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# A Review of Literature on Effects of fly ash on various living organisms

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## ABSTRACT

Fly ash is emitted from the thermal power plants as a by-product and is stored in specially constructed ash dykes. The coal fly ash is totally inorganic material and contrary for any living organisms. The fly ash having many elements, including heavy metals, ions and oxides, fly ash contains Arsenic, Cadmium, Zinc, Chromium, Cobalt and lead, The *Rattus rattus* also known as the roof rat, ship rat or house rat. Because of the most similarity and homology in between genomes of rodents and human beings make these animal models a major tool to understand the conditions which affects humans and which can be simulated in rats Diemen, *et al.*, (2006). The liver is the most important and second largest organ in the body. It is known as the “chemical factory,” of the body because it controls the level of most of the biomolecules and medicines that are present in the blood, The reaction of the coal fly ash inhalation for 4 hours daily and for 5 days in a week for 28 days on the accumulation of elements, ions, metal and histopathological alterations in the liver and serum enzymes has been studied by Mani *et al.*, (2007). Fish *Cirrhinus mrigala* exposed in different concentration of thermal power plant’s effluent to assess the biochemical activities like total protein and enzymes acid phosphatase, alkaline phosphatase, aspartate aminotransferases, and alanine aminotransferase. Total protein and aspartate aminotransferases, acid phosphatase, alkaline phosphatase level increased in liver, kidney and muscle tissue shows stress condition in fish. These compounds change the water quality and in turn the aquatic fauna like fish and their behaviour. Changes in water quality parameters may also be deleterious to the aquatic plants and consequently indirectly affects the native fish population.

**Key words :** Fly ash, Heavy metals, Liver, Chemical factory, Liver enzymes, ALP, AST, ALP.

## Introduction

The coal fly ash is totally inorganic material and contrary to any living organisms. As reported by earlier studies fly ash contains Arsenic, Cadmium, Zinc, Chromium, Cobalt and lead, (Shrivastava *et al.*, 2011; Mani *et al.*, 2007; Sarode *et al.*, 2010 and Gupta *et al.*, 2007. The *Rattus rattus* or house rat has most similarity and homology in between genomes of rodents and human beings that makes these animal models a major tool to understand the conditions which affects humans and which can be simulated in rats (Diemen *et al.*, 2006). The liver is the most important and second largest organ in the body and is known

as the “chemical factory,” of the body because it controls the level of most of the biomolecules and medicines in the blood. The enzymes ALT, AST, Gamma glutathione and Lactate dehydrogenase are markers for liver injury.

## Review of Literature

The fly ash contents including different elements, ions, oxides and many heavy metals. These compounds affect the physical, chemical and biological properties of water and indirectly the aquatic fauna like fishes and their behavior (Shrivastava, 2011). The research in fauna in relation to fly ash is not done so much in comparison to other pollutants

very few researchers have studied this (Shrivastava, 2012). The reaction of the coal fly ash inhalation for 4 hours daily and for 5 days in a week for 28 days on the accumulation of elements, ions, metal and histopathological alterations in the liver and serum enzymes has been studied by Mani *et al.*, (2007). The results showed an increase in the attentiveness of metals such as Cd, Cr, Co, Mn, and B present in the tissues of affected rats. The serum enzymes level such as Aspartate aminotransferase, Alanine aminotransferase, and Alkaline phosphatase were expanding in rats which are affected by fly ash using complete body inhalation exposure in comparison with control. Histopathological work of fly ash affected rat liver tells the infiltration of cells (mononuclear) in and on all sides of the portal triads of the liver which seems to be loaded with coal fly ash particles. Liver cells showed necrotic alterations such as pyknotic nuclei i.e. (irreversible condensation of chromatin), karyorrhexis, and karyolytic. These alterations were more on the side of the centrilobular areas than the midzonal and outer areas of the liver. These detections signify that the toxic elements and metals present during inhaled of fly ash in rats may get translocated into other than pulmonary organs, become deposited and consequently manifest their toxic and harmful effects on different tissues. In India discarding of domestic sewage of about 29000 million of liter per day from municipality and cities is a biggest source of pollution of water bodies. Chemical oxygen demand (COD) is the amount of oxygen that is required for the organic matter for its chemical decomposition and Biochemical oxygen demand is the amount of oxygen required for the biological decomposition. Kulkarni and Goswami (2013) attempted to reduce the pollution parameters like chemical oxygen demand (COD) and Biochemical oxygen demand (BOD) by using bagasse fly ash in batch and column operation. By using bagasse fly ash, it has been observed that 85-90 % removal of organic matter can be obtained.

