SCAN-CM 66:05
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SCANDINAVIAN PULP, PAPER AND BOARD
TESTING COMMITTEE

Mechanical and chemical pulps

Fines content

0 Introduction

This SCAN-test Method has been prepared to make it possible to determine the fines content of mechanical and chemical pulps.

This Method involves a more precise determination, i.e. a lower coefficient of variation of repeated determinations is achieved (see Annex A), than with SCAN-M 6:69 *Fibre fractionation of mechanical pulp in the McNett apparatus*. SCAN-M 6 has earlier been used to determine the fines content, although SCAN-M 6 was not primary intended for that purpose.

1 Scope

This SCAN-test method describes the procedure for determining the fines content of all kinds of pulp by means of a single-screen fibre classifier. The screening procedure is the same for mechanical and chemical pulps, although, the mass of the test portion and the total volume of water for screening are not the same.

Note – The procedure is also applicable for most kinds of paper samples, provided that it is possible to fully disintegrate the sample.

2 References

ISO 638	Pulps – Determination of dry matter content (EN 20638)
ISO 14487	Pulps – Standard water for physical testing
SCAN-CM 68	Pulp – Standard water for physical testing – Conductivity (40–150) mS/m
ISO 5263-1	Pulps – Laboratory wet disintegration – Part 1: Disintegration of chemical pulps (EN ISO 5263-1)
ISO 5263-2	Pulps – Laboratory wet disintegration – Part 2: Disintegration of mechanical pulps at 20 °C (EN ISO 5263-2)
ISO 5263-3	Pulps – Laboratory wet disintegration – Part 3: Disintegration of mechanical pulps at ≥ 85 °C (EN ISO 5263-3)
ISO 4119	Pulps – Determination of stock concentration (EN ISO 4119)

Note – SCAN-test has withdrawn a number of test methods and refers instead to the corresponding ISO and/or EN Standards.

3 Definitions

For the purpose of this Method, the following definitions apply:

3.1 *Chemical pulp* – Pulp in which the fibres have been separated principally by chemical means, normally by cooking, so that substances other than cellulose are largely removed by dissolution.

3.2 *Mechanical pulp* – Pulp in which the fibres have been separated principally by mechanical means.

3.3 *Fines* – The fraction of a pulp which passes a screen or a perforated plate with a diameter of the holes of 76 µm.

Note 1 – In this method, chemi-thermo-mechanical pulp (CTMP) is regarded as mechanical pulp.

Note 2 – There is no significant difference in the results obtained using a perforated plate and a wire in the fibre classifier, see Annex A.

Warning – If the sample contains mineral fillers, the filler particles will normally appear in the fines fraction.

4 Principle

The pulp sample is disintegrated using standard water.

The pulp suspension is screened through a plate with round holes, or through a wire screen. The material retained on the screen and that which passes the screen are dried and weighed separately. The fines content is calculated and reported as a percentage of the oven-dry mass of the test portion.

Note 1 – The mass of the test portion and the volume of water are different for mechanical pulps and chemical pulps.

Note 2 – The screening effect results from the turbulence and the pressure developed by a stirrer with a three-bladed propeller.

Note 3 – The mineral (fillers and pigment) content in the fines fraction can be calculated from the residue on ignition content (the ash) of the fraction, provided that the ash contents of the mineral and the pulp are known.

5 Apparatus

5.1 *Disintegrator*, as described in ISO 5263-1, ISO 5263-2 and ISO 5263-3, depending on which part of the standard is relevant.

5.2 *Fibre classifier*, of BDDJ type (Britt Dynamic Drainage Jar) or similar, *Figure 1*. A cylindrical sample holder with a diameter of (100 ± 10) mm, provided with 3 or 4 vanes on the inside, the vanes having a square section with (6,0 ± 1,0) mm side, and equipped for the insertion of a bottom screen and an air chamber. The bottom outlet shall have a diameter of (6,5 ± 1) mm.

Note – The water flow rate has a minor influence on the result when determining the fines content.

