

T 265 cm-09

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Natural dirt in wood chips

1. Scope, summary, and significance

The purpose of this method is to estimate the amount of natural (wood-derived) dirt in chips. The amount of dirt in the chips may be reflected in the level of dirt in the finished pulp or in bleaching and screening steps needed to produce an acceptable product. The determination is made by examining and classifying chips into categories defined by the ultimate contribution to dirt levels in the final product. For sulfite pulps from certain species, a dirt contribution values table (Table 1) is provided, which allows the results to be expressed in terms of an index based on square millimeters or equivalent area of black dirt. (See TAPPI T 213 “Dirt in Pulp.”)

Table 1. Dirt contribution values; acid sulfite cook; wood species-Engelmann spruce, balsam fir, alpine fir, and black spruce.

Chip Class	Unbleached pulp, mm ² of equiv. black area/g of pulp	Bleached pulp, mm ² of equiv. black area/g of pulp
Outer bark (2.1)	2000	950
Inner bark and dark knots (2.2)	50	35
Light knots, stains and resin pockets (2.3)	20	6
Rot and other defects (2.4)	4	1

Reference: Irwin, D., Lauer, B.D. “Dirt Contribution Values for Natural Dirt in Coniferous Wood,” *Tappi* **44**(1):33 (1961)

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2. Definitions of types of natural dirt in chips

2.1 *Outer bark*

2.1.1 *Solid outer bark* is usually dark in color and may be fibrous and much softer than wood. Its color and texture are both markedly different from those of wood and other types of dirt. Chips having even a small amount of outer bark should be included in this classification.

2.2 *Inner bark and dark knots*

2.2.1 *Inner bark* is found as a thin layer next to the cambium or a brown skinlike material which adheres very tightly to the wood. Because the bark comes from the outer layer of the wood, chips having inner bark on them will be smooth on one side and have a layer of grey or brown on that side. If any inner bark is present, the chip should be included in this classification.

2.2.2 *Dark knots* comprise chips with knots that are dark in color as well as chips with dark-color knotholes.

2.2.3 *Dark, hard knots* comprise chips consisting wholly of the knot portion of a dark knot. These chips are dark, hard, and resinous and have no wood material surrounding the knot.

2.3 *Light knots, stains, and resin pockets*

2.3.1 *Light knots* comprise chips containing light-colored knots with intact wood surrounding the knot. The chip is classified as a light knot whether the knot itself is present or missing. These chips are not appreciably different in color from the rest of the wood.

2.3.2 *Light, hard knots* comprise chips composed entirely of the knot portion of a light knot. The knots may appear a little darker than the rest of the wood but without a marked color difference. These chips will be hard and dense and the annual rings will be so compacted that they are indistinguishable.

2.3.3 *Pin knots* comprise chips having knots or knotholes with a diameter of less than 6 mm (0.25 in.).

2.3.4 *Brown stain* shows as various shades of brown and is probably caused by the penetration of extractives from the bark into the wood. Because of its wide range of color, its separation from the rest of the chips is not easily accomplished. There are many chips with very slight colorations, and the question may arise as to whether they should be classed as clean or as stained. In sorting this particular dirt type, whenever there is doubt whether a chip is clean or stained, it should be classified as a clean chip.

2.3.5 *Grey stain* ranges from a yellow-grey to slate grey. The chip may have streaks or spots of stain, but often the chip will be stained a uniform shade of grey.

2.3.6 *Resin pockets* comprise chips having ingrown bark, resin pockets, or pitch and chips highly impregnated with resin. These may be similar in appearance to those classified as dark knots, except for the absence of a knot or knothole.

2.4 *Rot and other defects*

2.4.1 *Brown rot* produces an abnormal brown color throughout, accompanied by brashness or other evidences of weakened wood. In advanced rot, the wood can be crumbled easily.

2.4.2 *White rot* gives decayed chips a whitish or "bleached" area in which the wood tends to be softer than normal. Sometimes this rot is present in small pockets.

