Lignin is the most abundant renewable aromatic material on earth. Research on lignin biodegradation has accelerated greatly during the past two decades, mainly because of the substantial potential applications of biolignolytic systems in pulping, bleaching, converting lignin to useful products and treating of agricultural wastes using bacteria (Hanafy et al., 2007). Isolation and identification of environmental friendly bacteria for lignin degradation becomes an essential task, because all the previous researchers concentrated on using fungal treatment. However bacteria seem to play a leading role in decomposing lignin in aquatic ecosystem because wood degrading bacteria have a wide tolerance to temperature, pH and oxygen limitation than fungi.

Bacteria isolated from habitats such as soil containing lignified decaying plant material can be expected to be able to metabolize lignin or lignin derived compounds. Therefore in the present investigation lignin degrading bacterial colonies were isolated from soils dumped with five different agricultural residues from the fields in and around Mayiladuthurai.

A total of 122 bacterial strains were isolated from the soil where the agricultural wastes were dumped (banana leaves, coir waste, groundnut shell, paddy straw and sugarcane bagasse waste) by nutrient enrichment method of Cartwright and Holdom (1973) using MSM supplemented with powdered groundnut shell as carbon source. Among the five different soil samples used in this study, paddy straw waste dumped soil produced more number of colonies followed by sugarcane bagasse, banana leaves, coir waste and least number of colonies with groundnut shell. Isolated colonies were identified based on morphological, biochemical and enzymatic activity. The 122 colonies constituted 19 genera and only 6 genera were identified upto species level.
Isolated bacterial strains were inoculated into MSM amended with four kind of lignin forms were separated from groundnut shell in order to identify the utilization pattern of different lignin. Among the 19 bacterial genera, 16 genera utilized either klason lignin or dioxane lignin as carbon source, MWL and HCl lignin were utilized by 11 and 10 bacterial strains respectively. However only 10 species coming under 8 genera were capable of utilizing all forms of lignin as sole source of carbon. Of these Arthrobacter globiformis and Bacillus subtilis showed fast and luxuriant growth in all forms of lignin but all the 8 genera exhibited luxuriant growth only with klason lignin except Azotobacter. Hence further studies were restricted to seven genera using klason lignin as carbon source.

Tolerance pattern of the selected isolates (7) were screened with 6 different concentration of klason lignin viz, 100- 600 mg/l supplemented into the MSM with 1% glucose and 0.5% peptone as additional carbon and nitrogen sources respectively. Fast and luxuriant growth was seen only with 500 mg/l with Arthrobacter globiformis and Bacillus subtilis. Lignolytic activity of 7 different bacterial strains were again tested with 50 mg/l of 7 different chemically defined lignin derivatives instead of klason lignin. Only strains of Arthrobacter globiformis and Bacillus subtilis grew very fast and luxuriantly on six of the 7 different chemically defined lignin derivatives tested. Hence, these two organisms were selected as potential lignin degrading organisms for further studies.

Lignolytic potentiality of the test isolates in terms of biodegradation and decolourization was tested under in vitro conditions. During biodegradation assay, bacterial growth, change in pH, colour reduction, lignin degradation and total substrates loss were analysed. Growth was maximum on fourth and fifth day for Bacillus subtilis and Arthrobacter globiformis. Initially the pH of the bacterial strains inoculated broth was decreased and then, it showed gradual increase from 5.1 to 7.9 by both isolates.
respectively. Due to the growth and activity of *Arthrobacter globiformis* and *Bacillus subtilis*, the percentage of colour reduction achieved were 50.8 and 55.8 and percentage of lignin degradation to 48.7 and 53.7 respectively. The total substrates loss in the broth inoculated with *Arthrobacter globiformis* and *Bacillus subtilis* were 36.8 and 47.9 % respectively.

Biodegradation potentiality of the test isolates were also confirmed by GC MS analysis. Totally 14 compounds were identified from the sample inoculated with test isolates and uninoculated control. Among the 14 compounds, five different LMWACs were obtained. In addition to the LMWACS, many acid types and phthalate derivatives were also noticed in TIC.

Lignolytic potentiality of the bacterial strains were tested in terms of lignin degrading enzyme production viz, laccase, catechol oxidase and lignin peroxidase in submerged fermentation conditions. Among the three enzyme tested, lignin peroxidase production was maximum followed by catechol oxidase and laccase. Optimization parameters needed for maximum enzyme production were noticed with pyrogallol as carbon source at 300 mg and with 400 mg of tryptone at pH 7.5 and an incubation temperature of 35 – 40°C.

In the present study, lignolytic enzyme production under SSF were also tried using agricultural wastes (banana leaves, coir waste, groundnut shell, paddy straw and sugarcane bagasse) as substrates by the bacterial strains. Microbial activities during decomposition of agricultural waste were analyzed in terms of CO₂ evolution by respirometry method. The amount of CO₂ evolution was expressed as mg CO₂ Kg⁻¹ shell⁻¹. The lignolytic enzyme productions under SSF were tried with following experimental condition such as, substrate without pretreatment, with treatment (acid and alkali) and supplementation with 5 different nitrogen sources. Among the two
organisms *Arthrobacter globiformis* is more effective than *Bacillus subtilis* with reference to lignolytic enzyme production

- Maximum quantity of laccase (34.3 IU/ml) was produced with yeast extract supplemented banana leaves and paddy straw,
- Maximum quantity of catechol oxidase (35.4 IU/ml) was produced with yeast extract supplemented paddy straw,
- Maximum quantity of lignin peroxidase (75.6 IU/ml) was produced with acid pretreated sugarcane bagasse followed by alkali pretreated coir waste (71.5 IU/ml).