

Chemical pulp bleaching

Chemical pulp, the raw material in paper, is not naturally white; its light color or pure whiteness is the result of a multi-phased bleaching process. Bleaching means removing or altering the color substances in the pulp. It is done in phases.

The darkness of chemical pulp is caused by lignin, the natural adhesive that binds wood fibers together. A key issue in bleaching is how the lignin is processed, i.e. how much lignin is removed from the pulp. Typically, chemical pulp is bleached by removing lignin and mechanical pulp by preserving it. If lignin is removed from the pulp, the pulp remains brighter longer and yellows more slowly later.

The objectives of bleaching are usually to lighten the color of the pulp, preserve brightness, improve cleanliness, or reduce pitch content.

Bleaching improves the cleanliness of the pulp. When the last of the lignin is removed from the pulp, the fibers of the fiber bundles, i.e. the shives, are released and any remaining bark debris dissolves. The chemicals used in bleaching also effectively dissolve any extractives contained in the pulp.

The chemical pulp stock is bleached in several separate phases. In between each phase it is washed. By alternating the bleaching and washing phases, the pulp can be made very bright without compromising its structure and strength.

The bleaching of the chemical pulp stock takes place in the pulp mill's bleaching plant.

Elemental chlorine free bleaching

Elemental Chlorine Free bleaching does not use chlorine gas or hypochlorite, but chlorine dioxide is used in one or more phases. In a chemical reaction, the dissolved lignin is extracted from the pulp with some type of alkali.

Small amounts of hydrogen peroxide can be mixed into the pulp before the first alkali phase to improve delignification. Also small amounts of hydrogen peroxide improve delignification in the alkali phase. ECF bleaching can remove virtually all the residual lignin, thereby turning the sulphate pulp into fully bleached pulp.

Total chlorine free bleaching

Total Chlorine Free (TCF) bleaching does not use any chlorine chemicals, but e.g. peroxide and ozone are used.

Ozone removes residual lignin from pulp stock more effectively than peroxide. When the effect of the peroxide is supplemented with ozone, it is possible to achieve very bright softwood sulphate pulp, which has a high lignin content.

The ozone phase requires special equipment. Moreover, ozone cannot be stored, so it must be produced on-site.

TCF bleaching is used primarily in Scandinavia.

Mechanical pulp bleaching

The objective of mechanical pulp bleaching is to improve the brightness and purity of the pulp. Because virtually all the wood material is left in the pulp in mechanical pulp production, the pulp is bleached with a method that removes as little lignin as possible from it.

Unlike in chemical pulp bleaching, the lignin is not intentionally removed in the bleaching of mechanical pulp. Rather, the intention is to change the lignin's pigment compounds into a colorless form. This is done with either oxygenating or reducing bleaching chemicals.

The most common of the oxygenating bleaching chemicals is hydrogen peroxide. The most commonly used reducing bleaching chemical is sodium dithionite. Primarily as a result of quality standards, there is an increasing shift towards the use of oxygenating bleaching methods.