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Requirements for Cleaning Cotton from Defective Compounds in Uzbekistan

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Abstract: This article explains the classification of defective compounds in cotton products, as well as the interpretation of combined sampling methods to determine the amount of cotton defects and impurities in Uzbekistan.

Keywords: defect, dirty mixtures, cotton, Uz DSt 614, neps, cotton analyzer, measurements, knot, seed, fiber length

The best quality cotton:

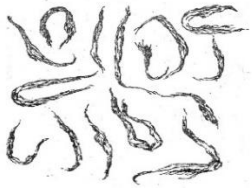
- Pima cotton (long fiber length - USA),
- Giza cotton (long fiber length - Egypt)

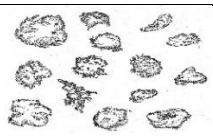
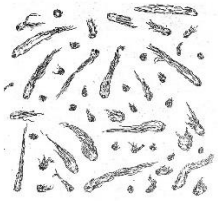
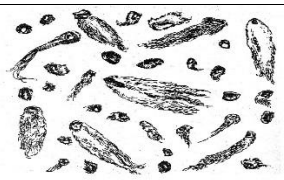
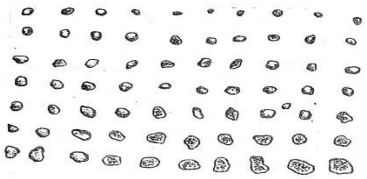
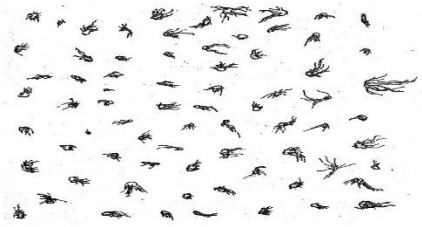
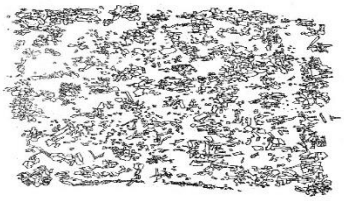
Cotton quality classification parameters:

The following basic parameters are taken into account to determine the quality of cotton material.

- Precision (calculation),
- Fiber length (staple length),
- Tensile strength of fiber,
- fiber elongation,
- Fiber uniformity (CV% of diameter) and
- Fiber maturity index/ratio [1].

Defects of cotton fiber

№	Defect name	Picture
1	Knots	
2	Combined knots	

3	Uncooked fiber plastic	
4	Fibrous seed husk	
5	Broken seed	
6	Great	
7	Knots	
8	Small dirty mixtures	
9	Large dirty mixtures	

Depending on the test method, a sample is selected for testing from the combined sample in the mass indicated in Table 1.1 [2].

Table 1.1

Test method, equipment	Mass of the test sample, g	Number of samples to test	Draw accuracy, max
Cotton analyzers	100 ± 0,5	2	100 mg
Until 5 %	50	1	50 mg
Above 5 %	10	1	10 mg
Determination of number of neps in SITC	The mass and length of each test specimen is in accordance with the SITC manufacturer's	SITC according to the manufacturer's technical document	The length of the fiber (strip) sample is ± 10 mm from the length specified in the SITC manufacturer's technical document

	technical document		Sample mass SITC according to the manufacturer's technical document
Comparison with appearance samples	100 — 150	1	

Preparing the cotton analyzer for measurements

In accordance with the recommendations given in the manual of cotton analyzers of each type, the mass fraction of defects and impurity of cotton fiber should be checked with state standard samples and an individual correction coefficient should be set [3].

Before conducting the tests, the cotton analyzer is thoroughly cleaned of fibers and impurities and is used (2-3 min) according to the manufacturer's manual for each analyzer model until it reaches a stable speed.

Preparation of SITC to determine the amount of Neps

Before starting the test, SITC (Standardized Instruments for Testing of Cotton) is heated for at least 5 minutes.

The strip is prepared or separated according to the manufacturer's instructions for the required SITC. The tape should be uniform and free of voids or large areas of loose cotton fiber.

At least once a week, two different test fiber samples of the SITC are checked for the correctness of the determination of the number and size of neps. Ten samples prepared according to Table 1.1 are tested from each test fiber sample.

The average of ten tests on each test fiber sample shall be within ±15 % of the specified values.

Sample packaging should not cover a large field of view during testing. It should be ensured that the surface of the test table is clean and that there are no foreign objects around the sample being tested.

Measurement procedure

Determining the mass fraction of defects and impurities in a cotton analyzer of the type of one-time cleaning of cotton fiber [4].

The sample for testing is spread evenly on the supply table of the cotton analyzer, and the mechanism for transferring the sample to the analyzer is started.

