

Hydrogen Peroxide for Treatment of Effluent in Paper Mills

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Paper mills in India primarily use alkaline processes viz. Soda and Kraft process. These Mills produce pulp from materials such as bamboo mixed hardwoods, bagasse, grasses, straw, rags and waste papers. Various chemicals e.g. soda, sodium sulphide, lime, whiteners, fillers etc. are used for this purpose in these pulp and paper mills.

Small pulp and paper mills normally manufacture approx. 25 to 30 tonnes of product per day and generates approximately 2,00,000 to 3,00,000 litres waste water per ton of product. Thus a mill generates approximately 5000 to 7500 M³ waste water per day.

The main sources of effluent streams in chemical mechanical and chemical pulp mills are digester cooking, washing, bleaching, thickening, deinking and defibering. These contain chemical based impurities like sulphites, mercaptans sodium sulphides, clay, ink, dyes and wood based impurities like hemicelluloses and lignin solubilised during cooking.

A common and successful method of effluent treatment is based on the oxidation of the offending material to an environmentally accepted form. The oxidation of species present in the effluent could be carried out either by mixing air by mechanical means or by using oxidising agents like pure oxygen, ozone, chlorine, chlorine dioxide, permanganate, hydrogen peroxide etc.

Air is the cheapest oxidising agent. However, to bring it into intimate contact with water it is required to split water into fine particles by mechanical means. This requirement involves a civil construction, the usage of a mechanical aerator and availability of electrical power for working of the aerator.

Most of the gases to be used as oxidising agent are required to be generated at the site and again require capital investment for generation. Some of these gases are toxic in nature.

Hydrogen peroxide is a powerful oxidising agent and has many advantages over other oxidising agents used for effluent treatment. Being a clear colourless liquid and miscible with water in all proportion it can be dosed easily either by gravity feed or by metering pump. It acts as an oxidising agent over a wide spectrum of pH with its oxidation potential—1.76 V in acidic medium and — 0.87 V in alkaline medium. It is easy to handle and its decomposition products are water and oxygen. Thus it also helps in to increase level of dissolved oxygen in effluent. Further, it has mild bactericidal property too. It can oxidise large number of organic species and wide variety of inorganic compounds.

Here in this article we refer to some case histories where hydrogen peroxide has been used to control sulphide level in the paper mill effluent and also for debulking of sludge.

The pulp mill effluent after passing through clarifloculator is subjected to lagoon treatment since it is large in volume. However, an anaerobic condition is developed in the lagoon and sulphides are liberated due to the reduction of sulphates, sulphites, etc. This condition is normally developed when depth of lagoon is too high or when lagoon gets covered with fibrous matters. This leads to the generation of hydrogen sulphide and bad odour. This problem of hydrogen sulphide and odour has been solved through usage of hydrogen peroxide by APM paper mill in Australia. The case history is as follows. The original effluent treatment scheme consisted of a clarifier followed by an aerated lagoon as shown in Fig. 1. To remove excess fibrous materials additional settling lagoon were constructed (Fig. 2). At the inlet of these lagoons, 3 to 7 mg/l of sulphides were observed which were

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reduced to a level below 1 mg/l by addition of 7 to 10 mg/l of hydrogen peroxide. Thereafter odour complaints were virtually eliminated.



FIG. 1

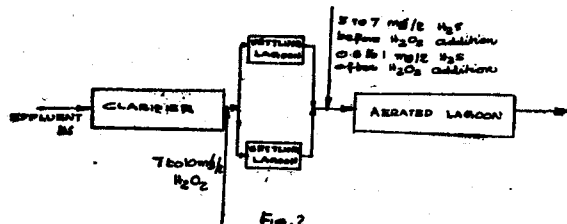


FIG. 2

A large quantity of sludge which comes out from clarifier during the waste treatment of pulp mill is sent to thickeners for thickening. The filamentous bacteria present are responsible for bulking of sludge. In addition there is the problem of high sulphide level. These problems were controlled using hydrogen peroxide in a pulp mill in North America. The quantity of hydrogen peroxide used was 2.3 times that of sulphide molar concentration and was added in the filter feed line.

Similarly sulphides e.g. hydrogen sulphide H_2S , methyl mercaptan ($-CH_3-SH$), dimethyl sulphide ($-CH_3-S-CH_3$), dimethyl disulphide ($-CH_3-S-S-CH_3$) produced in the Kraft process mill can also be oxidised by using hydrogen peroxide after condensation of all above gases together. Gas scrubbing through hydrogen peroxide is another possibility.