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Pulps — Laboratory beating — Part III : Jokro mill method

*Pâtes — Raffinage de laboratoire —
Partie III : Méthode au moulin Jokro*

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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 5264/III was developed by Technical Committee ISO/TC 6, *Paper, board and pulps*, and was circulated to the member bodies in December 1977.

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

Austria	India	South Africa, Rep. of
Belgium	Iran	Spain
Canada	Ireland	Sweden
Chile	Kenya	Switzerland
Czechoslovakia	Mexico	Turkey
Finland	Netherlands	USA
France	Norway	USSR
Germany, F.R.	Poland	
Hungary	Romania	

The member body of the following country expressed disapproval of the document on technical grounds :

Italy

Pulps — Laboratory beating — Part III : Jokro mill method

0 INTRODUCTION

It has been agreed that the ultimate aim of standardization of laboratory beating should be to develop one test method which is internationally acceptable and which, if possible, allows the energy consumption during beating to be measured. For practical reasons it has not proved possible to achieve this at present. Therefore, as an interim measure, in view of the widespread use of the following methods

- Valley beater,
- PFI mill,
- Jokro mill,

it has been decided to provide agreed guidance on the use of these equipments in order to achieve consistency of results with each instrument. While all three methods will show a similar trend in respect of the pulp tested, the actual results cannot be correlated between different types of beater¹⁾. The position will be kept under review, and the methods will be replaced by a single method as soon as practicable.

1 SCOPE

This International Standard specifies a method, using a Jokro mill, for the laboratory beating of pulp. The description is limited to the disintegrating and beating of the stock, the withdrawal and distribution of samples, and the beating equipment.

The beating is a preliminary step in testing the physical properties of pulp.

Part I specifies a method of laboratory beating using a Valley beater and Part II a method using a PFI mill.

2 FIELD OF APPLICATION

In principle, this method is applicable to all kinds of pulp.

NOTE — In practice, the method may not give satisfactory results with certain extremely long-fibred pulps, such as cotton linter.

3 REFERENCES

ISO 638, *Pulps — Determination of dry matter content.*

ISO 4119, *Pulps — Determination of stock concentration (Rapid method).*

ISO 5263, *Pulps — Laboratory wet disintegration.*²⁾

4 PRINCIPLE

A measured amount of pulp of specified stock concentration is beaten between the inner wall of a cylindrical beating box which revolves with a planetary rotation around a central shaft, and a grooved roll loosely placed in the box.

5 APPARATUS AND AUXILIARY MATERIALS

Ordinary laboratory equipment and

5.1 **Jokro mill**, as described in the annex.

5.2 **Standard distintegrator**, as described in ISO 5263.

5.3 **Balance**, capable of weighing the sample to an accuracy of 0,2 g.

5.4 **Distilled water**, or water of similar quality.

NOTE — Distilled water, or water of similar quality, is particularly recommended with a view to obviating any difficulties that might arise from the use of different qualities of water by the interested parties.

1) Should one of the three methods listed become the future standard method, the method chosen should be the one which works in the most economical way and yields the highest reproducibility of results obtained in different laboratories.

At present, some countries are of the opinion that the PFI mill described in ISO 5264/II meets these requirements best of all.

2) At present at the stage of draft.

6 PREPARATION OF SAMPLE

If the pulp is wet or air-dry, weigh out a sample for dry matter determination in accordance with ISO 638. If the pulp is in slush form, determine the dry matter content in accordance with ISO 4119.

Take an amount of the pulp corresponding to $16 \pm 0,5$ g of oven-dry pulp (do not cut the pulp, and avoid the use of cut edges). If the sample is in the form of machine-dried sheets or flash-dried slabs, soak the pulp thoroughly in 0,5 litre of water (see 5.4) at room temperature for not less than 4 h. Tear the soaked pulp into pieces approximately 25 mm $\times$ 25 mm in size. It is essential that the pulp be thoroughly softened by soaking, to ensure that the preliminary disintegration results in a minimal beating effect. Wet pulps may be disintegrated without soaking.

