Conclusions

Studies on microbial leaching of metals from waste printed circuit board were carried out.

1. Mixed bacterial consortium (MBC) was obtained from enriched microbial cultures from two ore samples.

2. MBC was found to have good ferrous iron oxidizing ability (oxidize 9 g/L of Fe$^{2+}$ in 60 h).

3. Iron oxidation was found to increase with increase in concentration of inoculum.

4. Initial pH 2.4 and initial ferrous iron concentration of 9 g/L was observed to be optimum for the growth of MBC when grown in the absence of printed circuit board (PCB) powder.

5. Chemical analysis of PCB powder was performed using two solvents viz. aqua regia and nitric acid. Using two solvents gives more perfect results of chemical analysis.

6. MBC showed good copper and zinc solubilization ability but poor lead solubilization ability, when individual metals were used.

7. Bioleaching of metals from PCB powder shows 10 g/L PCB powder concentration; initial pH 1.8 and initial ferrous ion concentration 13 g/L as optimum conditions.

8. The precipitate obtained in the bioleaching experiment was composed of Tin (59.96 %), Cu (23.97 %), Pb (9.30 %) and Fe (5.92 %).

9. Complete metal solubilization was achieved in 240 h when PCB pieces of size 4 × 2.5 cm were used.
10. Immobilized MBC showed low ferrous ion oxidizing ability and lower metal solubilization as compared to non-immobilized MBC.

11. Agarose was found to be the best solidifying agent for the growth of acidophilic organisms. Fe-TSB was found to be the best medium for the growth of chemolithotrophic iron oxidizers, heterotrophic iron oxidizers and non-iron oxidizing acidophilic heterotrophs.

12. The presence of *Acidithiobacillus sp.* was detected using DGGE and presence of *Acidiphilum spp., Leptospirillum spp., Thiobacillus ferrooxidans, Thiobacillus caldus* and *Sulfoarcillus* was detected by PCR based method using species specific primers in MBC.