International Standard 4912

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION•МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ•ORGANISATION INTERNATIONALE DE NORMALISATION

Textiles — Cotton fibres — Evaluation of maturity — Microscopic method

Textiles — Fibres de coton — Évaluation de la maturité — Méthode par microscopie

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 4912 was developed by Technical Committee ISO/TC 38, *Textiles*, and was circulated to the member bodies in September 1979.

It has been approved by the member bodies of the following countries:

Australia	Germany, F. R.	Romania
Belgium	Ghana	South Africa, Rep. of
Brazil	Indonesia	Spain
Bulgaria	Italy	Sweden
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The member bodies of the following countries expressed disapproval of the document on technical grounds :

Czechoslovakia
France
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Textiles — Cotton fibres — Evaluation of maturity — Microscopic method

0 Introduction

The term "cotton fibre maturity" is commonly used to signify the extent of fibre wall development. For cottons of similar length and perimeter, mature cottons (thick walled) generally give fewer neps, are usually more lustrous, and dye deeper in shade than immature (thin walled) cottons.

Immature fibres have the following characteristics :

1) they break easily during processing;

2) they have a tendency to form neps;

3) they have a tendency for becoming entangled around leaf and trash particles, thus making cleaning more difficult and increasing the amount of fibre removed as waste;

4) they have an adverse effect on yarn appearance;

5) they do not dye evenly in shade.

Since cotton fibres vary in both wall thickness and perimeter, fibre maturity is best characterized in terms of a ratio or average percentage of maturity representing the average degree of wall thickening, independent of perimeter. These values are derived from visual comparisons of wall thickness with maximum fibre width, after the fibres have been swollen in 18 % (m/m) sodium hydroxide solution.

As measurement of the degree of wall thickening is too laborious for most practical purposes, this method of determination of maturity of cotton fibres is an indirect test. It consists of an appraisal based on judgment and experience, and is suitable for routine research purposes.

1 Scope and field of application

This International Standard specifies a method for the evaluation of the maturity of raw cotton fibres, or fibres taken from cotton articles which have not been chemically processed.

It is applicable to test specimens taken at random. Annex B describes other methods of sampling, based on fibre sorter diagrams, or arranged fibres, which permit slightly more accurate appraisals of fibre maturity.

2 References

ISO 139, *Textiles — Standard atmospheres for conditioning and testing.*

ISO 1130, *Textile fibres — Some methods of sampling for testing.*

3 Definitions

For the purpose of this International Standard, the following definitions apply.

3.1 In the case of option 1, maturity ratio

3.1.1 dead fibres : Fibres which, after swelling, have a wall thickness of one-fifth or less of the maximum fibre width.

Dead fibres are present in various forms, from flat ribbons with no convolutions and little or no fibre wall (figure 2), to highly convoluted forms with somewhat greater development (figure 1).

3.1.2 normal fibres : Fibres which, after swelling, appear rod-like with a discontinuous lumen.

Normal fibres have no well defined convolutions (figures 5 and 6).

3.1.3 thin-walled fibres : Fibres which, when swollen, cannot be classed in the normal or dead groups (figures 3 and 4).

3.1.4 degree of fibre wall thickening : The ratio of actual cross-sectional area of the wall to the area of the circle with the same perimeter.

3.1.5 maturity ratio : The ratio of the degree of wall thickening to a standard degree of thickening selected arbitrarily to equal 0,577.

3.2 In the case of option 2, percent maturity

3.2.1 immature fibre : Fibre which, upon swelling, either assumes a spiral form (figure 8) or lies flat, thinly outlined and almost transparent (figure 9).

It has a wall thickness of less than one-fourth of the maximum fibre width.

3.2.2 mature fibres : Fibres, the cell walls of which have developed sufficiently so that, upon swelling, they become unconvoluted and almost rod-like in shape (figure 7).

The wall width is equal to or greater than one-fourth of its maximum width.

3.2.3 percent maturity : The average percentage of mature fibres in a sample, based on the total number of fibres.

4 Apparatus and reagent

NOTE — Photographs and standard cotton samples are useful for training and check testing purposes. (See annex A for sources of this material.)

