Section: Research Paper

ENVIRONMENTAL INFLUENCE OF STONE QUARRYING IN JODHPUR CITY

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Abstract : In Jodhpur City, Rajasthan, this study assessed the impact of quarrying on the local ecology. The quarry site was chosen using a planned sampling study design. These quarry locations were picked because of their magnitude and year-round output, which would produce a realistic result. At the quarry's edge, particles from the air, water, and soil were gathered. A control sample was taken away from the sites and four soil samples were taken at various points. We looked at the average concentrations of the physicochemical characteristics in soil and water samples. Two liter plastic containers were used to gather water samples from the surface water. At a depth of 4 meters, borehole water was also collected. The findings showed that the mean suspended and physicochemical parameter concentrations exceeded World Health Organization (WHO) guidelines. The outcome also showed that the amount of environmental pollution depends on the distance from the quarrying activities' source. Based on the aforementioned findings, all quarries should be required to conduct an environmental impact assessment, compliance monitoring visits should be made to quarry sites on a monthly basis to reduce the negative effects of quarrying operations, and quarry companies should be required to adopt modern dust trapping technology so that very little dust escapes from various quarry operations.

Keywords: Quarrying, impact on Air, Soil, Water, Jodhpur City , Stone Mining

1 INTRODUCTION

Mineral resource exploitation has been of utmost importance in many emerging nations, including India. India is blessed with an abundance of mineral resources, which have greatly increased national wealth and provided accompanying socioeconomic advantages. Mineral resources are a significant source of wealth for a country, but they must first go through the steps of discovery, mining, and processing in order to be used. Due to the addition of contaminants, human activities ranging from residential energy use to large-scale industrial activity are mostly

to blame for this poor status of atmospheric elements. A significant environmental issue that affects both industrialised and developing nations worldwide is air pollution. Since there are several sources of air pollution, which result in a wide range of impacts, the effects of air pollution on human health are quite complex. The emission of particulates from quarries is rather exceptional, despite the fact that industries including power plants, cement, refineries, petro-chemicals, and mines have been identified as important contributors of air pollution. Typically, dust pollution from quarries has both micro and macro consequences. Human health and wellbeing are negatively impacted by air pollution and ground vibration brought on by blasting, crushing, and the release of toxic gases. In order to meet the needs of the continuously expanding population, quarry products are becoming more and more in demand for industrial, home, agricultural, and other uses. Quarrying operations typically involve clearing out overgrowth, drilling, blasting, and crushing rock materials; the diverse effects that these operations have depend on their scale and location. [1,2,3]

This study focuses on the impact that granite mining activities have on the communities of Mandore and Sursagar in Jodhpur, India, where the quarries are located. The purpose of this study was to determine how stone quarrying activities affected the towns' air, water, and soil quality. Environmental problems are a result of stone quarrying activity. The host towns' surrounding air, water, and soil quality have been impacted by these operations.[4,5]

Social and economic factors, such as demographics, knowledge, economic development, and lifestyle, among others, have a tendency to influence human behaviour in these situations. Additionally, it states that when the physical environment is changed, government intervention is required. Quarrying is one of the development systems that involves elements of the physical environment and the natural system, including physical phenomena such as water, air, and climate that are not the result of human activity. which influenced the ecology, which is a component of the natural system. The only source of these effects, humans, are also impacted, and the socioeconomic effects of quarrying can be influenced by changes in the physical environment. Because quarrying is a physical activity that involves the removal of earth material for commercial purposes, it has an impact on both the physical environment and the socioeconomic environment.[6,7]

2 MATERIALS AND METHODS

The environmental impacts of the quarrying activity in Jodhpur City made this investigation necessary. How to deal with the effects of stone quarrying effectively presents a significant difficulty. A field study was conducted in the quarry sites in the mandore and sursagar regions in order to accomplish this goal. The majority of this work is an experimental study conducted at quarry sites. Data were gathered at the study site and processed in the lab. Purposeful sampling was used in this study's execution. In order to draw conclusions to address the study issue, primary data was gathered and put through an exploration design process for laboratory testing. Samples of the air, water, and soil taken from quarry sites served as the primary data, while secondary data sources came from earlier research that were relevant to the current topic. As a result, potential environmental impact factors resulting from stone quarry activities were

identified. The sensor was held at a height of two metres in the direction of the predominant wind, and the readings were recorded as stability. To achieve a trustworthy outcome, samples of the air, water, and soil were taken both during the dry and wet seasons. Away from the main operating sites, the particle concentration at the two drilling and crushing operation zones was observed. By conducting the study both during the dry and rainy seasons to see if there were any differences in the results, the impact of rainfall on the analysis's conclusion was completely eliminated. Two litre plastic containers were used to gather water samples from the surface water (10 to 20 cmdepth). At a depth of 4 metres, borehole water was also collected. The two samples were taken on-site, and an ice chest was used to transport them to the lab for examination. In a one litre glass bottle, samples for the measurement of heavy metals and total hydrocarbon contents (THC) were gathered. The samples were taken in the months of November 2021 and June 2022, throughout both the dry and wet seasons. Four locations were chosen for the air sample collection: 250, 500, and 750 metres from the quarrying site's boundary. 4 kilometres away from the site, a control was also taken. A reading was taken once the instrument stabilised at a height of 2 metres. Using an auger, the soil samples were taken and placed in sterile plastic containers in labelled polythene bags. For physicochemical investigation, the samples were brought to the Laboratories in ice chambers. For a full year, sampling was done during both the wet and dry seasons. Throughout the study, sampling for the dry and wet seasons was done from December to March and May to July, respectively. Each sampling season was sampled three times, for a total of twelve times throughout the study. Prior to examination, air-dried soil samples for physicochemical analysis were sieved through a two millimetre (2mm) micro sieve. For subsequent examination, the sieved soil samples were kept in airtight glass jars. Within two weeks of being collected, the soil samples were tested and stored. During the sampling season, water samples were taken from the upstream and borehole using sterile sampling bottles. The water samples were taken and placed in sterile sampling vials that were then transported to labs for physicochemical examination [8,9,10]

3. RESULTS AND DISCUSSION

In various areas of Jodhpur City, the impact of rock blasting and quarry mining was examined. impact on several areas of air quality, water quality with regard to rainwater, and ground water including soil quality were all examined.

