Environment Conservation Journal 18 (1&2) 117-119, 2017
ISSN 0972-3099 (Print) 2278-5124 (Online)
Abstracted and Indexed

Eco-restoration of coal mine overburden dump

Preeti Singh ✉ and Seema

Received: 22.01.2017 **Revised: 10.03.2017** **Accepted: 02.05.2017**

Abstract

Energy is needed for economic growth and more than 70% of the energy generation capacity in India is by using coal. The production of coal was 430.83 Mt out of which opencast contributed to around 373 Mt in 2006 with an estimated overburden removal of 600 million m^3. In India, opencast mining is most prominent method of coal excavation. However, each year hundreds of acres of pristine forest and productive agricultural land are brought in the gambit of open cast coal mining. Moreover, open cast mining leaves behind a lot of over burden which is an environmental problem. Faced with a burgeoning population, agriculture in India must bring under its gambit the non-conventional or non-traditional area, to feed the teeming millions. Reclaimed coal mine areas could be the non-traditional areas. Among the two methods of restoration, physical methods are costly and not viable. Biological methods are of low cost hence most appropriate. Among biological technique using tree species to restore coal mine spoil holds great promise because it accelerate the soil-forming processes, control erosion, build up organic matter, develop microbial communities, initiate nutrient cycling, decreases air and water pollution, reduces geo-environmental disasters, maintain biodiversity and enhance overall aesthetics of the area.

Key Words: Eco-restoration, Population, Biodiversity, Geo-environmental

Introduction

The rate of consumption of mineral resources is continuously increasing with the advancement of science and technology, economic development, industrial expansion, acceleration of urbanization and growth of population. Growth of our society and civilization thus heavily relies upon the mining industry to operate and maintain our comfort. India has long been recognised as a nation well endowed in natural mineral resources. India is ranked 4th amongst the mineral producing countries, behind China, United States and Russia, on the basis of volume of production. It is an extremely important sector and contributes significantly to our Gross Domestic Product. Energy is another component that is needed for economic growth, for improving the quality of life and for increasing opportunities for development. India's coal consumption rank third in the world, and the country's demand for coal continues to grow much faster than the world average. The Integrated Energy Policy (IEP, 2006) document formulated by Planning Commission in August 2006 has presented several alternative scenarios of energy mix to sustain a 8% growth rate until 2031-2032. The requirement of coal has been projected to 2,037 Mt (2031-2032) against the 627 Mt projected for the end of 2011-12 (11th plan). However, the requirement of coal -based energy has been projected to vary from 2,555 Mt for a coal dominant scenario to 1,540 Mt in the scenario of full potential of nuclear, hydro and renewable resources along with all energy conservation measures. Therefore, coal will remain a dominant source of energy in India up to 2031-2032 and possibly beyond (Chaudhuri, 2008). Thus coal mining industry in India play a very important role in the country's economy.

The goal of coal mining is to obtain coal from the ground. There are two processes by which coal can be removed from the ground opencast mining and underground mining. In India, the share of opencast production has increased from 26% (20.77 Mt) in 1974–1975 to 84.95% (345.79 Mt) in 2005–2006.

Impacts of opencast mining

The impacts of opencast mining are many-fold. During surface mining activities, trees, plants, and topsoil are cleared from the mining area. This destroys landscapes, forests and wildlife habitats at the site of the mine resulting in soil erosion and destruction of agricultural land. When rain washes the loosened top soil into streams, sediments

Author's Address
[1]Department of Soil Science and Agri. Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi
E-mail:singh.preeti8888@gmail.com

pollute waterways that can hurt fish and smother plant life downstream, causing disfiguration of river channels and streams, which leads to flooding. There is an increased risk of chemical contamination of ground water when minerals in upturned earth seep into the water table, and watersheds are destroyed when disfigured land loses the water it once held. In addition it causes air and noise pollution. On the other hand, underground mining causes huge amounts of waste earth and rock to be brought to the surface. These wastes often become toxic when it comes into contact with air and water. It causes subsidence as mines collapse and the land above it starts to sink. This causes serious damage to buildings. It lowers the water table, changing the flow of ground water and streams. It also disrupts soil components such as soil horizons and structure, soil microbe populations, and nutrient cycles that is crucial for sustaining a healthy ecosystem and hence results in the destruction of existing vegetation and soil profile (Kundu and Ghose, 1997). Coal mining also produces greenhouse gas emissions and ultimately loss of economic wealth.The overburden dumps produced by coal mining have adverse factors such as elevated bioavailability of metals; elevated sand content; lack of moisture; increased compaction; and relatively low organic matter content. Acidic dumps may contain sulphidic material, which can generate acid-mine-drainage (Ghose, 2005).