4.1 Microscope or microprojector, fitted with a mechanical traversing stage and substage condenser, giving a magnification of × 400, and equipped with a viewing aid such as a projection device or white matt screen. A magnification of × 150 may be used by agreement between the parties concerned.

4.2 Microscope slides, cover glasses, glass rod, dissecting needle.

4.3 Counters with registers, if required, for each fibre classification.

4.4 Sodium hydroxide solution (ϱ_{20} = 1,198 ± 0,002 g/ml), diluted to 18 ± 0,2 % (*m/m*).

5 Conditioning and testing atmosphere

Conditioning is not necessary and the test may be carried out in any prevailing atmosphere. However, the fibres are easier to mount when the atmosphere has a relative humidity of at least 40 % at the temperature used.

6 Preparation of test sample

Prepare the test sample by one of the following methods.

6.1 From the laboratory bulk sample previously treated by a mechanical blender, take two series of five test samples, each consisting of a tuft of about 2 mg. Double and draw each test sample several times to mix and parallelize the fibres and so permit the easy withdrawal of a test specimen.

6.2 Take two laboratory test samples of approximately 10 mg in accordance with ISO 1130, using at least 32 and preferably 64 pinches of fibres taken from various parts of the laboratory bulk sample. Double and draw each sample between the fingers several times to mix and parallelize the fibres, and then split it lengthways into five test samples of about equal size.

7 Preparation of specimens

7.1 The determination of fibre maturity shall be based on the examination and classification of duplicate sets of five test specimens, each test specimen containing 100 or more fibres mounted on a slide. Each set of five test specimens shall be prepared and tested by a different technician, as described below.

7.2 Hold one end of the test sample between the thumb and forefinger of one hand, and press the other end of the fibres against the slide by using either the other forefinger or the edge of a second slide. Pull the test sample gently, thereby pulling out a few fibres. Repeat the process to obtain the 100 or more fibres constituting a test specimen.

7.3 Spread the parallel fibres and evenly separate them to a width of about 25 mm, taking care to keep their centres aligned and using a dissecting needle to move them, while gently holding them with the edge of the second slide or the edge of the cover glass. Place a glass cover over the fibres and apply a drop of the sodium hydroxide solution (4.4) to one corner. Tap the cover glass gently to facilitate wetting of all the fibres and to prevent air bubbles.

7.4 Repeat the procedure for the other four test specimens, to obtain five test specimens. Swelling of the first test specimen is then completed and the slide is ready for viewing. (See annex B for other methods of preparing test specimens.)

8 Test procedure

8.1 Adjust the condenser of the microscope (4.1) to give critical illumination and then move it slightly to obtain a uniformly lighted field of view and a slightly exaggerated constrast between the fibre wall and lumen. Artificial lighting gives a more constant light than daylight and is an aid to maintaining the desired level of fibre classification.

8.2 Place the first mounted slide on the microscope stage so that the centre portions of the fibres are in the field of view. Move the slide across the stage perpendicular to the fibre axes until the first fibre is encountered. Classify each fibre according to one of the two following options.

a) option 1, maturity ratio :

1) dead fibre;

2) normal fibre;

3) thin walled fibre.

b) option 2, percent maturity :

1) immature fibre;

2) mature fibre.

Classify all the fibres found on the slide and record the total number.

8.3 Make similar counts on the remaining slides.

9 Calculation and expression of results[1)]

9.1 Option 1, maturity ratio

Calculate, for each series of fibre slides, the percentages of normal and dead fibres as a ratio to the total number of fibres on the five slides.

For each of the two classes, calculate the mean percentage obtained in each series.

The maturity ratio, M, is given by the formula

$$\frac{N - D}{200} + 0{,}70$$

where

N is the mean percentage of normal fibres;

D is the mean percentage of dead fibres.

9.2 Option 2, percent maturity

For each slide, the percentage of mature fibres, i.e. the percent maturity, PM, is given by the formula

$$\frac{M'}{T} \times 100$$

where

M' is the number of mature fibres;

T is the total number of fibres.

Calculate the mean of the ten results obtained.

10 Test report

The test report shall include the following particulars :

a) a reference to this International Standard;

b) the method used for preparation of the specimens (see clause 7);

c) the test result :

1) maturity ratio for option 1;

2) percent maturity for option 2;

d) details of any operations not specified in this International Standard or incidents likely to have had an influence on the results.

