Quality Evaluation of Fibre using Image Processing System

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ABSTRACT
Jute is a bastfibre and is obtained from the stems of the two cultivated species of the genus Corchorus, viz., *C. capsularis* and *C. olitorius*, of the Tiliaceae family. *C. capsularis* is commonly called white jute and *C. olitorius* is commonly called tossa jute, though the two species from which the jute fibre is obtained are similar in general appearance[1]. Jute ranks next to cotton as the most important natural fibre in products on besides its high tensile strength, low extensibility, high frictional resistance, etc. It is easily renewable, biodegradable and eco-friendly. India contributes about 65% of world production of jute fibre.

Natural fibres are greatly elongated substances produced by plants that can be spun into filaments, thread or rope. Woven, knitted, matted or bonded, they form fabrics that are essential to society. Like agriculture, textiles have been a fundamental part of human life since the dawn of civilization. The Fibre Sector occupies an important place in the economy of the country in general and eastern region in particular. In spite of being so cheap and easily available, in terms of usage, global consumption, production, and availability, Fibre sectors are mostly ignored and almost vanishing from the production point of view. This is due to a number of problems including the non-availability of sufficient quantity of superior quality raw material because of the absence of proper grading of the fibres. The worst sufferers in the occurrence are the Farmers. They failed to judge the best quality of jute and are deprived in the hand of the sellers[2].

In the earliest grading system *'Place of origin'* was the basic guideline for grading of jute fibre. The grades had also link with commercial classification in accordance with the place of origin of the fibre, such as, Selected Assam, Ordinary Assam, Assam Bottom, Murshidabad Middle, Nadia Top etc. It was very disadvantageous and inconvenient for the growers to follow such a system of grading[3]. As a result, a cultivator was unable to find out the quality of his produce. So the previous grading system was obviously very unscientific and arbitrary and acted against the interest of the growers.

To remove that defective procedure, ISI now BIS introduced eight grade grading system based on six quality parameters i.e., strength, fineness, color, root content, defects and density. Different score marks are assigned to each character according to the level of these characters. The score marks for different characters, however, vary from one grade to another according to the gradations of characters. This grading system is found to be more acceptable and helpful to jute growers.

The quality of jute fibre (*Corchoruscapsularis and Corchorusolitorius*) is usually judged by its suitability for the production of different types of yarns and its behavior in the manufacturing process. The BIS grading of jute envisages a scorecard system of grading that aims at eliminating personal bias as far as practicable. The six physical parameters viz., strength, fineness, color, root content, defects and density of jute fibres are assessed for sorting out the fibre into eight different grades. Relative weightage is given to each physical parameter by standard scoring system and the grade of fibre is determined by total score of the six parameters.

Keywords
Image processing, color, fineness, defects, jute fibre.

1. INTRODUCTION

There are two systems for grading of jute
- Hand & Eye Method
- Instrumental Method

But these methods have got limitations. To eliminate these limitations, this new attempt has been made as the crying need of today[4]. Using this proposed integrated method of grading the growers will not be deprived of right price of their produce, thereby will improve their life style and economic well-being.
In the areas of jute fibre grading, the following testing and measuring are of immense importance. These are:

- To measure the color of the fibrein percentage with respect to white.
- To measure the root contents and defects like knots, runner, dazed fibre, over retted fibre, mossy fibre and enlarged sticks, loose leaf, loose sticks, gummy fibres, specks and weak croppies and other minor defects of the jute and allied fibresin weight (%).
- To measure the fineness of the fibrein tex.
- To measure the bulk density in gm/cc.
- To measure the strength of fibre in gm. /tex.

The present paper deals with a new and novel method of finding the three grading parameters using image sensing and processing system to find the color, defects and the fineness of the fibre.

2. MATERIALS AND METHODS

Out of the above given parameters, emphasis will be given to obtain the three parameters using image grabbing and analyzing in the present domain of discussions. The properties which can be analyzed by Image Processing System are:

- Color Percentage and class of the Jute fibre with respect to
- Color value.
- Percentage of Defects in the jute fibre.
- Fineness of the fibre in Tex value calibrated with the number of fibres per mm.

