

Fillers and pigments

Dispersion agent requirement

1 Scope

This SCAN-test Method specifies a procedure for determining the amount of a given dispersion agent required to reduce to a minimum the Brookfield viscosity of a slurry of the pigment under test.

The method can be used to compare different dispersion agents in relation to a given pigment. It has been primarily developed for kaolin and can be used for pigments such as calcium carbonate but it is not suitable for talc.

2 References

- SCAN-P 39 Fillers and pigments – Dry matter content
- SCAN-P 50 Pigments – Brookfield viscosity of slurries

3 Definition

For the purpose of this Method, the following definition applies:

3.1 *Dispersion agent requirement* (of a filler or pigment) – The amount of a specified dispersion agent required to reduce to a minimum the Brookfield viscosity of a slurry prepared from the filler or pigment under test.

4 Principle

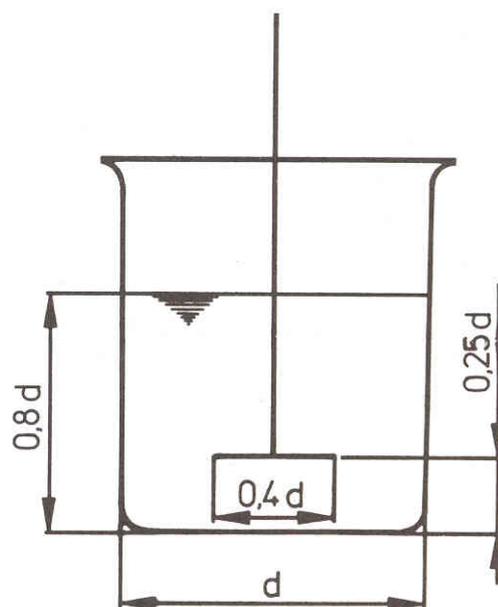
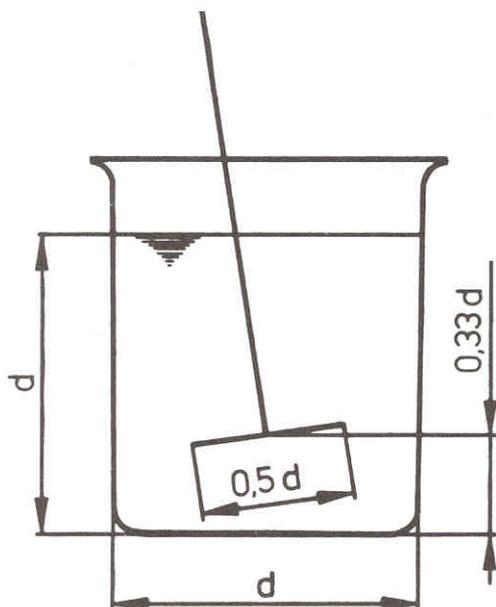
To a pigment slurry, of known dry matter content, small increments of a given dispersion agent are added. After each addition the Brookfield viscosity of the slurry is measured and plotted against the total amount added. The point at which the curve passes through a minimum indicates the dispersion agent requirement.

5 Apparatus

5.1 *Laboratory disintegrator*, suitable for the dispersion of pigments, with variable speed (maximum at least 1800 rpm) and a power of at least 500 W. The disintegrator must not draw air into the pigment slurry. The dimensions shown in *Figure 1* are given as a guide to ensure that the stirrer works with optimum efficiency. Note the oblique position of the propeller shaft.

5.2 *Beakers* of plastics, dimensions as indicated in *Figure 1*.

5.3 *Viscometer* as specified in SCAN-P 50.



6 Reagent

6.1 *Sodium hydroxide solution.* 2,5 mol/l. Dissolve 100 g of sodium hydroxide, NaOH, in distilled water and dilute to one litre.

7 Dispersion agent

Select the dispersion agent, or mixture of dispersion agents, relevant for use with the pigment under test. Sodium polyphosphate and sodium polyacrylate are commonly used as dispersion agents.

Use the commercial product as obtained or, if necessary, prepare a 250 g/l (oven-dry basis) solution of the selected dispersion agent.

8 Procedure

For an accurate determination of the dispersion agent requirement, the test should be carried out at an optimum dry matter content. The selection of dry matter content is difficult but important. Generally speaking the dry matter content should be kept as high as possible, but not so high that problems arise when preparing the pigment slurry.

