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# ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION



# ISO RECOMMENDATION
# R 302

## DETERMINATION OF THE KAPPA NUMBER OF PULP

(DEGREE OF DELIGNIFICATION)

1st EDITION

April 1963



For each individual country the only valid standard is the national standard of that country.

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# BRIEF HISTORY

The ISO Recommendation R 302, *Determination of the Kappa Number of Pulp (Degree of Delignification)*, was drawn up by Technical Committee ISO/TC 6, *Paper*, the Secretariat of which is held by the Association Française de Normalisation (AFNOR).

Work on this question by the Technical Committee began in 1961 and led in the same year to the adoption of a Draft ISO Recommendation.

In December 1961, this Draft ISO Recommendation (No. 492) was circulated to all the ISO Member Bodies for enquiry. It was approved by the following Member Bodies:

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|---|---|---|
| Australia | Germany | Republic of South Africa |
| Austria | India | Romania |
| Brazil | Israel | Spain |
| Bulgaria | Italy | Sweden |
| Canada | Japan | Switzerland |
| Czechoslovakia | Netherlands | Turkey |
| Denmark | Norway | United Kingdom |
| Finland | Poland | U.S.S.R. |
| France | Portugal | Yugoslavia |

One Member Body opposed the approval of the Draft:

Belgium.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in April 1963, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 302 April 1963

# DETERMINATION OF THE KAPPA NUMBER OF PULP

## (DEGREE OF DELIGNIFICATION)

### 1. SCOPE

This method applies to the determination of the relative hardness, bleachability or degree of delignification of pulp. It may be used for all types and grades of chemical and semi-chemical, unbleached and semi-bleached pulps obtained in yields under 60 per cent (Note 1).

### 2. DEFINITION

The Kappa number is the number of millilitres of 0.1 N potassium permanganate solution consumed under the conditions specified in this ISO Recommendation by one gramme of oven-dry pulp. The results are corrected to 50 per cent consumption of the permanganate added.

### 3. APPARATUS

**3.1** **Agitator** of propeller type, made of glass or other non-corrosive material (a plastics or glass-covered magnetic stirrer may be used instead).

**3.2** **Disintegration apparatus,** high speed, wet, e.g. a kitchen mixer or similar apparatus which disintegrates the pulp completely with a minimum of damage to the fibres.

**3.3** **Bath** capable of maintaining a constant temperature of 25.0 °C ± 0.2 °C in the reaction vessel.

### 4. REAGENTS

**4.1** *Potassium permanganate solution*, standardized 0.1000 N ± 0.0005 N.

**4.2** *Sodium thiosulphate solution*, ca. 0.2 N. Normality known with an accuracy of ± 0.0005 N.

**4.3** *Potassium iodide solution*, 1.0 M.

**4.4** *Sulphuric acid*, 4.0 N.

**4.5** *Starch indicator solution*, 0.2 per cent.

All reagents should be of analytical grade.

### 5. PREPARATION OF SAMPLE

**5.1** **Air-dried pulp sheets.** Tear 3 to 10 g of the pulp into small pieces.

**5.2** **Screened slush pulps.** Make a 3 to 10 g air-dry pad by filtering on a Buchner funnel, avoiding any loss of fibres. Air-dry the pad and tear it into small pieces.

5.3 **Unscreened pulps.** If the pulp sample is taken from unscreened pulp which is normally screened before bleaching or other processing, then the shives and knots should be removed from the sample by screening. The method of screening should be stated along with the test results and should be chosen to give results similar to those obtained by the industrial screening of the pulp. Complete the preparation of the screened pulps as in clause 5.2 above.

NOTES

1. *Application of method*

   The method may be used for pulps obtained in yields up to 70 per cent, provided the pulp has been well screened.

## 6. PROCEDURE

Prior to weighing the test samples, condition the samples for not less than 20 minutes in the atmosphere near the balance.

Weigh out to the nearest 0.001 g that amount of pulp which will consume approximately 50 per cent of the potassium permanganate solution (Note 2). The permanganate consumption should be between 30 and 70 per cent. At the same time, weigh out a separate test sample for moisture determination. Determine the moisture content according to ISO Recommendation R 287*.

Disintegrate the test sample in 500 ml of distilled water until free from fibre clots and from large fibre bundles. Avoid methods of disintegration which involve extensive cutting of the fibres. Transfer the disintegrated test sample to a 1 500 ml reaction beaker, using about 295 ml of distilled water to rinse out the apparatus (Note 3). Place the beaker in a constant-temperature bath adjusted so that the reaction temperature stays at 25.0 °C ± 0.2 °C during the entire reaction (Note 4). Adjust the stirrer to obtain a vortex approximately 2.5 cm deep in the solution.

Pipette 100.0 ml ± 0.1 ml of the potassium permanganate solution and 100 ml of the sulphuric acid into a 250 ml beaker. Bring this mixture to 25 °C and add it quickly to the disintegrated test sample and simultaneously start a stop-watch. Rinse out the 250 ml beaker, using not more than 5 ml of distilled water, and add the washings to the reaction mixture. The total volume should be 1 000 ml. At the end of exactly 10.0 minutes, terminate the reaction by adding 20 ml of the potassium iodide solution from a graduated test tube.

Immediately after mixing, but without filtering out the fibres, titrate the free iodine with the sodium thiosulphate solution. Add a few drops of starch-indicator solution toward the end of the reaction.

Carry out a blank determination using exactly the same method as above, but omitting the pulp. The titration can be carried out at once.

NOTES (*continued*)

2. *Use of smaller quantities*

   A suggested control method for full chemical pulps uses 50 ml of potassium permanganate solution, 50 ml of sulphuric acid, 400 ml of water and the appropriate amount of pulp. In this case, when only half the volumes and quantities of pulp are used, the permanganate consumption $a$ in the table should be changed to $2a$. If $a = 25$ ml (50 per cent), the factor $d$ thus is 1.000. The method follows the standardized procedure in all other respects.

   This variant should give results similar to those obtained by the standardized method, but it cannot be considered as complying with the standardized procedure, and its use should be stated with the test results.

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* ISO Recommendation R 287, *Method for the Determination of Moisture Content of Paper and Board (Oven-Drying Method).*