The cotton analyzer is stopped after all the sample has been passed for testing. Defects and impurities are removed from the guard chamber of the cotton analyzer and the air filter, and the sum of the masses is weighed to determine their total mass to the nearest 1 mg.

Determining the amount of defects and impurity by mass of cleaned cotton fiber using a cotton analyzer

For testing, a sample of cotton fiber is divided into approximately three equal pieces. One of the pieces is placed flat on the supply table of the cotton analyzer with the same thickness.

The air hole is fully opened, the drive clutch of the supply cylinder is engaged and the test sample supply to the cotton analyzer is started. As the sample of cotton fiber for testing is fed to the analyzer, parts of it are continued to be placed on the supply table, thereby maintaining the same supply rate until the entire sample is processed.

After the test sample is completely under the supply cylinder, all fibrous waste is collected from the dirt chamber and the dirt bed. They are spread in the center of the supply table and passed through the cotton analyzer.

The clutch is disengaged and the air damper is momentarily closed to collect the cleaned fiber from the hopper.

The cleaned fiber is passed through the cotton analyzer a second time.

Waste from the walls of the dirt chamber and the dirt floor into the waste box is removed and they are again passed through the cotton analyzer.

The clutch of the supply cylinder is disengaged, the air hole is momentarily closed with a stopper, and the cleaned fiber is removed from the hopper. The fiber is weighed to the nearest 0.1 g. The mass of this fiber will be L [5].

All fine particles are collected from the walls of the dirt chamber and impurities and impurities from under the surface of the supply table. Fiber defects and impurities are weighed with an accuracy of 0.1 g.

Determining the mass fraction of defects and impurities by manual separation. Arbitration method

The test sample m1 is placed on a polished thin board or cardboard, and impurities are separated with tweezers in three successive steps.

The first separation

From the test sample: nodules, combined nodules, unripe and crushed seed, unripe fiber plastic and large impurities are separated and placed in separate plastic containers. Small impurities separated during separation, large impurities are added to the collected container.

The mass of each type of impurities is measured separately with an accuracy of ± 1 mg, and then the sum of masses in m2 is calculated.

At the same time, the fiber cleaned of defects and impurities is also weighed with an accuracy of ±1 mg and its m3 mass is determined [6].

The second separation

The m3 of clean fiber obtained from the first separation is 0.05m3 when the mass fraction of defects and impurities is less than 5%, and 0.1m3 when the mass fraction of defects and impurities is 5% or more. m4 mass is chosen for the second separation equal to

Fibrous seed husks and small impurities are separated from the m4 mass and the mass is measured individually with an accuracy of ± 0.1 mg. The mass m5 of the clean fiber obtained as a result of the second separation is also measured with the same accuracy.

The third separation

0.2 m5 when the mass fraction of defects and impurities from several places of m5 mass is less than 5%, and 0.5m5 when the mass fraction of defects and impurities is 5% or more is equal to m6 mass is separated [7].

Nodules are separated from m6 mass, then measured with an accuracy of ± 0.05 mg.

Determining the amount and size of neps.

Each sample is tested according to SITC instructions for use.

If the fixture has a single specimen placement slot, the test specimen shall be passed slowly under the rotating supply roller in such a way that the test specimen is passed without stretching. The sample should be completely passed through the test zone [8].

If the SITC is equipped with an automatic carousel drum for sample transfer, it should be filled with the number of samples corresponding to the number of slots in the drum. In this case, all test samples taken from the same sample should be placed consecutively. It is permissible to use

a knitting needle to push the sample to the bottom of the drum into the test zone to insert the sample coil into the carousel drum.

SITC automatically calculates the total number of neps and the average size.

A method of determining the amount of defects and impurity of cotton fiber in the class room by comparing it with appearance samples.

Determining the amount of defects and impurities of cotton fiber is carried out in specially equipped classrooms. The sample to be tested is placed on the classifier's table side by side with samples of appearance representing a certain grade, and by comparison the class with the most defects and impurities is found. The sample being tested by the expert is divided into upper and lower parts (opened in the form of a book) and compared with the samples of the external appearance of defects and impurities on the internal surface of the sample. If the impurities on the external and internal surfaces of the sample do not match, the cell with the corresponding amount of defects and impurities is determined as the result of the evaluation [9].

Processing of measurement results

Determining the amount of defects and impurities using a cotton analyzer of the type of cleaning once and twice

The amount of defects and impurities (P) is calculated in percentages according to the following formula when testing on a cotton analyzer of the one- and two-time cleaning type:

$$П = \frac{m_2}{m_1} * 100 * K$$

Here:

m_2 is the mass of separated defects and impurities, g;

m_1 is the mass of the sample taken for testing, g;

K is the individual coefficient of the cotton analyzer determined using a standard sample.

