INTERNATIONAL STANDARD

ISO 22754

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Pulp and paper — Determination of the effective residual ink concentration (ERIC number) by infrared reflectance measurement

Pâte et papier — Détermination de la concentration d'encre résiduelle relative (nombre ERIC) par mesurage de la réflectance infrarouge

Reference number
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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 22754 was prepared by Technical Committee ISO/TC 6, *Paper, board and pulps*.

Introduction

This International Standard provides a means of assessing the effective residual ink concentration (ERIC) in paper made from recycled fibres. The presence of residual ink influences the brightness and colour of pulp and of paper made from recycled fibre. The effect of the residual ink can be counteracted more easily if the effective concentration of the ink can be monitored. Brightness is not, however, an effective parameter for monitoring the deinking process, since brightness is affected by the presence not only of ink but also of other light-absorbing materials in the blue region of the spectrum such as lignin and dyestuffs. The ERIC method employs reflectance measurements in the infrared region of the spectrum where the light absorption coefficient of the ink is several orders of magnitude greater than the absorption coefficients of the fibre and other components, and this provides a sensitive means of estimating the concentration of ink [1]. This International Standard is based on the TAPPI method T 567 pm-97.

Pulp and paper — Determination of the effective residual ink concentration (ERIC number) by infrared reflectance measurement

1 Scope

This International Standard specifies a method for the determination of the effective residual ink concentration (ERIC number) by infrared reflectance measurement.

This International Standard is applicable to all types of deinked, recycled pulp and to sheets of machine-made paper made from recycled pulp, where the residual ink is black. The method is applicable to materials available in sheet form only if the opacity at 950 nm is less than 97 %. The ERIC number obtained is dependent on the distribution of ink particle sizes, and the method is most effective for submicron particles [2]. The value obtained is reliable only if the test material is uniform in ink distribution, formation, and grammage such that presenting different parts of the sheet to the measuring aperture of the reflectometer produces very similar readings.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 186, *Paper and board — Sampling to determine average quality*

ISO 536, *Paper and board — Determination of grammage*

ISO 2469, *Paper, board and pulps — Measurement of diffuse radiance factor*

ISO 3688, *Pulps — Preparation of laboratory sheets for the measurement of diffuse blue reflectance factor (ISO brightness)*

ISO 14487, *Pulps — Standard water for physical testing*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
diffuse reflectance factor
R
ratio of the radiation reflected by a body to that reflected by the perfect reflecting diffuser under the same conditions of diffuse illumination and normal detection

NOTE 1 The ratio is often expressed as a percentage.

NOTE 2 This International Standard prescribes diffuse irradiation and normal detection in an instrument calibrated in accordance with the provisions of this International Standard.

3.2
intrinsic reflectance factor
R_∞
diffuse reflectance factor of a layer or pad of material thick enough to be opaque, i.e. such that increasing the thickness of the pad by doubling the number of sheets results in no change in the measured reflectance factor

NOTE The reflectance factor of a non-opaque sheet is dependent on the background and is not a material property.

3.3
single-sheet reflectance factor
R_0
reflectance factor of a single sheet of paper with a black cavity as backing

3.4
light scattering coefficient at 950 nm by reflectance factor measurements
s_{950}
⟨Kubelka-Munk method⟩ coefficient calculated by application of the Kubelka-Munk equations to reflectance factor data obtained at a wavelength of 950 nm in an instrument having a geometry and having been calibrated as specified in 5.1, and taking into consideration the grammage

NOTE 1 Units: m^2/kg.

NOTE 2 The relevant equations are given in Clause 9.

3.5
light absorption coefficient at 950 nm by reflectance factor measurements
k_{950}
⟨Kubelka-Munk method⟩ coefficient calculated by application of the Kubelka-Munk equations to reflectance factor data obtained at a wavelength of 950 nm in an instrument having a geometry and having been calibrated as specified in 5.1, and taking into consideration the grammage

NOTE 1 Units: m^2/kg.

NOTE 2 The relevant equations are given in Clause 9.

3.6
effective residual ink concentration
ERIC number
ratio of the light absorption coefficient of pulp or paper containing ink to the light absorption coefficient of the ink itself, both being determined at a wavelength of 950 nm

NOTE The ERIC number is dimensionless.

4 Principle

The intrinsic reflectance factor and the single-sheet reflectance factor of the test material are determined at a wavelength of 950 nm. The light absorption coefficient of the test material is calculated from these data by application of the Kubelka-Munk equations. The ERIC number may then be calculated as the ratio of this value to the light absorption coefficient of the ink.

5 Apparatus

5.1 Reflectometer, having the geometric, spectral and photometric characteristics described in ISO 2469, equipped with a filter or other device enabling the reflectance factor to be measured at a wavelength of 950 nm, and calibrated in accordance with the provisions of ISO 2469.

For such measurements, the effective wavelength of the reflectometer shall be (950,0 ± 5,0) nm. The spectral characteristics shall be such that the bandpass width at half peak height shall not exceed 150 nm, and the bandpass width at 10 % peak height shall not exceed 250 nm.

5.2 Reference standard, issued by an ISO/TC 6 authorized laboratory in accordance with the provisions of ISO 2469 for calibration of the instrument and the working standards, and having an assigned reflectance value corresponding to a wavelength of 950 nm.

Use new reference standards sufficiently frequently to ensure that the reflectometer is maintained in agreement with the reference instrument.

5.3 Working standards, two plates of flat opal glass, ceramic or other suitable material, cleaned and calibrated as described in ISO 2469.

Calibrate the working standards sufficiently frequently to ensure that satisfactory calibration is maintained.

NOTE In some instruments, the function of the primary working standard may be taken over by a built-in internal standard.

5.4 Black cavity, having a known reflectance factor of less than 1 % at 950 nm. The black cavity should be stored upside down in a dust-free environment or with a protective cover.

NOTE The condition of the black cavity can be checked by reference to the instrument maker.

6 Sampling and preparation of test material

6.1 Sampling

The sampling procedure is not included in this International Standard. If the tests are being made to evaluate a lot, the sample should be selected in accordance with ISO 186. If the tests are made on another type of sample, make sure that the test material taken is representative of the sample received.

6.2 Preparation of the test pieces

6.2.1 General

The method of preparation of test pieces depends upon whether the material is available as a machine-made paper or as a pulp.

6.2.2 Machine-made paper

For material available as a machine-made paper, cut test pieces with dimensions of at least (63,5 × 63,5) mm. Prepare a pad of test pieces sufficient to be opaque as defined in 3.2. Mark the top side of the pad for identification.

6.2.3 Pulp

Make a set of laboratory sheets from the pulp containing ink according to the procedure described in ISO 3688, each sheet having a grammage of 60 g/m^2. Do not use a retention aid.

NOTE ISO 3688 specifies two procedures for the preparation of laboratory sheets. The procedure using a Büchner funnel or similar is not suitable for making laboratory sheets in this case.

Do not adjust the pH of the pulp. Prepare sheets using reagent water as described in ISO 14487 or better and allow the slurry to find its own pH level. Measure and record the pH just before the deckle is drained.