

Assessment of reclaimed ash ponds and fly ash treated agricultural fields with special emphasis on alteration of metal availability in soil, growth pattern of established plants, and subsequent changes in microbial diversity

Executive summary

The establishment of vegetation cover over the ash directly unfolds a series of physiological changes through bio-geochemical cycle leading to enrichment of the surface and sub-surface medium (ash) to increase natural ground cover. The short lifespan of the ground cover species and litters of tree species established on fly ash gradually facilitates microbial activities leading to clay formation in the abandoned ash pond areas. Usually, as soon as there is indication of establishment of plant cover on fly ash, it is assumed that under the nurture of nature the process of reclamation will be on towards beneficial directions. Till date, no initiatives have been taken to investigate the effects of such reclamation in long-term projects on fly ash ponds. Thus, to further justify technology and its effectiveness, besides making some corrective actions, document leanings and execution of protocols are also needed for the future. On the other hand, lots of studies have been carried out on application of fly ash in agriculture and its effect on crop and short-term effect on soil. But, studies on its long-term effect on agricultural soil are very limited. So, the assessment of agricultural fields treated with fly ash, long back, is very important to evaluate the application potential of fly ash in agriculture.

The objectives of this project were: (a) Monitoring of physico-chemical properties of reclaimed fly ash ponds and agricultural soil treated with fly ash; (b) Studying microbial biomass, microbial activity, and community structure in reclaimed ash dumps and agricultural soil treated with fly ash; (c) Studying faunal population; (d) Investigation of growth abnormalities (if any) in established plant species.

Conclusions

- Significant improvement in organic carbon, available nitrogen was found in reclaimed ash ponds.
- No particular trend in alteration of heavy metals due to reclamation activities was found in reclaimed ash ponds.
- Total phenolics, dehydrogenase activity, and microbial biomass found significantly higher in reclaimed ash ponds.
- Continual development of micro-faunal population was found in reclaimed ash ponds.
- Denaturing Gradient Gel Electrophoresis (DGGE) analysis showed built-up of microbial population as compared to zero population in the fly ash ponds.
- No growth abnormality was observed in any of the plantation in reclaimed ash ponds.
- Application of fly ash not found to have significant role in alteration in soil total phenolics and microbial biomass in agricultural soil.
- No significant effect of fly ash on metal content of agricultural soil was found.
- An increase in dehydrogenase activities was found in agricultural soils treated with fly ash.
- The fatty acid methyl ester (FAME) profile showed the presence of saturated and unsaturated fatty acids associated with microbe in different levels. The varying levels could be due to the prevailing conditions on the sites.