AFIS & NATI neps count correlation during carding

There is a good correlation between the AFIS and the NATI neps count measurement before and after carding process, and this correlation depends on the form of the textile matter, infer **M Gazzah** and **B Jaouachi**.

Actually, according to the statistics of the International Consultative Committee of Cotton (CCIC), the world's consumption of cotton exceeds 22 million tons in 2006 compared to 6 million tons in 1940. Considering the importance and this evolution, the laboratory and industrial measuring testers for the quality control of cotton fibres (neps, trush, dust, regularity, etc) were diversified and automated. But the fundamental and classical problem in textile materials control is how to measure the rate of neps on cotton fibres before and after the carding process.

Because the neps are the fibres buttons[1-7], which are difficult to eliminate during carding[8, 9] and preparing process, it was important to decrease the proportion of neps (fibrous and seed coat neps) inside cotton fibres (See Figure 1).

Several studies have reported that 30% of neps changed with cotton origin, 30% resulting from maturity conditions and 40% correlating to manufacturing process. However the problem is established in the precision of these measuring instruments, especially when two tester machines intended to control the same parameter, give different measurement values. These different results can give wrong interpretations and the effectiveness of the spinning machines because each of those testers works according to a specific measurement mode.

This article reveals the neps rate relationship between the Afis Pro[10 and 11] and the new Mesdan Tester, Nati[12]. The variation result values are compared in order to carry out the relationship between neps data using each control apparatus before and after carding action process.

Materials and methods

Two different cotton mixtures, M_1 and M_2, shown in Table 1 were used. The samples were tested using two different measuring instruments: AFIS Pro (laboratory instrument) and the Nati (industrial tester). The average of such five tests was taken. The specimens using laboratory instrument were tested in an air conditioned labora-

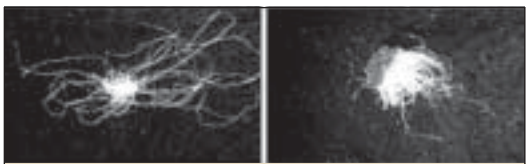

Figure 1: Fibrous neps (in the left) and Seed Coat Neps SCN (in the right).

tory (65 ± 2% rel humidity and 20 ± 2^0 C) according to standardised ASTM norm[1]. On the other hand, in the case of the industrial instrument, the authors worked in the industrial conditioned space of manufacture where the temperature was between 23^0 C and 28^0 C and moisture was between 44% and 50%.

The authors noted that the overall tested samples are chosen from the input and output carding brush. Two types of carding brushes of SITEX Company, Rieter and Trutzschler, were used to evaluate the samples. The number of tests was 170 measurements on both flock cotton (input of carding brushes) and rope (output of card) controlled with NATI and AFIS Pro instruments.

After measuring neps count, expressed by the number of particles, the authors compared all the experimental values to the theoretical ones calculated using the elaborated relationships. A Statistical Package for Social Sciences, SPSS software, was used to help their data analysis.

Results and discussion

Relationship between neps counts measured by AFIS and NATI Testers before carding: The neps count on cotton fibre before carding was carried out. Figure 2 shows that there is a good correlation between the results of AFIS instrument and NATI Testers. The regression coefficient R was 0.969. An excellent fit proved a good relationship between the two instrument results in case of fibre flock.

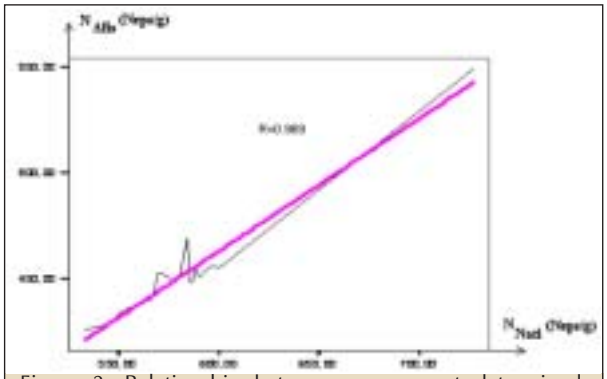

Figure 2: Relationship between neps count determined by both AFIS and NATI apparatus.

Using Equation 1, the neps count given by one of these comparative testers have been found predictable easily.

$N_{Afis} = 0.63 \times N_{Nati} + 87.22$.....Equation 1

With:

N_{Nati} : The number of neps per gram given by NATI Tester

N_{Afis} : The number of neps per gram given by the AFIS Tester

By comparing the results given by the two instruments, the number of neps per gram of cotton given by the NATI apparatus is definitely higher than that given by the AFIS Tester. The difference is due to the irregular cleaning action in NATI instrument. This can caused higher and accumulated neps number. On the other hand, AFIS tester is equipped with a cleaning module which controls and eliminates both the neps and trush after each measured test. Indeed, the average of the difference between the values given by the two testers is around 127 neps/g.

In order to find how and why difference between the experimental and theoretical values, we use visual method that consisted in preparing the opened fibres and place them on black paper. The neps number was counted visually. Figure 3 shows the relationships between visual values and the experimental results.

