International Scholars Journals

African Journal of Chemistry Vol. 3 (1), pp. 080-083, January, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals

Full Length Research Paper

A study of heavy metals in some cigarettes and tobacco leaves in Benue State, Nigeria

Idejhe B. Victoria*, Abasa W. Racheal and Onajomor Stephanine

Department of Chemistry and Centre for Agrochemical Technology, University of Agriculture P. M. B. 2373 Makurdi, Benue State, Nigeria.

Accepted 09 July, 2013

The concentration of heavy metals chromium, cadmium and lead (Cr, Cd and Pb) in tobacco leaves and some selected cigarettes from Benue State were analyzed using AAS techniques. The results obtained indicates that the mean concentration (ppm) of Cr, Cd and Pb in tobacco leaves were 0.216, 0.056 and 0.052, while that of selected cigarettes are 0.0378 (ppm) for Pb, 0.12 (ppm) for Cr and 0.0116 (ppm) for Cd in all brands of the cigarettes, respectively. The level of Cr, Cd and Pb in selected cigarettes and tobacco leaves were found to be below the WALOH standards for human consumption and plant uptake. It was also revealed that the concentration of the metals in ash tobacco leaves were lower compared to that of selected cigarette. Similarly, results of the analysis of all the ten different brands of cigarettes shows that Cr concentration was the highest, followed by Pb and Cd was the least.

Key words: Heavy metals, tobacco, cigarettes, cancer, Benue.

INTRODUCTION

Plants are amenable to absorb and accumulate heavy metals from the soil into their leaves. The factors governing heavy metals speciation, adsorption and distribution in soil are pH, soluble organic matter content and soil type, presence of organic and other metal ion (Noler, 2006). Tobacco leaves naturally accumulate and concentrate relatively high levels of heavy metals. A great number of people have become victims of environmental tobacco smoke (ETS) as they participate passively.

Factors that have impact on smoking habits of cigarette includes: the presence of additive compounds like nicotine, mass production, social acceptance, light weight, availability and relative cheapness. A cancer surgeon in India help to add the study of tobacco's health effects to school curricula, to establish a regulation banning public smoking, since those who only inhale suffer more consequent, and to prohibit sale to those under 21 years of age (Sharad, 2000). Therefore, smoking of tobacco is an important source of air exposure for smokers (Scherer et al., 2002). EL-Agha et al. (2002) investigated Cd level in the blood of tobacco smokers and non – smokers. They concluded that a significant level of Cd was found in cigarette smokers compared with non-smokers. Studies have shown that, each year about 3000 non-smoking adults' die of lung cancer as a result of breathing the second-hand smoke from other's cigarette (Hynes, 2007). Rodgman and Perfetti (2009) reported that cigarettes smoke has 7357 chemical compounds and many were contribute to environmental risk. Fowles and Dybing (2003) suggested an approach to identify the chemical components in

*Corresponding author. E-mail: Vicki.ijay@yahoo.com

Figure 1. A typical cross-section of tobacco plants in kwaghshir Agbe Village of Benue State.

tobacco smoke with the greatest potential for toxic effect. They considered the risks for cancer, cardiovascular diseases and heart disease. Using this approach, they found that 1,3- butadiene present by far the most significant cancer risk; acrolein and acetaldehyde had the greatest potential to be respiratory irritants; and cyanide, arsenic and cresols were the primary source of cardiovascular risk. Generally, heavy metals can directly influence behaviour by impairing mental and neurological functions, influencing neurotransmitter production and utilization, and altering numerous metabolic body processes (Dauwe et al., 2004).

Therefore, monitoring of tobacco in food sample is essential for the protection of the environment and of our health (Zhang et al., 2005). This research focus on the concentration levels of three toxic heavy metals (Cd, Cr and Pb) in tobacco leaves and some selected cigarettes that are commonly consumed in Benue State. The outcome of the research will be used to educate the masses through the media about the health implications of these metals in human body.

MATERIALS AND METHODS

Sampling

Tobacco leaves (Figure 1) were randomly collected from four different sample stations in Guma Local Government area of Benue State into a black polythene bag and transported to the laboratory. The leaf samples were washed with distilled water carefully and allowed to dry in oven for three days at 105°C. The dried leaves were pound using mortar and pestle and sieve with the mesh sieve. About 0.5 g of ground tobacco leaves was weighed into a clean 125 ml Erlenmeyer flask. A mixture of 4ml of $HClO_4$, 25 ml Conc. HNO_3 and 2 ml Conc. Sulphuric acid was added to the flask (Noler, 2006). The mixture was heated gently on a hot plate under a fume–hood for 30 min. The flask was allowed to cool and 2 ml of Conc. HNO_3 was further added. The mixture was finally heated strongly to a medium heat for 3 min and allowed to cool. The solution was completely filtered (using Whatman No 42 filter, 9 cm) into 100 ml volumetric flask and make up to the mark with distilled water. The filtrate solution was stored in the refrigerator waiting for heavy metal analysis using AAS.

Cigarettes

Ten different brands of cigarettes name and code as follows: Aspen (04), Rothmans (05), London menthol (06), Benson and Hedges (07), St. