

Applications of Hydrogen Peroxide

Hydrogen Peroxide for Textile Industry

Generals:

HYPROX® is especially well suited for the bleaching of natural, vegetable and animal fibres derived from cellulose such as cotton, linen and other bast fibres. The textile fibres are bleached in widely varying processing stages as loose stock, yarn, woven fabric, or knitted fabric. Corresponding to the various processing stages, various types of mechanical bleaching equipment are used: kier, winch, jig, J-box and steamer with and without storage. Today's equipment for peroxide bleaching is generally produced from stainless steel. For example, materials Nos.1.4571 (according to DIN 17440) and TP 316 Ti (according to US Standard ANS) are suitable. The target of the bleaching is a permanent brightness with the least possible adverse affect with respect to the degree of polymerisation of the fibres. When dyeing with vat and sulfide dyestuffs, hydrogen peroxide is applied as oxidizing agent.

Advantages of peroxide bleaching:

- Among the oxidizing bleaching agents, only hydrogen peroxide provides a high bleaching effect at reasonable costs, especially if modern short-term bleaching processes are used with only a few minutes bleaching time.
- Peroxide bleaching keeps the fibre quality.
- Cotton can be bleached with peroxide in a single stage. Other processes require two or three bleaching stages.
- Hot, alkaline, bleaching has not only a bleaching, but also a cleaning effect, it therefore combines the advantages of an alkaline extraction with the bleaching treatment.
- Animal fibres can only be bleached with peroxide to a high and stable degree of whiteness.
- Corrosion of stainless steel equipment does not occur during peroxide bleaching.
- The spent peroxide baths still contain residuals of hydrogen peroxide which favor the degradation of the organic impurities in the effluent, and this helps to decrease the chemical oxygen demand (COD).

Composition of the bleaching solution:

The bleaching bath is composed of hydrogen peroxide (HYPROX® grades; 35 % or 50 % by wt.) as the bleaching agent, an activator (usually alkali) and stabilizers. In general the peroxide bleaching bath is activated by alkali. The amount of alkali and the pH value depend on the fibres to be bleached and pretreatment. Cotton is bleached in caustic soda solutions. For the bast fibres, such as linen, weaker alkaline or soda alkaline baths are used in order to avoid a cottonizing. Regenerated cellulose fibres are more sensitive. Therefore, they are only bleached in weak alkaline baths. Alkali sensitive animal fibres must be bleached in very weak alkaline solutions. Phosphates and ammonia are most widely used as alkalisation source. With tetrasodium pyrophosphate simultaneously a stabilization of the bleaching liquor can be attained. Peroxide baths containing only alkali are not stable. To prevent decomposition of the bath stabilizers must be added. For caustic alkaline bleach sodium silicate, organic stabilizers or the combination of both are suitable. In weak alkaline baths the addition of tetrasodium pyrophosphates can be used alone or together with an organic stabilizer.

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In addition **wetting agents** and **detergent agents** are often added. Especially with dry and not pretreated fibres the addition of wetting agents and detergents is necessary to obtain a quick and thorough impregnation of the material to be bleached by the liquor. Very suitable are products that help to prevent the precipitation of carbonates and silicates from hard water. **The consumption of peroxide**, or the concentration of the solutions, depends on the type and the quality of the material to be bleached, on the liquor ratio and as well on the required brightness. The amount of hydrogen peroxide and other additives can be given in percent of the weight of goods or in grams or ml per liter of the bleaching liquor. The liquor ratio must simultaneously be known. The term "liquor ratio" means the relationship of the goods being bleached to the volume of bleaching solution.

Example: If 100 kg goods are treated with 500 liters of liquor the liquor ratio is 1 : 5. The fibres could be bleached either in a long liquor ratio, namely to a **bath process** or in a short liquor with a liquor ratio of 1 : 1 namely to an **impregnation process**.

Cotton and bast fibres are bleached at 80 - 95 °C in bath processes, while blends of cotton and regenerated cellulose fibres are bleached at 75 – 80 °C. The bleaching time is generally between 2 and 5 hours. In a pressurized high temperature (HT) apparatus cotton can also be bleached at temperatures of 110 - 130°C in only 1 to 2 hours. During the impregnation processes the temperature and as well the retention time varies widely. During a cold bleach process a dwell time of 18 to 24 hours is necessary. In the pad steam process under atmospheric pressure the bleaching time is generally between 1 to 3 hours. The above mentioned processes describes batch processes. Today a lot of continuously, intelligent finishing equipment exists in which the bleaching step is only one of some other treatments and the reaction time of the impregnated material in such steamer is only between 7 to 20 minutes. In general these bleaching process correspond to a preliminary bleach.

Consumption of hydrogen peroxide for medium quality cotton for 100 kg goods:

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