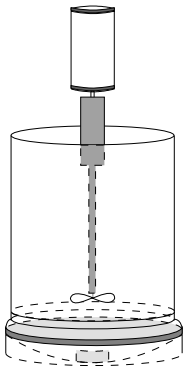
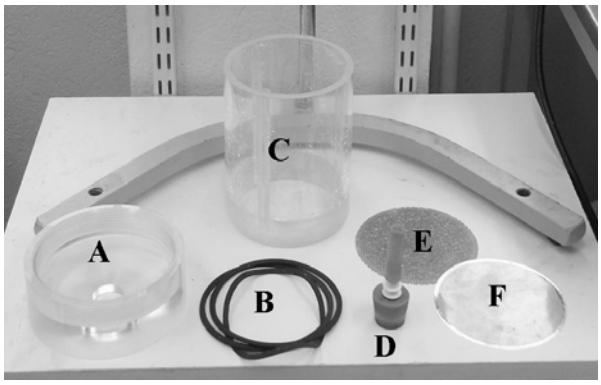


Figure 1. A sketch of the fibre classifier

5.3 *Stirrer*. A shaft that carries a three-bladed, (5 mm ± 1 mm x 1 mm ± 0,1 mm) propeller. The blades shall be circular, (17,5 ± 2) mm in diameter with a pitch of (30 ± 3)º. The stirrer shall be well centred and the distance between the propeller and the screen shall be (3,5 ± 0,5) mm. The rotation direction of the motor must be so that the pressure of the propeller blades is downward toward the screen and the speed of the propeller shall be (750 ± 50) rpm.

5.4 *Screen.* A perforated metal plate with circular holes, each hole with a diameter of (76 ± 4) µm or a wire screen



having a nominal aperture size of (76 ± 4) µm (12.1).
Figure 2. A photograph of the different parts of the classifier

A *Bottom with outlet*
B *Gaskets*
C *Sample holder*
D *Plug for outlet*
E *Supporting plate*
F *Metal plate, hole diameter (75 ± 4) µm.*

5.5 *Filter paper*, e.g. Munktell No 3 (grammage 90 g/m^2, filtration speed 700 ml/min through 100 cm^2 filtering area) or equivalent. The recommended diameter is 120 mm for the fibre fraction and 90 mm for the fines.

6 Chemicals and reagents

6.1 *Standard water*, as described in ISO 14487 or in SCAN-CM 68.

For samples containing chemicals, it is recommended that a dispersant be added to the water (6.1). Prepare a concentrate of 2,5 % of Na_2CO_3, 2,5 % of $Na_5P_3O_{10}$ and 2,5 % of an acrylate dispersant and then dilute it 1:1000 in water (6.1). If dispersant is used, it must be used throughout the procedure.

7 Sampling

The sampling procedure is not covered by this method. Make sure that the aliquot taken to disintegration is representative of the sample received.

8 Procedure

8.1 Disintegration

Use standard water (6.1) and a disintegrator (5.1), and disintegrate the pulp as described in the relevant part of ISO 5263. Use ISO 5263-Part 3 for mechanical pulps exhibiting latency.

Determine the concentration of the pulp suspension as described in ISO 4119.

8.2 Screening

Carry out the screening procedure in duplicate.

From the well-stirred, disintegrated pulp suspension, take a test portion having a mass as specified in *Table 1*. The total volume of screening water to be used is also specified in the table.

Pulp grade	Oven-dry mass of test portion, g	Total volume of water, ml
Chemical pulp, fines content <10 %	5,0 ± 0,5	5 000
Mechanical pulp, fines content >10 %	0,5 ± 0,1	2 500

Note 1 – For chemical pulps, a mass of 5 g has been chosen to guarantee good precision even for pulps with low fines content.

Note 2 – The content of dissolved and colloid substances can for example be determined by determination of the total dry matter content of the sample, i.e. concentration by evaporation. Then calculate the difference between the total dry matter content and the concentration determined using a pre-weighed filter paper.

Dilute the weighed test portion with 1000 ml of standard water (6.1) and transfer it to the sample holder (5.2) of the fibre classifier having the bottom outlet closed. Set the stirrer above the screen as described in 5.3 and start the stirrer. Open the outlet. Allow the content of the jar to drain into a beaker. When the level in the jar is within 1 mm to 5 mm above the screen, add an additional portion of standard water (6.1), e.g. 1000 ml, and allow the content to drain into another beaker. Continue this procedure until the total volume of standard water (6.1) for screening, as specified in *Table 1*, has been used. Collect all that passes through the screen into beakers. After the final addition of screening water, continue until the water in the jar has disappeared.

Note 3 – The concentration of the last filtrate should not exceed 10 ppm.

In a bucket, collect the contents (the fines) from all the beakers. Then filter the fibre fraction and the fines fraction separately using pre-weighed filter papers (5.5). Dry and weigh the filter papers with the mat of fibres and the mat of fines. Calculate separately the oven-dry mass of the fibre fraction, *b*, and of the fines fraction, *a*.