Figure 3b and Figure 3a show that the coefficients of determination, R are 0.894 and

Table 1: Characterisation of cotton mixtures used in the study

	M_1	M_2
Cotton Origin and tested percentages	22% ouzbek	28% grec
	21% Togolais	20% Senegal
	51% B Fasso	16% B Fasso
	3% Senegal	25% Espangol
	3% dust	11% dust
Upper Half Mean Length, UHML (mm)	28, 5 - 29, 4	27 - 28, 4
Micronaire	4 - 4, 4	3, 5 - 4
Type of the spinning mill	Ring spinning	Open-End spinning

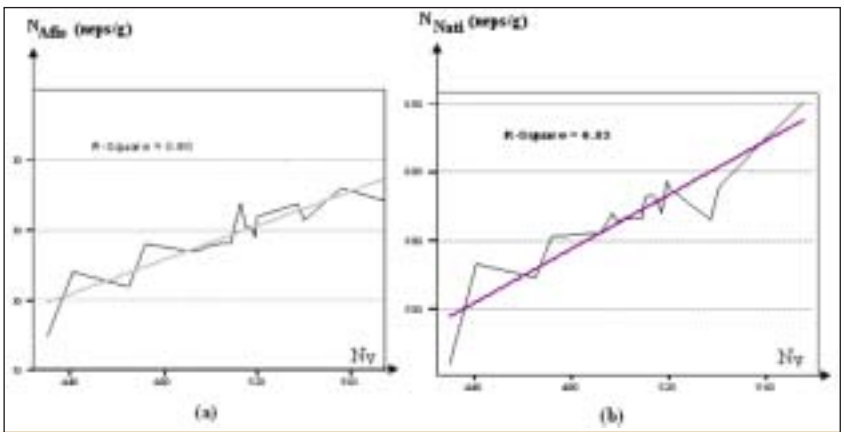

Figure 3: Relationship between visual method results (NV) and two tester results (NNati and NAfis), (a): Curve Nafis=f (Nv); (b): Curve NNati= f (Nv).

addition, the visual method, a subjective method, remains very slow and the measuring instruments are not reproducible.

Relationship between neps counts measured by AFIS and NATI Testers after carding

In the case of output carding brush, it may be concluded that the number of neps per gram tested using AFIS instrument is in agreement with those measured with NATI Tester. The correlation coefficient was R = 0.948. This proved that one can predict the neps count after carding process using the Equation 2.

$$N_{Afis} = 0.8 \times N_{Nati} + 73.12 \quad \text{.....Equation 2}$$

Figure 4 shows that there is a strong correlation between the two instruments according to Equation 2:

The correlation coefficient in this case is R = 0.894. These results are justified by making a comparison between the values of all the measurements tested using the AFIS apparatus to determine the number of neps

0.911 respectively. The visual method confirms well the authors' investigation. As a consequence, they note that theoretical and experimental results are correlated. The results show that visual method can also be used to determine the neps count. However, the visual method disadvantages include the difficulty to the eye during counting of the neps. In

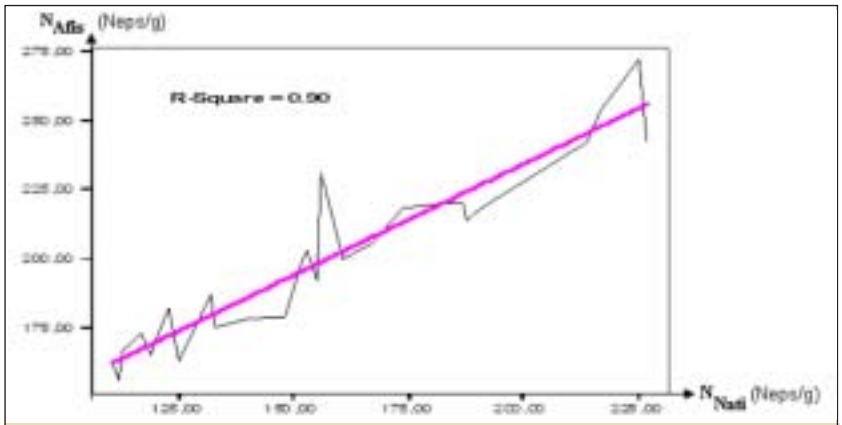

Figure 4: Relationship between NAFIs and NNati values after carding process.

and those theoretically calculated from Equation 3.

Conclusion

This work showed that there is a good correlation between the AFIS and the NATI neps count measurement before and after carding process. Indeed, this correlation depends on the form of the textile matter (cotton fleeces or rope fibres). But it is independent of the carding brush and the mixture fibres. In order to evaluate and compare the difference between theoretical and experimental data given by the two instruments, the results show good correlation (high R regression coefficients).

It may be concluded that the variation rate was minimal. With these relationships it is possible to choose visual method used by experts or theoretical methods given by the equations mentioned above in this work. The main reason is the significance of the correlation coefficient. However, the visual method is subjective and cannot give accurate results because it is not reproducible and related to human experimentation. In addition, the visual method used by experts is slow and takes more time to judge the neps number.

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M Gazzah is with the Engineering School of Monastir Rue Ibn eljazar 5000, Tunisia and B Jaouachi is with the Textile Research Unit of Ksar hellal, Rue Elhadj Ali soua 5070 Tunisia.