1) The relationship between maturity ratio and percent maturity is given in annex C.

Annex A

Typical examples of cotton fibres swollen in sodium hydroxide

(This annex does not form part of the Standard.)

A.1 The test specified in this International Standard necessitates constancy in visual classification because maturity is not measured directly.

Figures 1 to 9 illustrate typical fibres after swelling in 18 % (*m*/*m*) sodium hydroxide solution for options 1 and 2. However, they cannot show the range of variations of maturity one may encounter.

A.2 Reference samples, whose maturity ratios have been established, may be obtained from Shirley Developments Ltd. Wilmslow Road, Didsbury, Manchester 20, England. So that a similar range of samples may be furnished, indicate the type of cotton usually tested, i.e. Egyptian, medium staple, American etc.

Maturity ratios of the reference samples were established on specimens using comb sorter diagrams; the results obtained are slightly more accurate than those obtained on specimens taken at random.

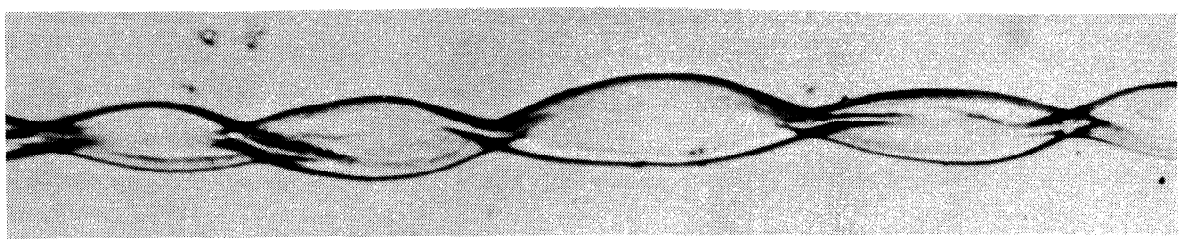

Figure 1 — Dead fibre (Shows frequent convolutions and very narrow wall)

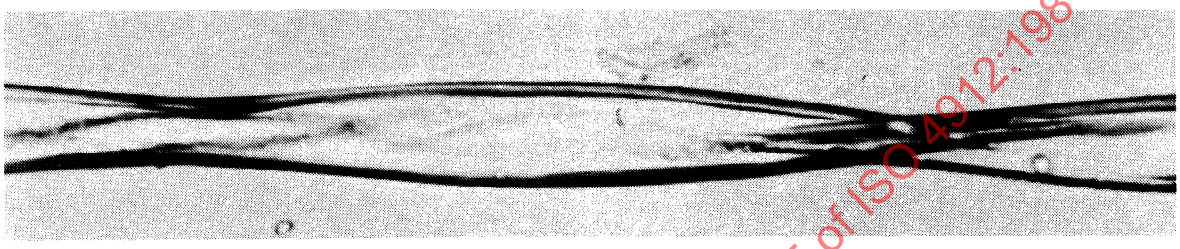

Figure 2 — Dead fibre (Convolutions are less frequent but wall thickness less than 1/5 of the maximum ribbon width)

Figure 3 — Thin-walled fibre (Non-convoluted form, wall thickness greater than 1/5 of the maximum ribbon width)

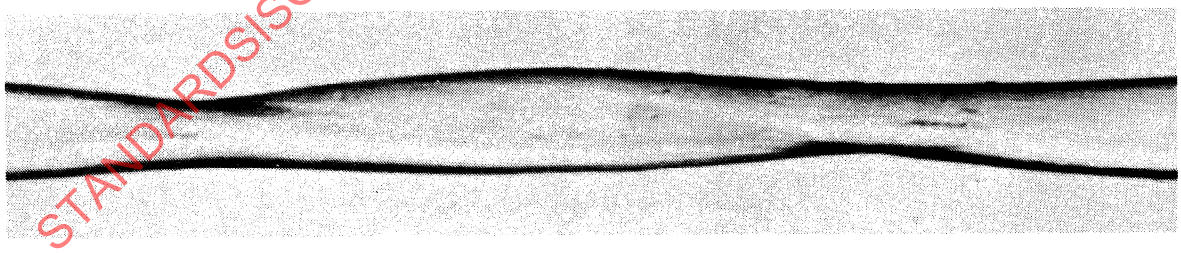

Figure 4 — Thin-walled fibre (Convoluted form with wall thickness greater than 1/5 of the maximum ribbon width)

