Chapter 3

Scope & Objectives.....
3. Scope and Objectives

3.1 Scope and Objectives

In recent years biotechnology has made considerable progress and knowledge, on the relevant microbiological processes, has widened the scope of applications of the same in the environmental pollution control, especially in the field of treatment of toxic compounds. Treatment of wastewaters containing dyes has been one such major environmental issue for which biotechnological solutions are being sought.

There are several physical and chemical techniques available for the treatment of colored effluents, their major limitations lie in the production of secondary pollution due to excessive chemical usage, large volumes of sludge production and concentrated secondary waste streams. Biological methods have the advantage of making use of the microbiological mineralization process by which the pollutants are converted to harmless inorganic end products that are part of natural recycling processes. The application of both anaerobic and aerobic biological processes for the removal of dye related hazards has been suggested and demonstrated in the literature. It has been reported that azo dyes are decolorized under anaerobic conditions by bacteria via reductive fission of azo bond leading to the formation of aromatic amines. Further mineralization of these aromatic amines take place in aerobic conditions. Generally many studies report only decolorization of azo dyes. Simple decolorization does not remove the dye related hazards, as aromatic amines formed are carcinogenic and mutagenic in nature.

In order to address the issues referred above, the present research was conceived, designed and carried out. A schematic outline of the research protocol is depicted in Fig. 3.1. The specific objectives of the present investigation intend to cover these aspects more thoroughly. They include:
Scope and Objectives

♦ Studies on decolorization of few azo dyes with mixed bacterial consortia under anaerobic conditions.

♦ Effect of organic carbon source and environmental conditions on the decolorization of selected dyes.

♦ Development of potential aerobic microbial consortia for the degradation of few aromatic amines derived from the azo dye.

♦ Isolation and identification of amine degrading bacterial strains.

♦ Sequential anaerobic/aerobic treatment for decolorization and mineralization of the selected azo dyes.
Scope and Objectives

Genesis
Bacteria capable of efficient decolorization of azo dyes and degradation of aromatic amines

Literature Review
♦ Toxicity of azo dyes
♦ Critical comparison of physio-chemical and biological processes

Objectives
♦ Decolorization of few azo dyes.
♦ Effect of organic carbon sources
♦ Development of potential aerobic microbial consortia for the degradation of aromatic amines
♦ Isolation and identification of amine degrading strains
♦ Sequential anaerobic/aerobic treatments for decolorization and mineralization of selected azo dye

Methodology

Anaerobic
Mixed bacterial consortia
For dye decolorization

Aerobic
Enrichment culture for aromatic amine degradation
Identification of few strains

♦ Kinetic Studies
♦ Metabolic versatility of bacterial strains
♦ Analysis of results
♦ Conclusions, Suggestions for future work

Fig 3.1 Research Protocol
3.2 Practical Significance

Azo dyes represent the largest class of dyes used in the textile-processing and other industries. The discharge of these compounds into the environment is undesirable, not only because of the aesthetic problem, but also for their toxicity to aquatic, terrestrial and to human lives. These industrial effluents thus have to be treated to remove them before wastewater can be discharged to the waterways.

The overall objective of this research is to assess the decolorization and biodegradability of azo dyes under anaerobic and aerobic environment. The present investigation involves detailed laboratory studies on the microbial aspects including the identification of bacterial strains, performance evaluation, elucidation of metabolic pathway and biokinetic constants determination. Thus the outcome of this research would add to the existing fundamental and applied knowledge on azo dye decolorization and amine degradation. This can lead to the development of a suitable reactor configuration for the treatment of wastewaters containing azo dyes.