The pH of the pigment slurry influences the result. The more alkali added the less the requirement of dispersion agent. Because of the difficulties in determining an accurate pH value of a pigment slurry, the test should be carried out at a fixed amount of alkali and not at a fixed pH.

The analyst should obtain advice from the purchaser or client regarding both the choice of dry matter content and the amount of alkali. When kaolin is tested 0,1 % sodium hydroxide, calculated on the pigment, is normally added.

8.1 Weigh at least 500 g of pigment, oven-dry basis, to the nearest 1 g.

8.2 Calculate the volumes of water and sodium hydroxide solution (6) required to reach the chosen dry matter content and sodium hydroxide concentration. Pour the calculated volumes of water and sodium hydroxide solution into the disintegrator beaker. Add dispersion agent solution from a graduated pipette. The amount should be 50 % of that anticipated to be the dispersion agent requirement. Note the volume added.

8.3 Start the disintegrator at a low speed and add the pigment in small portions. As the viscosity of the pigment slurry increases, increase the speed of the disintegrator. See that no air is entrapped in the slurry. This can occur if the disintegrator speed is high. When all the pigment has been added, disintegrate for 20 min.

8.4 Remove the propeller from the beaker. Measure the Brookfield viscosity of the slurry as described in SCAN-P 50 but do not remove it from the beaker used in the disintegration. Measure the temperature but do not adjust it.

8.5 Weigh a clean beaker of the same size as the previous one and transfer the slurry to this beaker. Weigh the beaker again and calculate the amount of slurry. Clean and dry the propeller and lower it into the slurry.

Note – This procedure is necessary to allow for the fact that material adhering to the propeller and the walls of the beaker do not mix with the body of the suspension in subsequent disintegrations, which

therefore must be made in a clean beaker and with a cleaned propeller.

Add 0,25 ml dispersion agent and disintegrate for 3–4 min at a moderate speed. Measure the Brookfield viscosity of the slurry in the beaker.

8.6 Repeat the procedure described in the preceding paragraph (8.5) several times, using a clean beaker each time, until the Brookfield viscosity begins to increase. See also the example in *Table 1*.

At the end of the test, determine the dry matter content of the slurry, using the procedure described in SCAN-P 39.

9 Calculation

Calculate the amount of dry pigment present at each measurement. Calculate also the amount of dispersion agent added after each addition from the density and the dry matter content of the dispersion agent. Express this as a percentage of the amount of pigment.

The first addition of dispersion agent is calculated on the amount of pigment originally added. The subsequent additions are calculated from the amount of pigment which remains after transfer to the next beaker, given by the difference in weights and the dry matter content. An example is given in *Table 1*.

Table 1. Example of the calculation procedure.

Slurry mass g	Dry pigment g	Dispersion agent added		Total amount added		Viscosity at 100 rpm mPa s	Spindle no
		ml	%	ml	%		
–	500	1,25	0,126	1,25	0,126	12 600	7
608	417	0,25	0,030	1,50	0,156	1 400	4
559	383	0,25	0,033	1,75	0,189	720	4
535	367	0,25	0,034	2,00	0,223	600	4
510	350	0,25	0,036	2,25	0,259	610	4
465	319	0,25	0,040	2,50	0,300	760	4

Pigment: Kaolin SPS

pH-value: 6,8

Dispersion agent: Dispex, density 1,26 g/ml

Temperature: 34 °C

Dry matter content: 400 g/kg

Water: 225 ml

Dry matter content of the slurry at the end of the test: 68,8 %

NaOH: 0,5 g

Plot the Brookfield viscosity against the total percentage of dispersion agent added. The dispersion agent requirement is equal to the percentage added when the viscosity passes through a minimum. Express the result with two significant figures.

10 Report

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

- date and place of testing;
- identification mark of the pigment tested;
- description and identification mark of the dispersion agent used;
- the temperature at the beginning and the dry matter content at the end of the test;
- the amount of alkali added;
- the dispersion agent requirement, expressed as a percentage of the amount of pigment;
- any departure from the procedure described in this Method and any other circumstances that may have affected the results.

11 Precision

When five laboratories tested the same pigment, the results (dispersion agent requirement) varied within the range 0,20 % to 0,23 %.

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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