DETERMINATION OF LEAD AND CADMIUM LEVELS IN SELECTED SINGLE-USE PLASTICS IN SOKOTO

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ABSTRACT
The estimation of selected heavy metals (Lead and Cd) was carried out using Atomic Absorption Spectroscopy (AAS). Therein, the levels of Lead (Pb) range from 1.0791±0.023ug/kg to 0.07060±007ug/kg; the ranges of Cadmium (Cd) are 0.0552±0.003ug/kg to 0.0045±0.006ug/kg. The results revealed varying degrees of heavy metals in the selected plastics examined. Pb was highest in Plastic Bottles (PB) and lowest in Straw (S); whereas, Cd was highest in Straw and lowest in Plastic Bottles.

KeyWords - Heavy metals, Pb, Cd, plastics, straw, plastic bottles

1. INTRODUCTION
Plastics are polymers with large molecular weight. The plastic was originated from Greek words “plasticos” meaning moulded. The term plastics refer to the property of a material having ductility during the process of manufacturing (Alabi et al., 2019; Sarkingobiet al., 2020). The nature of plastic renders them the ability to be converted into several products that are diversely applicable in human endeavour (Alabiet al., 2019). Plastics are diverse, like their functions. Some plastics are thermosets, thermoplastics, micro plastics, macroplastics, nanoplastics, elastomers, bioplastics and single use plastics (Alabiet al., 2019). Recently, plants served as sources of useful synthetic compounds (Upadhyay et al., 2013). Like other polymers, plastics can be synthesized from plants. Most of the currently use plastics are from non-plant sources. Some plastics are synthesized from Commonly use plastics include: polyethene Terephthalate, found in soft drinks, salad trays, mouth wash bottle; high density polyethylene, found in food packaging, rest mats, cosmetics, raincoats; polyvenyl chloride, found in toys, dolls, beach balls, rubber medicine bottles; polypropylene, found in yoghurt bottles, medicine bottle; polystyrene, found in...
cassette cases, coffee cups, cutlery, computers; and polypropylenes, found in yoghurt bottles, medicine bottles (Alabi et al., 2019, Sarkingobir et al., 2020). However, one of the leading types of plastics of concern is the single use-plastics. Single use-plastic are plastic products that design to be use and dispose once. Examples include: light-weight plastic bags, disposable utensils, beverage containers, coffee capsules, straws, food wrappers, takeaways, plastic bag, and drink bottles (Institute for European Environmental Policy, 2016). They are the leading plastics produced and used every day and are the most prevalent in the waste produced and discarded in our environment (Ibrahim et al., 2017; Sarkingobiretal., 2019). Similarly, every plastics are produced as a mixture of specific monomer resins and additives. In some of the additives added to these plastic materials are heavy metals (Sarkingobiretal., 2020). Forsooth, there are revelations that shows these heavy metals in the plastics can leach to the environment or other contacts (such as food, water, human body) and might elicit negative effects (Sarkingobiretal., 2020).

All elements on earth can either be metals or nonmetals based on sets of criteria. Metals are large group of substances, which are opaque, form alloys, conduct electricity and heat. They are usually malleable (WHO, 2011). Metals occur naturally in the environment, and in the crust. They vary significantly between different regions in spatial variations of background concentrations (Muhammad et al., 2014). Out of the 92 naturally occurring elements, about 30 metals and metalloids are potentially harmful to humans, Be, B, Li, Al, Ti, V, Cr, Mn, Co, Cu, Ni, As, Se, Sr, Mo, Pd, Li, Cd, Sn, Te, Sb, Cs, Ba, Lu, Pt, Au, Hg, Pb and Bi (WHO, 2011).

Heavy metals are the family of metals having an atomic weight above 40.04. Heavy metals enter the environment via natural or anthropogenic processes, such as in natural weathering, mining, soil erosion, industrial discharge, pest control methods, sewage effluents, air pollution fallout e.t.c. Heavy metals explored from the earth crust or industrial processes are released to the environment. Therein, humans contacted them through ingestion (drinking or eating) or inhalation (breathing) or absorption by the skin/other body openings (WHO, 2011).