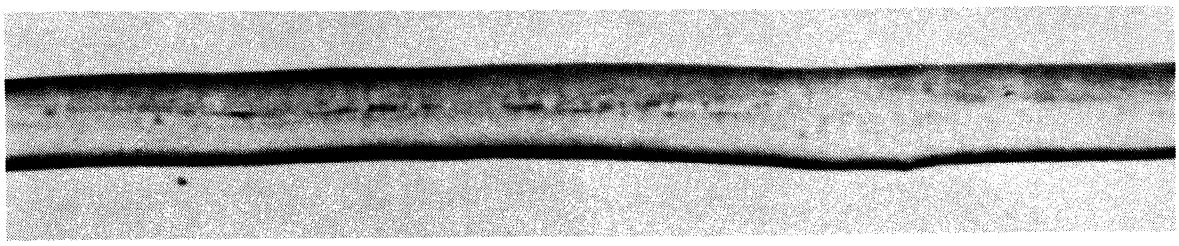

Figure 5 — Normal fibre (Rod-like appearance; the lumen may be seen indistinctly in places but is not continuous)

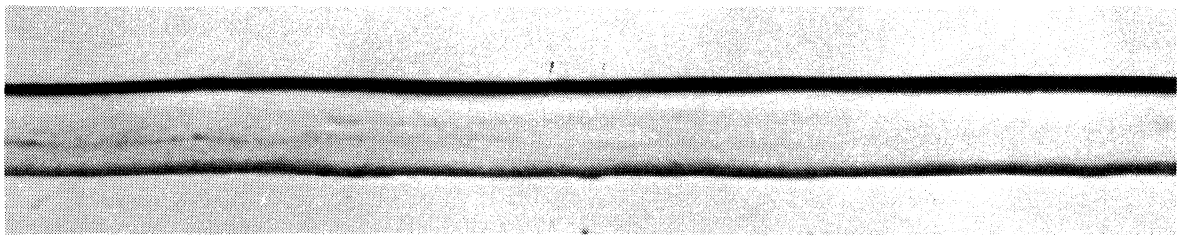

Figure 6 — Normal fibre (Rod-like appearance with hardly any trace of the lumen)