3. PROCESS OF ANALYSIS

3. 1 Color Detection System

To analyze the color using image sensing and processing, at first the color content has been segregated to its equivalent RGB components in 8 bits form[5]. In practice, color is always represented in the form of its whiteness index value. So, in order to find the whiteness index value, first the color components have been computed and from those values, the whiteness index value has been evaluated. The color components in 8bits form have been shown in Figure 1.

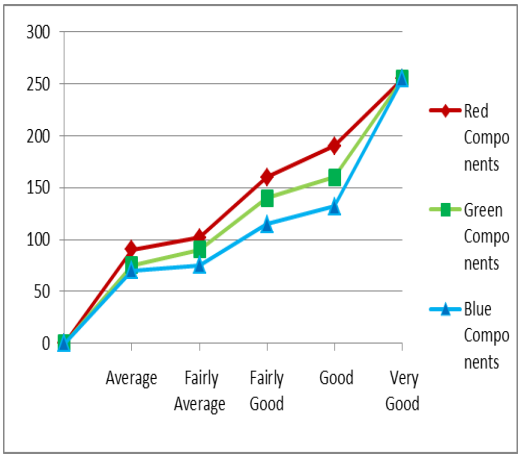

Fig 1: Grading of fibre with respect to RGB range.

The detected color values have been calibrated with the well-known Hunter scale which shows almost similar results and is given in Fig 2.

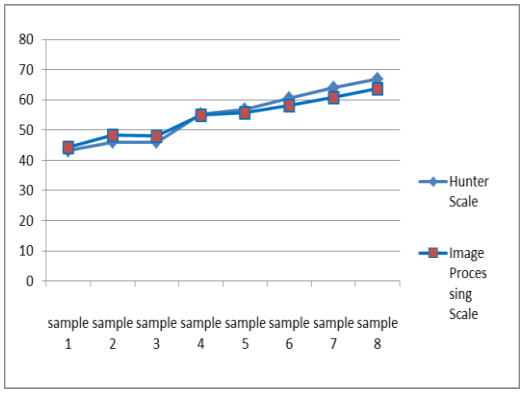

Fig 2: Calibration with Hunter scale

The entire unit of color analysis system is shown in block diagram below:

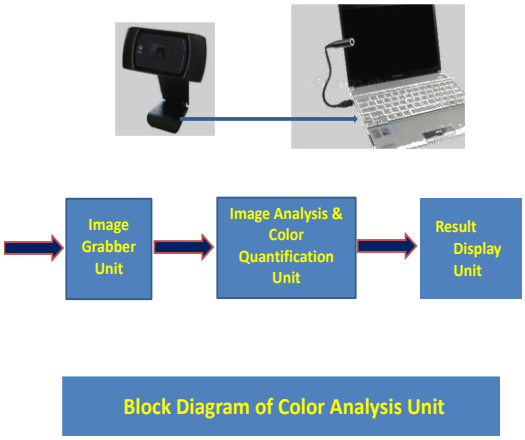

Fig 3: Block diagram of color analysis unit

The screenshot of the color analysis is given below through MATLAB.

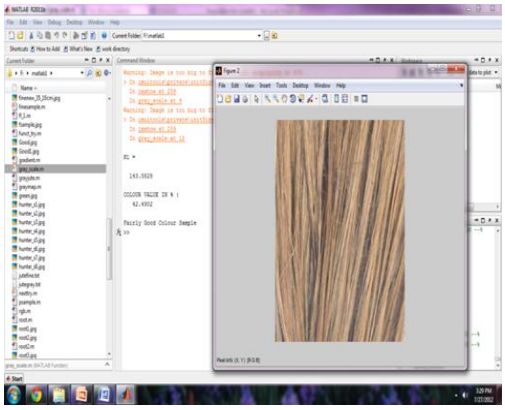

Fig 4: Color analysis screen shot

3.2 Defects Analysis System

To analyze the defects and root content in percentage using the new image processing system, the color gradient i,e (dc/da) is computed over the complete area under observation6. When that value exceeds a given threshold value, it is to be considered as a defect area. Over that scanned area, when the value of dc/da returns below the threshold value, it is considered as the end of the defect line. In this way the defect area is calculated. Thus by computing the percentage of defected area is obtained. The type of defects is also checked and identified with the contents of the defect database.

