



ORIGINAL RESEARCH PAPER

Environmental Science

TINY BUT DEADLY: A THREAT TO ENVIRONMENT

KEY WORDS: Cigarette, heavy metals, Microplastics, Carcinogens

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ABSTRACT

Cigarette butts are small which tend to go unnoticed. It is the common form of plastic pollution. It contains hundreds of toxic chemicals, which when released can be a serious threat to us and to our environment. The theme of World No Tobacco Day 2022 is "Tobacco: Threat to our environment." This puts our focus on cigarette butts. Hence the aim of this study was to analyse the metals leached out from cigarette butts. The objectives was to quantify and compare metals leached out from the filter part of the cigarette butts and the whole cigarette butts. The methods followed was the cigarette butts were collected from smokers. Following collection, Cigarette butts and only the filter part of the cigarette butts were added separately to aqueous solution of 50 ml of concentrated HCL in deionized water. pH of the solution was adjusted to 6. It was allowed to soak for 24 hours. The trace metals concentration from the resultant leachate was estimated using Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES). From the results, Metals such as Al (4.2 ppm), Cu (5.5 ppm) and Sr (3.6 ppm) were identified from the leachates of filter part of the butt alone and metals such as Ba (9 ppm), Fe (3 ppm), Sr (31 ppm), Cu (8 ppm), and Al (17 ppm) were identified from the leachates of whole cigarette butt. The study concludes that multiple metals are released from the butts which can be a potential source of threat to the humans and to the environment.

INTRODUCTION

Cigarette butts are small which tend to go unnoticed. It is the common form of microplastic Pollution, as the filters are made of cellulose acetate strands. It contains hundreds of toxic chemicals, which when released can be a serious threat to humans and to the environment because, once cigarettes are smoked it initiates chemical reactions and when thrown to the environment in the form of litter, the filter part becomes brittle and breaks off when UV light and water comes in contact with it, causing release of heavy metals and carcinogens into the environment. Although many may argue that a single piece of cigarette would not cause any environmental hazards, the cumulative effect of many littered cigarette butts at an area may pose significant threat to the environment. (Register, 2000) Hence the aim of this study was to analyse the metals leached out from cigarette butts.

MATERIALS AND METHODS

Sampling

Smoked cigarette butts were collected from smokers. Following collection, the cigarette butts are divided into 2 groups. For Group A, the tobacco part of the butt was separated and only the filter part was kept. For Group B whole cigarette butt was used. Littered butts are not used as it may cause loss of any analyte prior to sampling. (Moerman & Potts, 2011) The sample was kept inside a plastic container to prevent moisture contamination and was analyzed in a laboratory.

Leaching procedure

Aqueous solution was prepared by adding concentrated supra pure hydrochloric acid to 50 ml deionized water and pH 6 was determined with a pH meter Eutech (pH 700). The samples from both groups are weighed in Sartorius CPA 225 D. The leachates of Smoked Cigarette butts without tobacco part for Group A was prepared by adding 1.08 g of samples into the aqueous solution. Similarly, the leachates of Smoked Cigarette butts with tobacco part for Group B was prepared by adding 1.15 g of samples into the aqueous solution. It was allowed to soak in the aqueous solution for a period of 24 hours under room temperature.

Filtration and ICP-OES Analysis

After 24 hours, the leachates of Group A and Group B samples were filtered separately using Whatman filter paper. The metal concentrations from both the groups were analyzed

using ICP-OES method.

RESULTS

From Leachates of Group A

From Group A, Metals such as Al, Cu and Sr were identified at 4.2 ppm, 5.5 ppm and 3.6 ppm respectively (Table 1).

Table 1. Concentration of Metals leached from Filter Part (Group A), After 24 Hours of Leaching Procedure.

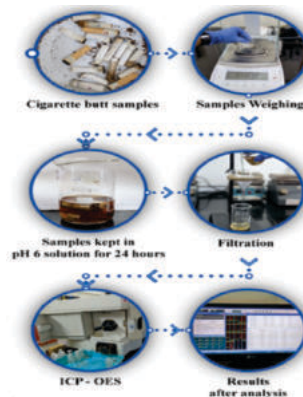
Metals Leached	Metal concentration in ppm
Aluminium	4.2
Copper	5.5
Strontium	3.6

From Leachates of Group B

From Group B, Metals such as Ba, Fe, Sr, Cu and Al were identified at 9 ppm, 3 ppm, 31ppm, 8 ppm, 17 ppm respectively. (Table 2)

Table 2. Concentration of Metals leached from Whole cigarette butt (Group B), After 24 Hours of Leaching Procedure.

