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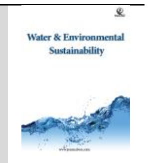

Research paper

Detecting Organic Materials in Fly Ash using Chromatographic Method

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A R T I C l E I N F O

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A B S T R A C T

Fly ash, a byproduct of coal-fired power plants, is entirely inorganic and inert, making it unfit for life. In Korba, fly ash is deposited in dykes, which are open embankments. The quest for organic compounds was critical because the humus formation is a revolution in fly ash, and just it will be capable of supporting life forms. This was conducted in the dykes to verify the organic materials source in fly ash, namely, whether they are originated from coal, furnace start-up oil, or animals and plants that grew in the area. Thin layer chromatography and ascending paper chromatography in a liquid medium were used as the method.

Introduction

Fly ash is generally made up of quite fine particles, much finer than cement. The vast majority of the particles resemble glass spheres. The majority of fly ash is composed of inert mineral oxides, roughly 95 % of which include aluminum, silicon, iron, and calcium oxides and some crystalline phases generated while cooling. The trace components in fly ash vary greatly in terms of kind and amount.

The fly ash characteristics are mostly determined by the type of coal burned. Many characteristics of coal alter as a result of this process. The proportions of hydrogen and nitrogen in coal and fly ash were found to be comparable, while the Sulphur concentration in Springfield fly ash was twice as high as in Danville fly ash. Mercury levels in fly ash, on the other hand, were 15 times lower than in coal. According to Tiwari (2007), the fly ash in Korba is made from bituminous coal and comprises of materials like alumina, silica, calcium oxide, sulphate, iron oxide, and magnesium oxide.

Being completely dumped in the ash dyke, the fly ash totally inorganic strata would be unsuitable for life. This water might take a long time to dry and can develop little pools or puddles on the dykes, leading to the natural process of introducing plant and animal life from out of the region, often known as succession. Shrivastava has already examined the succession of these dykes (2003). It is normal for plants and animals from the dykes' surrounds to make their presence known in the dykes, despite their limited life span. Life begins in these Korba dykes during the rainy season and ends with the arrival of summer. This cycle has been going on for more than ten years. Therefore dykes are classified in two areas: 1. Areas with plantation at some point during the year, and 2. Areas that never experience plantation.

It is apparent that where there was the plantation and animals, their dead parts and excretory contents would have transformed into humus. However, it is unknown if the areas where there was no life included humus or any other organic substance. The quest for organic substances in fly ash is especially essential since fly ash is derived directly from coal, which contains carbon that is an organic substance. Some fly ash produced by boilers that burn oil throughout start-up periods could contain residual oil. The most likely assumption is that organic material is developed in areas in which life forms exist.

Methods and Materials

Five ash dykes from Korba were chosen because they contain some life. The dykes utilized by the power plant for plantation and reclamation were excluded from the research since the fly ash substratum is adjusted by the power plant firm for these purposes through adding soil and fertilizers, so research on these areas would not demonstrate the attributes of ash alone. As a result, the research was conducted in places where there were no soil amendments, no other form of intervention from the employees, and so on. The dykes occupy enormous expanses of up to 50 acres of land, and in Korba six such dykes exist, thus identifying barren and unbroken places in dykes was easy. Paper chromatography and thin layer chromatography (ascending method) are two methods used to identify organic materials.

Results and Discussion

Method of Thin Layer Chromatography

Fly ash from dyke desolate areas: First, a concentrated solution of water and ethyl alcohol was made (50:50). The chromatographic glass plate used was around 5 *1.5 inch in diameter and activated at 60-70 °C. The concentrated solution was spotted only after the slide had reached room temperature. In an iodine chamber, the chromatogram was conducted. There was no spotting, demonstrating the lack of organic components (Table 1).

Fly ash from regions where there were living organisms: This ash was used for repeating the same method, but with a lower polarity. The existence of organic materials was confirmed by the appearance of prominent spots (Table 1).

B. Paper Chromatography

The concentrated fly ash solution was observed on chromatography paper. When the spot dried, the paper was placed in a chromatographic chamber with eluent. When the eluent had almost reached the top of the paper, it was removed, dried, and placed in an iodine chamber before being sprayed with ninhydrin solution. There were no spots seen, demonstrating the lack of any organic substance (Table 2).

Fly ash has a high surface area to volume ratio having particles with agglomerated components on its surface due to its form and size. Because of its glassy nature, the spherical component of it is often resistant to dissolving. Spherical sections have a completely inert nature. Yet, there are either easily adsorbed or exchangeable molecules on the surface of the spheres, which become dissolved in the presence of liquid and eventually form leachates. Thin layer chromatography is a method that scientists in biological sciences have regularly employed (Nema & Shrivastava 1991a, b).

The method of chromatographic-enzyme inhibition based on thin layer and paper chromatography was developed for detecting heavy metal compounds such as copper sulphate, mercuric chloride, silver nitrate, and cadmium sulphate using succinate dehydrogenases of mammalian liver as biovector and also for zinc sulphate (Seethamma & Nandakumar 2007).

As a result of these findings, chromatography was chosen as the optimum method for detecting the presence of organic compounds. Shrivastava previously documented the occurrence of living forms in fly ash dykes (2006). According to the macro and micro investigations of Shrivastava (2007), it is obvious that living forms occur largely on the dyke's edge, where there is the greatest interaction with the outside world and the most water stagnation, but the center portions of the dyke do not contain life forms. Therefore, it is proved by these chromatographic methods that the places where living forms were present at any point of year had organic components, whilst organic materials were absent in all other barren sections.

Kunlei Liu et al. (2000) found that in the solid phase most of polycyclic aromatic hydrocarbons are formed from breakdown reactions during pyrolysis or combustion in a system of fluidized bed combustion, confirming the existence of organic components in fly ash. The PAH's overall quantity in fly ash was observed to be much greater than in gas phase and raw coal. Chabbi's research (2004) has also confirmed the existence of organic material in fly ash produced from plant material.

Table 1: Presence of organic matter in dykes by TLC method.

Samples of fly ash	Method of testing	observation	Result
1. From barren area of the dyke Dyke-1 Dyke-2 Dyke-3 Dyke-4 Dyke-5	TLC	No spots were found on TLC plate	Organic materials absent
2. From the areas where plantation was present Dyke-1 Dyke-2 Dyke-3 Dyke-4 Dyke-5	TLC	Clear spots were observed on the plate	Organic materials present

Table 2: Presence of organic matter in dykes by paper chromatography method.

Samples of fly ash	Method of testing	observation	Result
1. From barren area of the dyke Dyke-1 Dyke-2 Dyke-3 Dyke-4 Dyke-5	Paper chromatography	No ninhydrin stains observed on the chromatographic paper	Organic materials absent
2. From the areas where plantation in present Dyke-1 Dyke-2 Dyke-3 Dyke-4 Dyke-5	Paper chromatography	Clear spots were observed on the chromatographic paper	Organic materials present

The existence of organic components in completely inorganic fly ash is a significant step toward the establishment of a self-sustaining substratum, since the substratum changes step by step over the succession cycle, allowing a wide range of life forms to acclimate.

Fly ash is a truly combusted component of charcoal that is the major source of hydrocarbons (organic material), but the absence of organic material shows that it is entirely combusted and therefore all C contained in the charcoal has been eliminated as CO2 during burning. The surface fly ash is distant from the beneath soil, thus no material exchange occurs from it to the fly ash upwards, and so there will be no organic material from soil. The leaching of fly ash into the earth is still a possibility.

Conflict of interest

The authors declare that they have no conflict of interest.

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