Certainly, plastic materials are remarkably resourceful and are utilized in variety of applications. More than half of the plastics produced are disposed when they are used once (Khan and Khan, 2015). These single use plastics are ubiquitous in our environment and everywhere you go in Sokoto state and many other places in the country (Plastics Europe, 2016). Therefore, they make majority of our waste which find it ways into the environment and exert negative effects to living organisms including humans, because of their component monomers and additives (Alabietal., 2019). One of the additives found in plastics are the heavy metals, which are added deliberately and through impurities during production (Khan and Khan, 2015; Sarkingobiretal., 2020).
However, heavy metals have been shown to cause negative effects, such as cancer effect, neurotoxicity, oxidative stress, cell damage, apoptosis etc (Adepoju-Bello et al., 2012; Goodlaxson, 2017). Parable, cancerous breast biopsies show higher level of nickel, chromium, cadmium, mercury and lead. Lead is proven to cause neurotoxicity, learning and land defects, behavioural effects, infertility, miscarriage, reduced fertility, etc. (Adepoju-Bello et al., 2012). The objective of this paper was to determine the levels of Pb and Cd heavy metals in some selected single use plastics in Sokoto, Nigeria.

2. MATERIALS AND METHODS

Different single-use plastics were bought from Gwadabawa Market. They were cut into pieces using knives to make tiny pieces. The pieces were thoroughly washed with distilled water. Double distilled water, ethanol (8% v/v), NaCl (0.9% w/v) were used as stimulating agents. Each plastic type was exposed to 100ml of stimulating solvents in sterile beakers at a ratio of 2cm³/ml. The samples were kept at 40± 2°C for 24hrs. Parallel sets having stimulating solvents only were run under identical conditions and it as basal control. The stimulating solvents were taken in a conical flask and digested with conc. Nitric acid in a fuming chamber. The digested samples were sealed done to 10ml with 0.1N HNO₃. The final processed samples were analyzed by Perkins-Elmer 500 Atomic Absorption Spectrophotometer (AAS). The instrument was firstly calibrated by using stock solution provided by Merck. The AAS is a spectro-analytical method for the quantitative determination of chemical elements in digested samples down to parts per million (ppm) in a sample.

3. RESULTS AND DISCUSSIONS

Table 1: Results of levels of of and Cd in Selected Heavy Metals in Sokoto

<table>
<thead>
<tr>
<th>Type of single use plastic</th>
<th>Lead (Pb)ug/kg</th>
<th>Cadmium (Cd)ug/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Bottle</td>
<td>1.0791±0.023</td>
<td>0.0045±0.006</td>
</tr>
<tr>
<td>Straw</td>
<td>0.0706±0.007</td>
<td>0.0552±0.003</td>
</tr>
<tr>
<td>Takeaway</td>
<td>0.4095±0.1</td>
<td>0.0095±0.003</td>
</tr>
<tr>
<td>Icecream cup</td>
<td>0.8347±0.1</td>
<td>0.0052±0.002</td>
</tr>
</tbody>
</table>

The results for determination of selected heavy metals (Lead and Cd) were presented in table 1. Therein the levels of Lead (Pb) ranges from 1.0791±0.023ug/kg to 0.0706±0.007ug/kg; the ranges of Cadmium (Cd) are 0.0552±0.003ug/kg to 0.0045±0.006ug/kg. Certainly, the results revealed varying degrees of heavy metals in the selected plastics examined. Pb was highest in Plastic Bottles (PB) and lowest in Straw (S); whereas, Cd was highest in Straw and lowest in Plastic Bottles.
Cd is found in the Earth crust and harvested through industrialization or anthropogenic processes. Albeit the level of Cd found in this study from all the single-use plastics were lower than the allowed limit of 0.1ppm, the content might be available to leach into the surrounding food or contacts (plants and animals or soil). Pb has shown very lower levels in the analyzed plastics below the permissible limit. Albeit there is no known safe levels of Lead. Pb also has the ability to affect all organs of the body (Muhammad et al., 2014). Cd have the ability to elicits health effects such as diarrhea, stomach pain, vomiting, damaged central nervous system, immune damage, psychological disorders etc (WHO, 2011; Khan and Khan, 2015). Therefore since there is no safe Cd and Ld levels monitoring of their levels in plastics need to be intensified to prevent chronic accumulation of miniscule levels in soils (leading to leaching and uptake by plants or animals) and organisms to prevent toxic effects in animals.

4. CONCLUSION

The results of this study have revealed that the different single-use plastics analyzed contains varied levels of Pb and Cd and the levels are low.

REFERENCE