The entire unit of defect analysis system is shown in block diagram below at Fig 5.

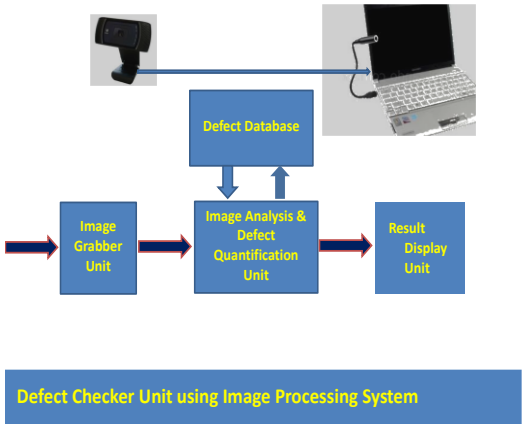

Fig 5: Block diagram of the defect checker unit.

The screenshot of the imaging processing output of defect analysis is given below through MATLAB in Fig 6.

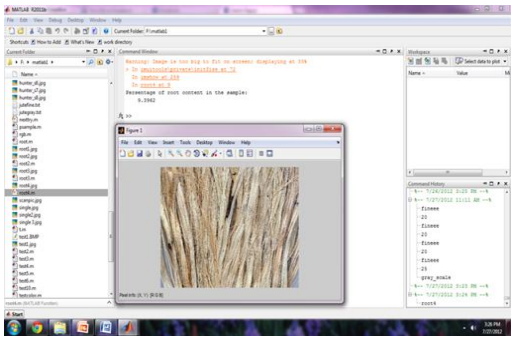

Fig 6: Screen shot of defects analysis using image processing system.

3.3 Fibre Fineness System

For measurement of fineness of the Jute fibre, at first the fibres are aligned in a way that there is no overlapping and gaps is present between the fibres. A suitable program has been developed to count the number of fibres present over a particular width of the image grabbed. From a large number of trials, an empirical formula has been developed using which the fibre fineness value in tex can be obtained from the number of fibres present in unit length.

The entire unit of fineness measurement system is shown in block diagram form in Fig 7.

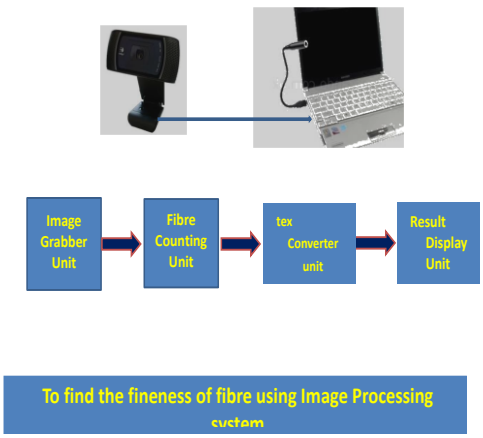

Fig 7: Block diagram of the fineness checker unit

The screenshot of the imaging processing output of finenessmeasurement is given in Fig 8 through MATLAB.

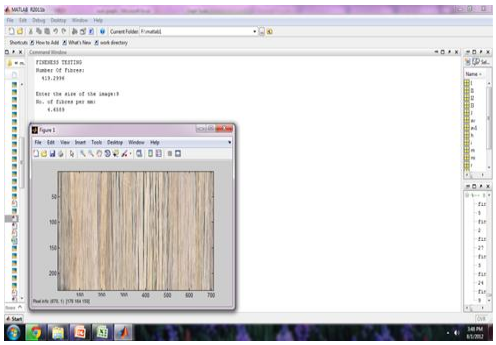

Fig 8: Screen shot of the fineness measurement output

4. CONCLUSION

Different dedicated instruments are available to assess the grading parameters of jute fibres. Some of these instruments use the destructive methods of testing and in most of the cases the measurement methods need a long time to produce the results. Moreover, the conventional methods essentially need the preoperational steps of the sample preparation. Sample preparation also needs experienced and skilled personnel. In contrast to that, using this new method of image processing system of analysis the following advantages are obtained:

1. No sample preparation is required
2. No human error is present
3. Nondestructive method of testing is used
4. Cost effective method of testing.

5. ACKNOWLEDGEMENT

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6. REFERENCES

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