The developing countries fulfill their energy requirements from coal-based thermal power plants. The disposal of the large amounts of solid waste generated from thermal power plants is becoming a serious problem to the environment. Coal fly ash, ~80% of which is very fine in nature that is why known as fly ash is collected by electrostatic precipitators in stacks. At present in India, nearly 90 mt of fly ash is generated per year and is greatly responsible for major environmental pollution.

In recent years thermal power stations are growing. This was studied by Chaudhari *et al.* (2017) which indicated that the power plant affects the quality of water bodies as much as air. Fish *Cirrhinus mrigala* exposed is different concentrations of thermal power plant's effluent to assess the biochemical activities like total protein and enzymes ACP, ALP, AST, and ALT. Total protein and ALP, AST, and ACP level increased in liver. The investigation was done by Dwivedi *et al.* (2008) to screen various deposition of different heavy metals by different species of plants was detected. We found that the *Hydrilla verticillata* was most systematic metal depositor of all 9 aquatic plants, *Eclipta alba* out of 6 terrestrial plants and *Phormedium papyraceum* in between 2 algal species. Generally, the utmost levels of most metals were detected in terrestrial plants and the lowest detection was in algal species. This was studied by Shrivastava *et al.* (2011) who investigated the effect of fly ash on the behavioral pattern of *Tilapia mossambica* (a native species of South Africa). They noticed the movements of their operculum and pectoral fins. In addition, their feeding behaviour and swimming habits were also studied as well as their sensory responses like acoustic, rheological and aggressiveness etc. Fish in water having fly ash were compared to fish in water without fly ash under laboratory conditions. The industrial waste materials fly ash comes to the farming soil. Decomposers specifically microorganisms play very important role with relation to the productivity of the soil. The study was aimed to understand the influences of the coal fly ash on ballooning of slim pickings soil fungi and was studied by Shrivastava *et al.* (2018). From the crop land these fungi were secluded which is affected with the fly ash, while media supplement pure fly ash was added which were collected from the power station located in Korba. A low diversity of fungi that is 0.090 by Simpson diversity index indicates in the particular selected study area. Another species that is *P. chrysogenum* has highest growth (142.13%) in the low concentration (10 mg L<sup>-1</sup>) of fly ash as long as the species *C. lunata* and *A. niger*, while varied growth suppress and also support some fungi in the high concentration of fly ash.

#### **Rat as research model animal**

The homology and great similarity between the genomes of rodents and humans make these animal models a major tool to study conditions affecting humans, which can be simulated in rats. In animals'

obesity can be induced by neuroendocrine, dietary or genetic changes. The most widely used models to induce obesity in rats are a lesion of the ventromedial hypothalamic nucleus (VMH) by administering monosodium glutamate or a direct electrical lesion, ovariectomy, feeding on hypercaloric diets and genetic manipulation for obesity. Diemen *et al.* (2006).

### Role of liver

The liver plays a crucial role in both the homeostasis and pathology. In the body liver is the prime site of drug metabolism and, a common target for drug-induced toxicity and is vulnerable to a large range of diseases. In contrast to other solid organs, the liver possesses the unique ability to regenerate. To understand the human physiology, disease the physiological importance and plasticity of the liver make it a crucial system for study of the response to exogenous compounds. Firstly, the physiologic roles of the liver and its cellular components will be studied. Second, they will discuss the need for development of an *ex vivo* liver system. Third, the benefits and drawback of different cell sources utilized to populate the system will be mentioned. Fourth, the advantages of recently employed *ex vivo* liver culture systems will be discussed. Finally, future directions to boost these systems, including complexing liver culture systems with other organ-based culture systems ("organ chips"), will be proposed by Beckwitt, *et al.* (2008).

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