Metals Leached	Metal concentration in ppm
Barium	9
Iron	3
Strontium	31
Copper	8



Figures/ Steps followed in the study Figure 1

DISCUSSION

The sampling and leaching procedure used in this study were designed to simulate natural conditions as closely as possible. pH 6 was selected for aqueous solution as it represents the range of pH usually observed in natural rain water. (Moerman & Potts, 2011) From the present study it was found that within 24 hours of leaching procedure, the metals such as Al, Cu and Sr have leached to a concentration of 4.2 ppm, 5.5 ppm and 3.6 ppm respectively from leachates of Group A (smoked Cigarette Butts without tobacco part). Also metals such as Ba, Fe, Cu, Sr and Al have leached to a concentration of 9 ppm, 3 ppm, 8ppm, 31 ppm, 17 ppm respectively.

Aluminium was present in both the groups at 4.2 ppm and 17 ppm which indicates a higher concentration of the metal. According to a review article by Barabasz et al 2000, aluminium presence at higher concentration will be a major threat for humans, animals and plants and can cause many diseases. In plants, Aluminium toxicity inhibits the root growth by hindering the cell division and elongation even with a brief exposure to Aluminium. Sometimes excess Aluminium even induces iron (Fe) deficiency symptoms in rice, sorghum and wheat. Aluminium toxicity also results in suppression of photosynthetic capacity of shoots in many plants. In other animals, e.g. birds and mammals, aluminium is usually taken in with food and evokes diversified toxic actions. In birds, aluminium most frequently affects eggshells and the metabolism of calcium and phosphorus, causing diminished efficacy of Calcium absorption and Aluminium toxicity for humans results from replacing Mg+2 and Fe+3 by Al+3, which induces numerous disturbances in the organism, connected with intercellular communication, secretory functions, and cellular growth. The severest danger of toxic aluminium action lies in its neurotoxicity. Aluminium-evoked changes in neurones are similar to degenerative lesions observed in patients suffering from Alzheimer's disease. ("Ecotoxicology of Aluminium," n.d.)

Iron was found at 3 ppm from leachates of Group B. The direct and indirect impacts of iron contamination have a significant impact on the quantity of species including periphyton, benthic invertebrates, and a diversity of fish (Vuori, 1995). Fish respiration will be hampered by the iron precipitate, which will also significantly harm the environment (EPA, 1993). The features of iron toxicity in rice include high uptake of Fe²⁺ by roots, acropetal translocation into leaves, bronzing of rice leaves and yield loss (Becker & Asch, 2005). (Jaishankar et al., 2014)

Copper was found in both the groups at 5.5 and 8 ppm respectively. Wilson's disease, a hereditary ailment that results in neurobehavioral abnormalities resembling schizophrenia, is brought on by excessive copper retention. Copper is one of the heavy metals that causes soil pollution and affects the biological and biochemical properties of the soil. (Mitra et al., 2022)

Barium was found at 9 ppm. Barium is a metal that rarely accumulates in plants, but does so in some plants, seaweed, and fish. According to EPA guidelines, the maximum permissible dose of Barium in drinking water is 2 ppm above which it can cause various adverse effects. (Peana et al., 2021)

Recommendations

- Need for continual litter cleanup to reduce the magnitude of metal contamination.
- Smokers should consider carrying their own "pocket ashtrays" to collect cigarette waste.
- Ensuring that cigarette butts find their way to the waste bin or sent to a recycling facility.

CONCLUSION

This study finds that the cigarette litter is a point source of

metal contamination in the environment. Heavy metals change the physical, chemical and biological properties of soil. These metals uptake by plants from the soil, reduces the crop productivity and also the absorption by plant roots is one of the main routes of entrance of heavy metals in the food chain. Heavy metals uptake by plants and successive accumulation in human tissues and biomagnifications through the food chain causes both human health and environment concerns. when these butts ends up in lakes and rivers where fish can mistake them for food. If the fish survive, the toxic can accumulate in their body, and when man consumes them, these toxins affect human health too. The consumption of heavy metal contaminated food can seriously deplete some essential nutrients in the body that are further responsible for decreasing immunological defences, intrauterine growth retardation, disabilities associated with malnutrition and high prevalence for various types of cancers. Hence cigarette butts are potential source of threat to the humans and also to the environment.

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