Table 1: Air quality (ug/m^3) during the dry season (New Quarry ,Mandore)

variable	Edge	250	500	750	Control
CO	3100	1200	600	620	600
NOx	35.50	25.21	17.04	15.08	16.6
SOx	110	100	77.88	16.6	16.2
VOC	1600	1400	1000	600	210
PM_{10}	700	450	350	20	100

Table 2: Air quality (ug/m^3) during the rainy season (New Quarry, Mandore)

variable	Edge	250	500	750	Control
CO	2200	1600	640	590	600
NOx	25.40	20.35	14.34	14	14
SOx	80	60	30	17	16
VOC	1700	1500	900	500	110
PM_{10}	390	500	337	18	20

Table 3: Air quality (ug/m^3) during the dry season (Old Quarry, Soor sagar)

variable	Edge	250	500	750	Control
CO	4000	3300	3000	1200	1000
NOx	40	38	30	15	16
SOx	90	75	60	25	18
VOC	2000	1500	1300	180	222
PM_{10}	900	780	333	22	20

Table 4: Air quality(ug/m^3) during the rainy season (old Quarry, Soor sagar)

variable	Edge	250	500	750	Control
CO	3100	2700	1500	450	430
NOx	30	25.10	22	8	8.8
SOx	66	44	33	16	17
VOC	1234	777	544	321	124
PM_{10}	256	160	110	18	19

The parameters that were measured were particulate matter, CO, NOx, SOx, and VOC (PM10). All of the parameters at the study sites surpassed the suggested limits, according to an analysis of the results. At the mandore Quarry site, it reached a sample point of 250 metres, whereas at the old Quarry in Sursagar, it reached a point of 500 metres. This observation suggested that the old Quarry's influence spread considerably further than the area immediately around it, where Quarrying activities were restricted. Observations, however, revealed that there was a distinct gradient in the values of the evaluated attributes. This was due to the fact that parameter values dropped the further they were from the premises. These findings suggest that residents who live close to these quarry sites are at risk for developing respiratory diseases as a result of breathing in the aforementioned pollutants. Particulate matter, particularly PM10, has been linked to a number of respiratory conditions. According to claims, the other compounds, CO, SOx, and NOx, are acidic oxides that, when dissolved in water, produce acids with varying quantities. The research area's rainwater quality assessment revealed that the water was hard, turbid, slightly

acidic, and included varying levels of phosphates, nitrates, and sulphates. This might be related to the preceding information on the air quality. Rainwater contains nitrates, sulphates, and carbonates as a result of NOx, SOx, and CO being dissolved in water. The subsequent hardness and turbidity seen were caused by these chemicals alone, along with the particle debris. The elevated TSS and TDS recorded were caused by these chemicals in equal measure. The fact that CO and NOx are acidic oxides that dissolve in water to produce a variety of acids has already been mentioned. Observation revealed that as one moves away from the source, the values of the various parameters decrease. Once more, higher values were seen at the old Quarry in Sursagar than the new one in Mandore. The quarry at Mandore, however, is also older than the one in Sursagar. This proves that the quarry's size and age play a significant role in determining the degree of harm caused by its operations. The findings of this study show that the physicochemical characteristics of borehole water continued the trend of sampling points closest to quarries having higher parameter values than those away from these enterprises' facilities. As the pH readings rose throughout the wet season, acidic soil was seen to exist. When compared to the dry season levels, the PO4, NO3, and SO4 values all rose during the wet season. Additional research revealed that the effects were more pronounced in the old Quarry at Sursagar than in the new Quarry at Mandore. Again, the concentrations of metallic ions increased throughout the rainy season in the same manner. This finding suggests that the examined soil contains significant amounts of metallic ions. Only Fe, nevertheless, was found to have a low concentration.

4. CONCLUSION

Quarry operations have a detrimental effect on the quality of both surface and ground water (physicochemical properties). Quarrying has a detrimental effect on the site's soil quality, which reduces the quality of the soil for cultivation. Because there are considerable changes in the air quality and physicochemical features of samples taken from different locations, the distance from the source of quarrying activity influences the size of the environmental consequences. Quarries should therefore be located far from populated areas. Quarrying operations have a harmful impact on the environment and the air we breathe, which can lead to respiratory illnesses. The result is over WHO Limits due to the suspended particulate matter PM10. To lessen the impact, mitigation is required. The findings show that people who live close to these quarry regions are vulnerable to respiratory organ damage from inhaling the PM10 chemicals that have been recognised to be hazardous to health. According to the results of the analysis of variance using an ANOVA, the variables are generally independent between the two sites, and the soil samples there are also different, which is likely related to the lead and zinc mining that has taken place in some areas of the soorsagar and mandore sites. At the mandore and soorsagar quarry sites, seasonal fluctuations have an impact on the air quality and physicochemical qualities because rain dissolves some of the suspended particulate matter, which has an additional impact on the soil and surface water.

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