7 PROCEDURE

7.1 Disintegration

Transfer the wet-pulp sample, and the water used for disintegration, to the disintegrator (5.2). Add water at $20 \pm 5^\circ\text{C}$ to give a total volume of $1\,100 \pm 25$ ml; the pulp concentration will then be about 1,5 % (m/m). Set the revolution counter to zero. Switch the motor on and allow the disintegrator to run for a few seconds. Switch the motor off and, before the propeller stops, switch on again. For pulps having an initial dry matter content of 20 % (m/m) or more allow the propeller to make 30 000 revolutions. For pulps having an initial dry matter content of less than 20 % (m/m), allow the propeller to make 10 000 revolutions.

When the propeller has stopped, check that the pulp has been completely disintegrated.

NOTES

- 1 Where necessary for climatic reasons, a temperature of $25 \pm 5^\circ\text{C}$ may be used, provided that this is noted in the test report.
- 2 Ensure that the pulp is completely disintegrated. Pulps that are difficult to disintegrate, such as unbleached sulphate pulp, may require a longer time than that specified above.
- 3 A sample disintegrated as described above may not be regarded as a sample of unbeaten pulp disintegrated in accordance with ISO 5263.

7.2 Thickening

After disintegration, drain the pulp suspension on a Buchner funnel to a concentration of approximately 20 % (m/m). To avoid loss of any fibres, refilter the filtrate through the fibre mat, if necessary several times. Dilute the thickened pulp with water to a total mass of 265 ± 5 g, corresponding to a 6 % (m/m) stock concentration.

7.3 Beating

Beating conditions : Rotational frequency of the vertical shaft of the Jokro mill : $2,50 \pm 0,05$ s⁻¹.

Bring the beating elements of the Jokro mill (5.1) and the pulp suspension to a temperature of $20 \pm 5^\circ\text{C}$. Transfer the pulp suspension, prepared in accordance with 7.2, to the cylindrical beating box, and distribute the pulp as evenly as possible around the grooved roll previously placed in the unit with the running base downwards. Place the lid on the box, and ensure that the rubber ring fits tightly. In each set, the box, lid and grooved roll shall all bear the same number. Place the unit in a holder of the turntable, and fix it with a clamp. Distribute the boxes symmetrically on the holders, to avoid one-sided loading of the mill. Thus, if beating is effected with only one unit, or with five units, a further unit shall be mounted, containing the same amount of fibre water mixture as a weight balance.

When the beating boxes are placed in the Jokro mill, and the mill has been closed, set the mill into operation, and adjust the rotational frequency of the control shaft to exactly $2,50 \pm 0,05$ s⁻¹ as the beating pressure is dependent upon this.

The time of beating required for the desired beating point depends upon the beating resistance of the pulp, and may vary according to the type of pulp.

The following is an example of a schedule for sample removal :

Sulphite pulps and other pulps that are easily beaten :	10, 30, 40, 70 min
Sulphate pulps and other pulps that beat more slowly :	15, 30, 60, 90, 120 min

The beating time (duration between starting and stopping the motor) shall be kept to within ± 5 s.

When the beating time has been obtained for a certain unit, switch off the motor, and remove the box concerned. At the same time, read off from the counter, the value for the number of central shaft revolutions and note it. After a standstill, which should if possible not exceed approximately 1 min, continue the beating, but ensure that the units which remain in the mill are arranged symmetrically; this is achievable by inserting an additional unit, made up with the usual fibre/water mixture.

Transfer the stock to a measuring cylinder with a volume of at least 1 000 ml. Rinse the beating box and add the rinsings to the cylinder. Dilute the stock with water to $1\,100 \pm 25$ ml, and clear the pulp suspension by disintegrating it in the standard disintegrator (5.2) using 10 000 revolutions of the propeller.

NOTES

- 1 When the mill is started, knocking may be heard; this should disappear after a few rotations, depending upon the evenness of the original distribution of the pulp.
- 2 After beating, clean the beating boxes thoroughly with water and, if necessary, with a pitch solvent.
- 3 If the drainability is measured, this should be done with a minimum of delay.