Eco-restoration

In India, land degradation due to mining is inevitable as major coal deposits are under thick forest cover and more than 85% of coal is extracted by opencast method. It is imperative from the above that the mining process must ensure return of productivity of the affected land. An increase in the concerns for environment has made concurrent post-mining restoration of the degraded land as an integral feature of the whole mining spectrum (Ghose, 1989). Restoration is the process by which derelict or highly degraded lands are returned to productivity, and by which some measures of biotic function and productivity is restored. Long term mine spoil restoration requires the establishment of stable nutrient cycles from plant growth and microbial processes (Singh *et al.*, 2002; Kava mura and Esposito, 2010). Soil provides the foundation for this process, so its composition and density directly affect the future stability of the restored plant community. Restoration of vegetation cover on overburden dumps can fulfill the objectives of stabilization, pollution control, visual improvement and removal of threats to human beings (Wong, 2003). Restoration strategies must address soil structure, soil fertility, microbe populations, top soil management and nutrient cycling in order to return the land as closely as possible to its pristine condition and continue as a self-sustaining ecosystem.

All landscape restoration schemes has two distinct types: (a) physical, technical or engineering (this is the high-cost) and (b) biological (this is low cost) Therefore, biological restoration is most adopted and it concerned with establishing and maintaining vegetation cover on the landform, which is compatible with surround landscape, stable and fulfils after-use requirements. Planting is done to enhance the speedy recovery of ecosystem. Therefore, establishment of tree cover in mine degraded land aims to accelerate soil-forming processes, control erosion, build-up organic matter, develop microbial communities, initiate nutrient cycling and enhance overall aesthetics of the area.The concept of restoration using trees is simple. Trees are efficient biomass generators. They add more organic material to the soil, both above and below ground, than other plants, and they are associated with a relatively large array of soil organisms, including earthworms (Banov*et al.*, 1995). Their deep roots involve a greater depth of raw mine stones in the soil organic system. They loosen soils to greater depths than grass and, with a little encouragement, penetrate to the less dense soil layers that lie below the compacted surface layers that characterize many lands reclaimed after surface coal mining (Haigh, 1995). Given time, trees create new self-sustaining topsoil's in and above the mine spoils.

In view of the increasing mining activities, decreasing soil fertility and adverse effects on soil flora and fauna, it is of utmost concern to monitor the physico-chemical,biological characteristics of coal mine overburden spoil as affected by planting tree species to gain a greater understanding of the direction of improving in soil fertility and bioremediation. It is an also a pre-requisite for assessing the process of spoil restoration with respect to time.

Conclusion

Most of the physical, chemical and biological properties improved over the years of restoration under plantation. Hence it may be concluded that planting trees is an excellent way of restoration of coal mine overburden dumps. However it is a continuous process and takes a long time to attain equilibrium with the surrounding environment.

References

Banov, M., Hristov, B., Filcheva, E., Georgiev, B. 1995.Humus accumulation and its quality composition in reclaimed lands. In: Sofia: in: One Hundred and Twenty Five Years of the Bulgarian Academy of Sciences and 65 Years of the Forestry Institute, Scientific Papers from the Jubilee Symposium. Institut za Gorata, Bulgarska Acadamiiya na Naukite, Sofia, pp. 279–285.

Chaudhuri, S. 2008. *Environmental and social aspects of coal mining – an overview*. In: Chaudhuri S, Singh G (eds) EDP course on environmental management in coal mining areas. ISM, Dhanbad.

Ghose, M.K. 1989. Land reclamation and protection of environment from the effect of coal mining operation. ***Mine technology.***10(5): 35-39.

Ghose, M.K. 2005. Soil conservation for rehabilitation and revegetation of mine-degraded land. TIDEE – TERI ***Information Digest on Energy and Environment.*** 4(2): *137-150.*

Haigh, M.J. 1993. Surface mining and the environment in Europe. ***International Journal of Surface Mining Reclamation***. **7**: 91–104.

IEP 2006. *Integrated energy policy*, Planning Commission, Government of India, August 2006.

Kavamura, V.N., and Esposito, E. 2010. Biotechnological strategies applied to the decontamination of soil polluted with heavy metals. ***Biotechnology Advances***.**28**: 61-69

.

Kundu, N.K., and Ghose, M.K. 1997. Soil profile Characteristic in Rajmahal Coalfield area. ***Indian Journal of Soil and Water Conservation***.25 (1), 28-32.

Maiti, S.K. 2013. *Ecorestoration of the Coalmine Degraded Lands*, (Eds.). Springer Publishers, India, 3-20.

Singh, A.N., Raghubanshi, A.S., and Singh, J.S. 2002. Plantations as a tool for mine spoil restoration.***Current Science***.82(12): 1436–1441.

Wong, M.H. 2003. Ecological restoration of mine degraded soils, with emphasis on metal contaminated soils.***Chemosphere***.**50**: 775–780.