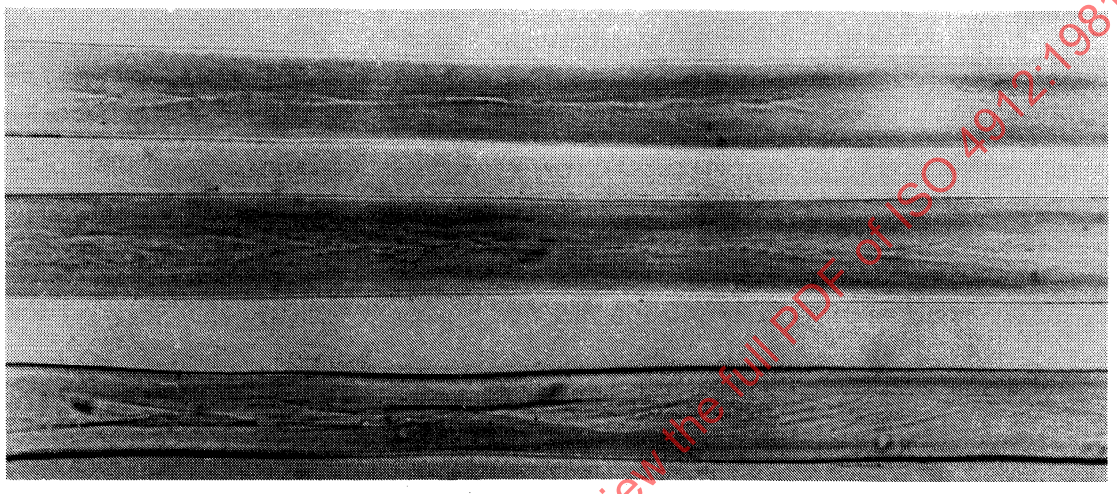

Figure 7 — Mature fibre

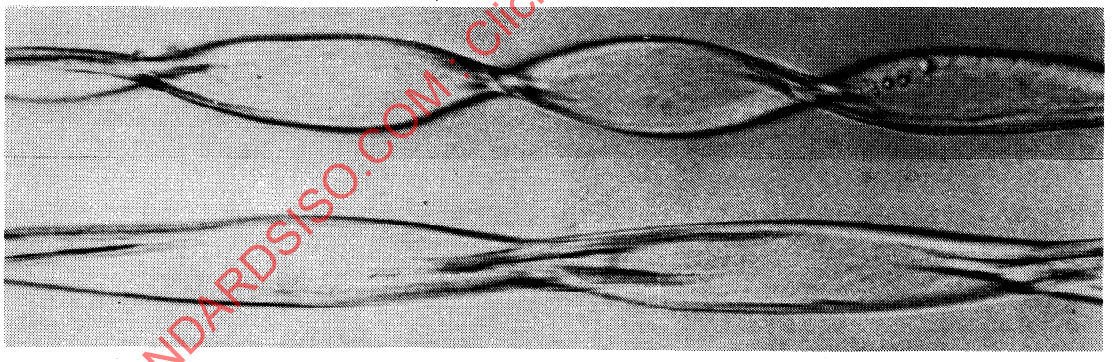

Figure 8 — Immature fibre (type A)

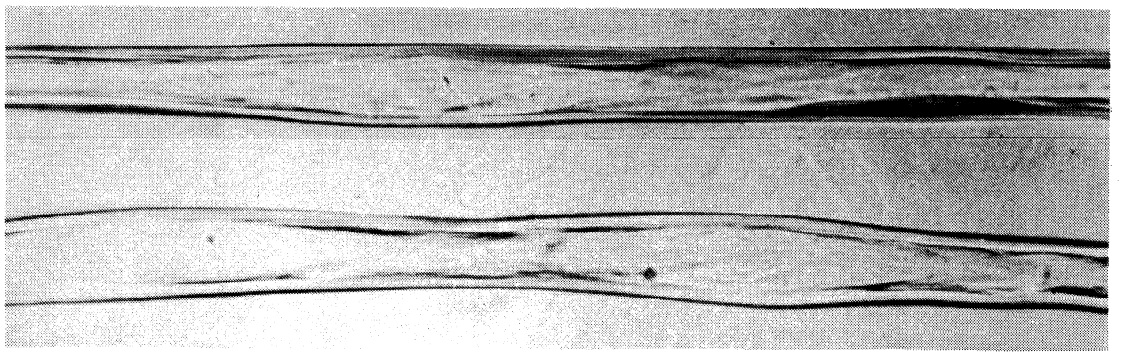

Figure 9 — Immature fibre (type B)

Annex B

Methods for preparation of specimens using comb sorter diagrams or fibres grouped by classes

(This annex does not form part of the Standard.)

B.1 Sampling method from comb sorter diagrams

Take a specimen from the longest group, another from fibres of half the "effective length", and three spaced equally along the diagram between these two. Mount the test specimens and classify them in the same way as for those taken by random sampling methods.

B.2 Sampling method from fibres grouped by classes

Take a specimen from each of the length groups (groups differ consecutively by 3 mm in length) with the exception of the 1,5 mm and 4,5 mm groups and any other group containing less than 1 mg. Weigh the test specimens to the nearest 0,005 mg, then mount and classify them in the same way as for those taken by random sampling methods.

NOTE — One can then calculate the percent maturity using the weighted mean averaged for all the length groups using the formulae

$$(N) = \frac{m\,N_1}{m_1}$$

where

N is the number of fibres in each group;

N_1 is the number of fibres in the specimen;

m is the mass, in milligrams, of fibres in the length group;

m_1 is the mass, in milligrams, of the specimen.

Then

$$P = \frac{\Sigma\, NM_1}{\Sigma N}$$

where

P is the percent maturity;

N is the number of fibres in each length group;

M_1 is the percentage of mature fibres in each length group.