# *REMEDIATION OF POONTHURA SOIL USING FLY ASH*

*Akhila V Mani*
M Tech: Civil Engineering
Marian Engineering College
Trivandrum, India

*Rani V*
Associate Professor: Civil Engineering
Marian Engineering College
Trivandrum, India

***Abstract* — The purpose of this article is to assess soil pollution in the Thiruvananthapuram District of Kerala, South India. Soil Pollution occurs due to waste generated from industry. The definition of pollution is the introduction of contaminants into the environment that have adverse effects. Although natural occurrences can cause soil contamination, they can also be caused by human activity such as manufacturing, extractive industries, improper waste management, transportation, or agriculture. Nowadays, industries may be found in and around Poonthura. A majority of these are small-scale industries, coir industries. Soil is contaminated with heavy metals due to industrial waste. Chemical Analysis of soil samples primarily revealed the presence of iron above permissible limits. Considering the greater abundance of iron in the soil than the other constituents, the remediation of iron-contaminated soil was undertaken. It was found that fly ash, a byproduct of thermal power plants, could be effectively used for this purpose.**

**Keywords— *Contaminated Soil, Industrial Waste, Fly Ash, Removal efficiency***

## 1. Introduction

The presence of chemical substances or other modifications to the natural soil environment as a result of land degradation is the main cause of soil contamination. It is frequently brought on by commercial operations, agricultural pesticides, or improper waste management. The most often utilized materials are those made of iron, sulphur, lead, and other heavy metals. Heavy metal pollution is the most serious environmental issue, particularly in developed countries. These wastes have a significant impact on clay content and soil mineralogy. In addition, soil parameters such as consistency limits, shear strength, compressibility, pH, swell-shrink behavior, and permeability may change. This change or modification in soil qualities and structure necessitates the use of various remediation approaches.

The discharge of heavy metals into the environment has become a main issue because their buildup in the environment may have hazardous effects on living species. Heavy metal pollution has negative impacts on both the surface and subsurface environment. There are several heavy metals on the globe. The pollution is caused by the abundance of metals in the Trivandrum region.

This study focused on the environmental issues of soil pollution in poonthura region. The present study aims were to remediate the soil using industrial byproducts.

## I. MATERIALS AND METHODOLOGY

### *A. STUDY AREA*

The study was carried out in the Poonthura area, one of Kerala's most important coastal wetlands, which is located in the Thiruvananthapuram district. It is located on India's southwest coast, between 8o25' and 8o30' North latitude and 76o55' and 77o00' East longitude. The area consists of small-scale coir industries are located in the area. Over some time, the Poonthura region has been under severe ecological degradation due to municipal sewage, land drainage, and industrial effluent disposal.

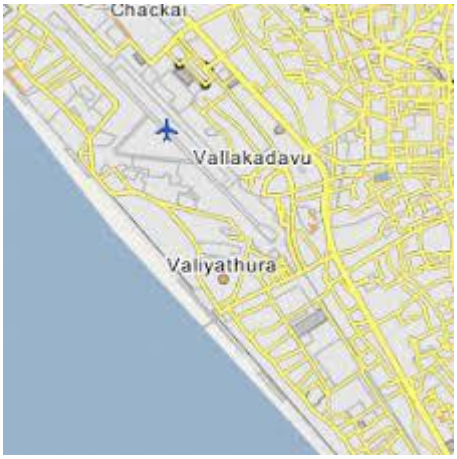


Fig:1. Map showing the study area

### *1.1 MATERIALS*

The soil was collected from the Poonthura region**.**

#### *1.1.1 SOIL*

The soil used in this study is collected locally from Poonthura, Thiruvananthapuram district. Fig 2 shows the picture of collected soil**.**

***Fig:2 Poonthura soil***

The soil's characteristics are investigated, and the findings are presented in the table:1

*Table :1 Properties of Soil*

| *Property* | *Values* |
|---|---|
| *Coefficient of Uniformity ($c_u$)* | *1.96* |
| *Coefficient of Curvature ($c_c$)* | *1.35* |
| *Gravel(%)* | *0.2* |
| *Sand(%)* | *99.4* |
| *Fines(%)* | *0.4* |
| *IS Classification* | *SP* |
| *Specific Gravity* | *2.66* |
| *Relative density, $\gamma d(g/cc)$* | *1.5* |
| *Cohesion($kg/cm^2$)* | *0.14* |
| *Angle of internal friction, $\phi$* | $36.6^0$ |

