated fabric of electrode distance 4cm for 15mins)

ELECTRODE DISTANCE: 8 CM / TIME: 5MINS

Fig:6.2.4 (SEM analysis of plasma treated fabric of electrode distance 8cm for 5mins)

ELECTRODE DISTANCE: 8 CM / TIME: 15MINS

Fig:6.2.5 (SEM analysis of plasma treated fabric of electrode distance 8cm for 15mins)

S.NO	WITHOUT PLASMA TREATMENT	ELECTROD DISTANCE: 4 CM / 5 MINS	ELECTROD DISTANCE: 4 CM / 15 MINS	ELECTROD DISTANCE: 8 CM / 5 MINS	ELECTROD DISTANCE: 8 CM / 15 MINS
1.	1	1	0.8	0.7	0.8
2.	1.1	0.9	1	0.9	0.6
3.	0.9	0.8	0.9	0.8	0.7
AVG.	1	0.9	0.9	0.8	0.7

6.3.WICKING TEST:

Table: 01 (Observation of wicking test of plasma treated fabric)

7. CONCLUSION:

Let us conclude by telling the extra advantages of plasma treatments. The finished textile shows better performance and improved absorbency. Though currently not very relevant in produced amounts, this type of high-performance textile will certainly grow in economic importance. From this study we conclude that the plasma treated samples showed better absorbency and dyeability compared to untreated samples. Also, by increasing the time of plasma treatment and increasing the distance between the electrode plates plasma treatment was seen well. As a result of their high added value even small textile batches can be produced at high profit, although perfect process control is absolutely necessary. Typically, textiles for medical applications or uses in sector of biotechnology are expected to increase in importance. Future applications such as special selective filtrations, bio compatibility, and growing of biological tissues, would be interesting fields for plasma physics.

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