2.4.3 *Black streak* shows as a narrow line, usually black but sometimes brown, between the annual rings in otherwise clean chips. Annual rings normally vary in color and in thickness, so care must be taken that the chips do actually have an abnormal line between the annual rings before making this classification. If there is a doubt if the chip has the streak, it should be classified as clean.

2.4.4 *Pith* comprises chips containing the soft core of a twig or stem. The pith is darker than the rest of the chip and its structure is very different from the wood. Pith is so soft that it can be crumbled readily.

2.4.5 *Insect holes* comprise chips containing holes and/or residue from the attack of insects on the wood.

NOTE 1: White rot may appear along with insect holes.

3. Apparatus

3.1 *Container*, with lid, of 25 L (6 gal) or more capacity, to accommodate the test specimen of chips.

3.2 *Scale*, of 10 kg capacity and with sensitivity about 10 g, to weigh the test specimen

3.3 *Balance*, 200-500 g capacity, and sensitivity about 0.1 g, to weigh the dirty chips.

3.4 *Screen*, U.S. Standard Sieve Series, with 6.35-mm (0.250-in.) openings, commonly known as a three-mesh screen.

3.5 *Mechanical screen shaker*, optional.

- 3.6 Chip containers, four of about 4 L (1 gal) capacity, with covers, for holding the different kinds of dirty chips.
- 3.7 Sorting table, about 2 m² (about 20 ft²) in area, shaped as to have its surface at a convenient distance from the operator and well lighted.
- 3.8 Reference samples of dirt types (optional), or a corresponding set of color photographs (Figs. 1-4).

4. Sampling and test specimen

4.1 Collect a sample of the wood chips of about 0.02 m³ (about 3/4 ft³), in accordance with TAPPI T 257 "Sampling and Preparing Wood for Analysis." If necessary, mix and quarter several samples collected to give a specimen of about this size.

4.2 If the chips in the specimen are unusually moist or very dry, spread them to bring their moisture into equilibrium with the surrounding atmosphere.

5. Procedure

5.1 Screen out any sawdust and undersized chips that pass through the three-mesh screen. Weigh the remainder of the chips.

NOTE 2: It is assumed that this fine material will be removed in the commercial wood room or in transportation.

5.2 Lay a large white sheet of paper, or the equivalent, to cover the sorting table and place the specimen on this sheet. Examine each chip and classify it as clean or dirty. Separate the dirty chips into classes (see Table 1) by putting them into one of the four containers provided for the purpose. If a chip has more than one kind of dirt, put it into the container representing the greater dirt contribution.

5.3 Weigh each class of dirty chips (except those with outer bark) to the nearest 0.1 g.

5.4 With a penknife carefully separate the outer bark from those chips bearing it and weigh the outer bark separately.

NOTE 3: For unusually small quantities of bark it may be necessary to use a balance of greater sensitivity in order to have the weight determination with an accuracy of $\pm 1\%$ of the total weight of bark.

NOTE 4: Make the various weighings soon after sorting so that the relative moisture content of the chips does not change appreciably.

6. Calculations

6.1 Calculate the weight fraction of each class of dirty chips (based on the weight of the screened specimen) and express each as a percentage by multiplying by 100.

6.2 If a dirt index is to be calculated, multiply each weight fraction (6.1) by the appropriate factor from Table 1. Sum the products to give the dirt index.

6.3 The factors given are averages based on data for acid sulfite pulps from Engelmann spruce, balsam fir, alpine fir, and black spruce. Birkhimer *et al.* (1) and Irvin and Lauer (2) provide more detailed information.

6.4 The average of the figures given in Table 1 might be applied to other woods to be made into sulfite pulp and possibly also the average of those for bleached sulfite pulp by other processes. The factors, especially those to be applied to the quantity of outer bark present, should be experimentally verified, since, for example, a caustic pulping process may dissolve and remove much of the dirt that would remain in a sulfite pulp.

7. Report

Report the percentages of each chip class present after screening, or report the dirt index. No more than two significant figures should be reported.