### *1.1.2 FLY ASH*

Fly ash is a glass-like residue, about the size of a micron, left behind from the burning of coal in power plants.is the little portion of the ash that is caught by electrostatic precipitators and is transported upward with the flue gases. Silica, alumina, and iron make up the majority of this pozzolanic material. Anthracite, bituminous, and lignite coal all have different chemical compositions, which affects the chemical characteristics of fly ash. Based on its calcium, silica, alumina, and iron concentration, ASTM C618 defines and divides it into classes C and F. Bituminous coal and anthracite coal combustion produce Class F fly ash. The fly ash, which is categorized as class F fly ash, was obtained from Taureen Metals and Trading in Chathannoor.

### *METHODOLOGY*

#### ➢ *COLUMN STUDY*

The removal efficiency of ferric chloride was investigated in laboratory column tests that modelled field circumstances. The experimental setup consists of two PVC pipes 60 cm in height and 11cm in diameter columns. The column is filled with field soils and clays with an optimum dosage of fly ash. By maintaining the requisite density and ideal moisture content, the soil was retained at the bottom of the columns. A filter media was inserted to stop soil from floating on top of the column and clogging the output collecting tube. Throughout the saturation period, the water column was maintained at a constant 20 cm above the earth. The effluents were collected at regular time intervals of 5,10,15,20,25and 30 minutes from columns.

#### ➢ **Chemical Analysis**

In order to conduct a chemical analysis to determine the iron concentration in the samples, the effluents collected from the bottom of the column at predetermined intervals were provided to Green Method Engineering (P)Ltd.

### 1.2 RESULTS AND DISCUSSIONS

The removal efficiency of soil with an optimum dosage of industrial wastes is tabulated in Table1

Table:1 Removal Efficiency of soil at 15.7 mg/l beginning concentration

| Time (min) | CS1 (Iron concentration) (mg/l) | CS1+FA (Iron concentration) (mg/l) | Removal efficiency (%) |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 5 | 8.2 | 5.24 | 66.6 |
| 10 | 7.6 | 3.84 | 75.5 |
| 15 | 6.2 | 2.5 | 84 |
| 20 | 5.3 | 1.7 | 89 |
| 25 | 4.5 | 0.8 | 94.4 |
| 30 | 3.9 | 0.6 | 95.6 |

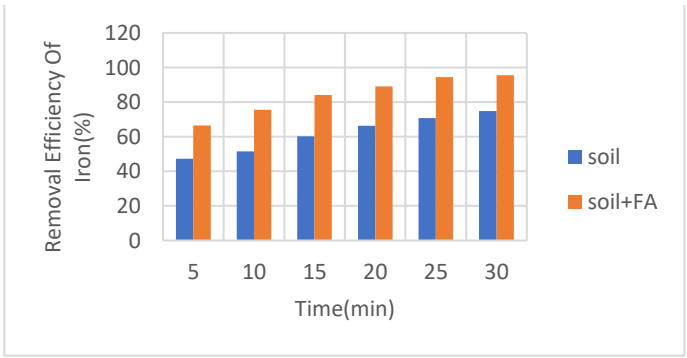


Fig:3 Removal Efficiency of Soil

The removal efficiency was 95.6%.

REFERENCES

1. Arunkumar K S(2020), “Heavy Metal Accumulation in Sediments of a Tropical Estuary: A Case from the Southwest Coast of India”, *International Journal of Lakes and Rivers*,13(1), 57-71

2. Chandran m and Natarajan P (2013), “Evaluation of the status of heavy metal contamination and texture of sediments in the Poonthura Estuary, southwest coast of India”, *Journal of Aquatic Biology and Fisheries*,369-375

3. Deb T and Pal S K(2014), “Effect of fly ash on geotechnical properties of local soil-fly ash mixed samples”, International Journal of Research in Engineering and Technology,3(5), 2319-1163

4. Nalbantoglu Z(2004), “Effectiveness of Class C fly ash as an expansive soil stabilizer”, Construction and Building Materials,18,377–381

5. Simatupang M, Mangalla L K, Edwin R S, Putra A A, Azikin M T, Aswad N H and Mustika W(2020), “The Mechanical properties of Fly-Ash-Stabilized Sands”, Geosciences, 10(4), 132