Otherwise, a third test will be conducted. If the difference exceeds the permissible limit even in repeated determination, then the arithmetic mean value of the results of three parallel tests is considered as the test result.

Calculations are made to the second decimal place and are rounded to the first decimal place after the decimal point.

Determining defects and impurities through the mass of cotton fiber using a cotton analyzer [11].

Model:GT-B16A
Place of Origin: Quanzhou,China(Mainland)
Brand: GESTER

The mass fraction of processed fiber Ls is determined in percent according to the following formula:

$$L_c = \frac{L}{W} * 100$$

Here:

- L- mass of cleaned fiber, g;
- W is the mass of the tested sample, g.

The mass percentage of visible waste in WV percentage is determined by the following formula:

$$W_V = \frac{L}{W} * 100$$

Here:

V — waste mass (removed from the analyzer), g.

Waste (invisible waste) is calculated in percentage Wi according to the following formula:

$$W_i = \frac{W - (V + L)}{W} * 100$$

The mass fraction of defects and impurity is determined in percentages P by the following formula:

$$П = 100 - L_c$$

Calculations are made with an accuracy of 0.1%.

Manual determination of the mass fraction of defects and impurity

Each type of defects and impurities (Xi) is calculated in percent according to the following formula:

$$X_i = \frac{m_i * K_i}{m_1} * 100$$

Here:

m_i is the mass of i type of defects and impurity impurities isolated as a result of sample separation, g;

m_1 — the mass of the sample taken for testing, equal to 50 g or 10 g, g;

K_i is a coefficient that takes into account the decrease in the mass of the sample in the second and third separation [10].

The magnitudes of the Ki coefficient depending on the mass of the sample taken for testing and the stage of separation are presented in Table 2.

Table 2.

The step of separating the sample for testing	K_i is the coefficient of reduction of the mass of the sample in grams of the sample taken for testing			
	50		10	
First	1		1	
Second	20		10	
Third	100		20	

The final mass fraction (P) of defects and impurities in a sample of cotton fiber is calculated by summing all Xi values in percentage according to the following formula:

$$П = \sum_{i=1}^{n} X_i$$

Calculations are accurate to the second decimal place and rounded to the first decimal place after the decimal point.

Errors in measurements

The permissible difference between the test results of two samples (similarity of the method) in cotton analyzers of the type of single and double cleaning and in the method of manual identification should not exceed the following:

when the mass percentage of defects and impurities is no more than 5.5% - 0.4% abs.;

the mass fraction of defects and impurities is 5.5% and more — 0.8% abs.

Table 3 shows the difference between the results of different laboratory analyses, as well as between the results of two analyzes obtained in the same laboratory, but with manual separation by different operators, and with single- and double-cleaning type cotton analyzers (method reproducibility) values should not be exceeded.

Table 3

Mass fraction of defects and impurities, %	One-time and two-time cleaning type cotton analyzer, abs. %	Manual separation, abs. %
up to 2.5	0,4	0,2
2.5 to 5.5 together	0,4	0,4
5.6 and above	0,8	0,8

Conclusion.

The permissible difference (similarity of the method) between the test results of the two samples should not exceed the limits set by the cotton analyzer for determining the amount of defects and impurity by the mass of the cotton fiber:

the mass fraction of defects and impurities is 5.5% together with — 0.35% abs.;

the mass percentage of defects and impurities is 5.6% and more — 0.84% abs.

Laboratory analyzes of the consumer and the supplier, as well as the determination of the amount of defects and impurity through the mass of cotton fiber by different operators in the same laboratory (method reproducibility), the allowed difference between the results of the two analyzes should not exceed :

the mass fraction of defects and impurities is 5.5% together with — 0.64% abs.;

the mass percentage of defects and impurities is 5.6% and more — 2.06% abs.

Between the results of testing two samples, as well as between the supplier's and consumer's laboratory analyses, as well as between the results of testing the amount of neps at a confidence level of 0.95 between the results of two analyzes obtained in the same laboratory but by different operators (reproducibility of the method) The difference (method similarity) should be less than that shown in Table 4.

Table 4.

The average amount of neps	Less than the standard deviation of similarity (within a laboratory)	Less than standard deviation of reproducibility (among laboratories)	Less than the allowable variance results within a laboratory (method	Less than the allowable interlaboratory variance results (reproducibility of the method)

			similarity)	
6	3,1	3,1	8,6	9,6
86	15,1	16,5	42,1	46,1
109	15,0	18,8	42,1	52,7
138	31,6	37,3	88,6	104,4
348	32,4	37,2	87,8	104,2
516	44,3	44,3	124,0	124,0
650	50,6	63,5	141,8	177,9
824	49,7	58,2	139,2	163,1

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