8 TEST REPORT

The test report shall indicate the following particulars :

- a) reference to this International Standard;
- b) all the indications necessary for complete identification of the sample;
- c) the number of revolutions used for preliminary disintegration;
- d) the time used for beating;
- e) the results obtained in the drainability test, if made (see note 3 to 7.3);
- f) any unusual features observed in the course of the procedure;
- g) any operations not specified in this International Standard or in the International Standards to which reference is made, or regarded as optional, which might have affected the results.

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ANNEX

THE JOKRO MILL (see the figure)

The Jokro mill comprises a horizontal revolving table (1) in which are mounted 6 cylindrical holders (2), which make a planetary movement around the central shaft (3) when in operation. The actual beating units (beating box with lid, grooved roll and wooden disc) are inserted in these holders, and fixed with clamps.

These cylindrical beating boxes (4) have an internal diameter of 145 mm at an inside height of 67 mm, measured along the internal wall of the box. The bottom of the box is tapered 2 mm up towards the centre to a recess 28 mm in diameter. In this recess, a disc (5) of hornbeam (wooden plate) is fixed by soaking in water; the grooved roll (6) runs on this newly made disc, which extends beyond the adjoining base area by 0,4 mm.

The internal wall of the beating box is provided with knurling at the periphery at a height of 57 mm; this knurling takes a lefthand course at an angle of 55° , and commences 5 mm from the base edge. It has a pitch of $132 \text{ mm} = 7.64 \text{ knurls on each } 10 \text{ mm}$.

The inside of the lid of the box is plane. A washer (8) is placed between the lid (7) and the box. The box and the lid are made of stainless material of a Brinell hardness of $105 \pm 10 \text{ HB}$.

The grooved roll consists of stainless material, Brinell hardness $85 \pm 10 \text{ HB}$, finished in the form of a cylindrical cutter roller and exactly centred. It has a diameter of 89,15 mm, and a height of 60 mm. The cutter edges, 2 mm in width, distributed evenly around the periphery, are formed by 35 semicircular recesses 3 mm in radius. The mass of the grooved roll is $2\,000 \pm 1 \text{ g}$.

The geometrical shaft of the box revolves clockwise around the vertical central shaft of the Jokro mill at a distance of 225 mm.

The rotational frequency of the central shaft is fixed at $2,5 \text{ s}^{-1}$. The planetary gear is rated in such a way that the holders which take the boxes rotate around their shaft at a rotational frequency of $2,5 \times 1,14 \text{ s}^{-1} = 2,85 \text{ s}^{-1}$.

The mill shall be operated only when it is made up symmetrically with boxes. Otherwise a separate box, usually an old one useless for exact working, should be inserted to balance the mass.

To ensure reproducible beating, the following conditions shall be fulfilled :

- a) The mill shall be installed in such a way that the central shaft is vertical.
- b) The revolution counter readings and the rotational frequency of the central shaft shall be checked from time to time. Revolution adjustment can be effected by readjusting the friction wheel gear, or by electrical control.
- c) The box units, i.e. boxes with lids, grooved roll and wooden discs, shall be in good condition. Although, as a rule, cutters wear and burring occurs only when new units are being run in, a check shall always be made that the wooden discs are still swollen and firmly fitted into the base recess of the box. Consequently, when the units are not in use, the wooden discs shall be kept wet by filling the boxes with distilled water, and exchanged when they have been used for a length of time such that the grooved roll begins to grind on the metal.
- d) The beating units shall be clean and free from deposits. Pitch deposits should be removed with a non-corrosive solvent.
- e) The general condition of the beating boxes shall be checked from time to time by beating reference pulps in comparison with a control unit, kept for checking purposes. The drainage values obtained after beating to about 50° Schopper-Riegler number or 200 "Canadian Standard" freeness number shall be within $\pm 5\%$ of those normal for the reference pulp; if not, the box shall not be used for reference purposes.