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Impact of Sequential Backfilling of Basalt Stone Quarry by Fly Ash for Restoration: On Ground Water Quality - A Case Study

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Abstract: ***Ash disposal in general is a huge problem for Coal Based Thermal Power Plant. Thermal power plant has to dispose fly ash generated during power generated in enviro friendly manner. There is another environmental and safety problem with the basalt stone quarries used as minor mineral for construction and infrastructural activities from restoration point of view due to non availability of backfilling material to restore the pit during mining. Hence to overcome these two issues a solution to backfill basalt stone quarry with fly ash is proposed. But major threat involved during prolonged backfilling of Ash in Basalt Stone Quarries from ground water point of view are i) between the water and fly ash at the bottom of fly ash filled void/quarries results in leaching of heavy metals into ground water system ii) The infiltration of rain water falling on fly ash filled mine void is confined only to the top 1 m or even less, and as such there will be reduction in recharging of ground water in the area. Study is carried out to conclude whether "between the water and fly ash at the bottom of fly ash filled void/quarries results in leaching of heavy metals into ground water system". A stone quarry admeasuring 4.2 ha at Pimpalgaon Singru in Warora Tahsil of Chandrapur district is selected. Four ground water samples around the basalt stone quarry and one ground water sample within stone quarry lease hole area are collected analyzed before start of fly ash backfilling and at a interval of six months for eighteen months during backfilling of void by fly ash. It is concluded that no leaching of heavy metals in to ground water quality found due to backfilling of mine pit void by fly ash. The study reveals that fly ash generated from Coal Based Thermal Power Plant can be dumped into the basalt stone quarry as a backfilling material to restore the void and hence fly ash disposal can be addressed in enviro friendly manner.***

Keywords: Basalt Stone Quarry, Fly Ash Disposal, Leaching, Ground Water Quality

1. Introduction

Majority of power generation plants are based on coal as a fuel. Indian coal used for generation of power in thermal power plant has 40-45 % ash content. A basalt stone quarry identified in such a way that i) it would be the part of basalt stone quarry cluster ii) flyash be available nearby easily iii) stone quarrying operations be under going with valid clearances iv) quarrying shall not be intercepted basalt layer, ground water table and shall not have any fractures or faults.

A quarry at Pimpalgaon Singru is identified for sequential backfilling of fly ash generated from thermal power plant.

A year wise google view of stone quarry during backfilling by fly ash is as shown below in figure-1.

2. Literature Review

This project has been arrived at after study in the literature given in cited references herein, various reports in scientific and nonscientific publications regarding disposal of fly ash in basalt stone quarries on environment. Purpose of literature review is to consider all the available literature on the subject and help to arrive at a judicious view based on factual status of environment. A case study done by CSIR-NEERI Nagpur, MoEFCC- GoI, CPCB and SPCB-Odisha submitted to National Green Tribunal, Principal Bench, New Delhi in the year 2015 is thoroughly studied and reviewed.

3. Methodology

During the quarrying of stone by the stone quarry operated, fly ash generated by thermal power plant is backfilled from the south east boundary of the quarry. A blanketing of 0.5 meter murrum is done for every backfilled strip of 2m of fly ash along the southeast boundary so as to make backfilled strip compact. Backfilling of quarry with fly ash was started in year January 2016 onwards till December 2017.

A ground water sample was collected and analyzed as per IS10500: 2012 quarterly from tube wells within the quarry area, at village and nearby two quarries around the subjected quarry within all directional 300m peripheral area.

4. Ground Water Monitoring and Analysis

Ground water samples were collected quarterly between May 2016 – December 2017 around subjected stone quarry and range of analysis result is presented in tables below

Table 1: Ground Water Analysis

Sr. No.	Sampling Locations	Parameters with unit and Range of Results between May 2016 – December 2017				
		pH	EC (µS)	T.Fe (mg/L)	Cr^{+6} (mg/L)	T.Cr. (mg/L)
1	Quarry of Mr. Mandaokar	7.8-8.1	800-1161	0.3-0.36	0.025-0.031	0.158-0.0164
2	Quarry of Mr.Satpute	7.2-7.8	800-881	Nil	0.028-0.029	0.074-0.083
3	Quarry of Mr.Debnath	7.3-7.8	576-706	Nil	0.024-0.026	0.092-0.0119
4	Tubewell at Village Pimpalgaon Singru	7.6-8.1	984-1195	Nil	0.026-0.033	0.118-0.147

Parameters like Cadmium, Lead, Manganese, Copper, Zinc, Nickel, Arsenic, Mercury found below detectable limits.

It may be seen from above analysis that all parameters meet the permissible limit of drinking water standards (IS10500:2012) and W.H.O. Standards (WHO 2008)

5. Conclusion

Analytical result of ground water samples collected from four locations around stone quarry where sequential backfilling of void by fly ash is under going shows that drinking parameters for ground water are within the prescribed limits for human health. Also it is observed that the ash disposal quarry is above the ground water table and local geology belong to basalt which is impervious rock.

Hence basalt stone quarry can be a suitable location for disposal of fly ash generated by thermal power plants.

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