CHAPTER 1

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A vast pulp and paper industry exists around the World to supply an ever increasing demand for a wide variety of paper products. In the industrialised world, the production of paper is considered to be an index of technological development of a nation and a hallmark of its literary ability. Pulp and paper manufacture is one of the most important industries in India, categorised as "Core Sector Industry". India produces at present almost all varieties of industrial and cultural papers.

The production of paper demands vast deforestation which in itself leads to severe ecological imbalances. The various unit operations in a paper mill are mainly chipping, digestion, pulp washing, bleaching and paper making. Practically all the integrated pulp and paper mills in India adopt sulphate or kraft process of pulping as this is the most cost effective, versatile and efficient wood delignification method available despite some shortcomings. This process dissolves the fibre binding materials such as lignin and hemicellulose and loosens the cellulose fibre to certain extent.

Pulp fibres obtained after chemical digestion in kraft pulping are distinctly brown coloured as the residual lignin is modified by alkaline condensation reaction, thereby producing chromophoric groups. The residual lignin is
removed by subsequent multiple stage bleaching processes employing various chlorine compounds such as gaseous chlorine, hypochlorite and chlorine dioxide. Chemical bleaching results in production of bleaching effluents containing large quantities of chlorinated organics. Many of these compounds have been shown to be actively toxic, bacteriostatic and mutagenic. Discharge of these polymeric products into rivers and streams creates serious water pollution problems resulting in toxicity to aquatic life, deterioration in water quality and increase in cost of water treatment. The brown colour due to lignin and its derivatives causes aesthetic pollution and persists in the receiving waterways for long distances.

Rising concern over environmental pollution is leading scientists to seek ways to eliminate/reduce the use of chlorine in bleaching or to suitably treat the bleaching effluents. The bacterial treatments used so far for the treatment of wastewaters are not efficient at removing these high molecular mass chlorinated lignins completely and the physical/chemical processes are very expensive.

Biobleaching of kraft pulps using white rot fungi is sought to be a better method to partly or completely replace the use of chlorine in bleach plants, chlorine being the source of major environmental problems in the paper mill. Biological bleaching with white rot fungi has been explored only in a very preliminary way, but with results that suggest the desirability of additional study. Besides,
white rot fungi can also be used for biocolour removal of bleach plant effluents.

White rot fungi, almost all of which are wood decaying Hymenomycetes are the most active ligninolytic microorganisms described to date. They are the only microorganisms conclusively proven to be capable of totally degrading all major wood components to carbon dioxide and water. *Phanerochaete chrysosporium* has been extensively studied for its potential for biodelignification with encouraging results.

In the light of above observations this investigation was undertaken to study biobleaching of kraft pulp and biocolour removal from the effluents with following major objectives:

1. To study the biobleaching process on kraft pulp from some Indian trees and grasses using *Phanerochaete chrysosporium* or any other selected isolate.
2. To study characteristics of biobleached pulp for manufacture of good quality paper.
3. To study the combination of biological and chemical bleaching processes.
4. To treat the paper mill effluents with white rot fungi for biocolour removal.