9 Calculation

9.1 If no dispersant has been used

Calculate the fines content, as a percentage, using the expression:

$$X = \frac{100\,a}{a+b} \qquad [1]$$

where

X is the fines content, as a percentage;
a is the oven-dry mass of the fines fraction, in milligram;
b is the oven-dry mass of the fibre fraction, in milligram.

9.2 If a dispersant has been used

Do not use equation 1 to calculate the fines content since the dispersants normally becomes attached to the fines and contributes to the mass of the weighed fines. Instead, calculate the fines content from the difference between the total mass of the test portion (before adding the dispersant) and the mass of the fibres.

9.3 Mean fines content

Calculate and report the mean fines content as a percentage with three significant figures.

10 Report

The report shall include a reference to this SCAN-test Method and the following particulars:

(a) date and place of testing;
(b) precise identification of the sample;
(c) the kind of standard water used, ISO 14487 or SCAN-CM 68;
(d) the fines content, as a percentage;
(e) if not as stated in this SCAN-test method, the mass of the test portion and the volume of standard water used for screening;
(f) any departure from the procedure described in this Method and any other circumstances that may have affected the test results.

11 Precision

11.1 Repeatability

One laboratory tested three pulp samples several times. The following results were achieved:

Samples	Fines content, %	CV, %
Bl. softwood kraft, 33 SR	7,28	2,8
CTMP, CSF 130 ml	23,9	3,0
TMP, CSF 260 ml	25,0	2,9

11.2 Reproducibility

In an interlaboratory test, four laboratories tested three pulp samples. One laboratory determined the fines content using both the metal plate and the wire. Thus $n = 5$. The following results were achieved:

Samples	Fines content, %	CV, %
Bl. softwood kraft, 33 SR	6,82	5,7
CTMP, CSF 130 ml	23,7	4,8
TMP, CSF 260 ml	24,7	4,6

12 Literature

12.1 ISO 3310-1:1990 Test sieves – Technical requirements and testing – Test sieves of metal wire cloth

Annex A –
A comparison between McNett classifier and fibre classifier

In a laboratory study, results from the determination of fines content using SCAN-CM 66 and SCAN-M 6 were compared. In SCAN-CM 66, a fibre classifier of the BDDJ-type is used and in SCAN-M 6 a McNett classifier.

Four different pulp samples were included; a bleached softwood kraft, a bleached hardwood kraft, an unbleached softwood kraft and a CTMP. In this comparison study, the mass of the test portion was 0,5 g when testing in accordance with SCAN-CM 66, irrespective of whether the pulp was a chemical or a mechanical pulp. The sample size when testing in accordance with SCAN-M 6 was, as stated, 10 g.

In the determination of fines content using SCAN-M 6, the fines content is obtained as the difference between 100 % and the sum of the added contents of the fibre fractions, which has the consequence that any error in the determination of the content of the fibre fractions will influence the size of the fines content. For that reason, the coefficient of variation is normally higher in the determination of fines content using SCAN-M 6 than when using SCAN-CM 66.

	Bl softwood kraft			Bl hardwood kraft		
	Fines content, %.			Fines content, %.		
	SCAN-CM 66		**SCAN-**	**SCAN-CM 66**		**SCAN-**
	Wire	Plate	**M 6**	Wire	Plate	**M 6**
	7,7	6,8	7,6	8,1	7,7	8,8
	6,7	7,2	6,2	8,7	8,2	10,6
	6,7	7,5	6	7,5	8,8	8,7
Mean	7,03	7,17	6,60	8,10	8,23	9,37
CV, %	8,2	4,9	13,2	7,4	6,7	11,4

	Unbl softwood kraft			CTMP		
	Fines content, %.			Fines content, %.		
	SCAN-CM 66		**SCAN**	**SCAN-CM 66**		**SCAN**
	Wire	Plate	**-M 6**	Wire	Plate	**-M 6**
	12,7	12,3	12,2	20,8	20,1	22,2
	12	12,6	10,9	20,4	20,3	20,2
	12,4	13,3	12,5	20,9	21,2	19,8
Mean	12,4	12,7	11,9	20,7	20,5	20,7
CV, %	2,8	4,0	7,2	1,3	2,9	6,2

CV = Coefficient of variation

SCAN-test Methods are issued and recommended by KCL, PFI and STFI-Packforsk for the pulp, paper and board industries in Finland, Norway and Sweden.
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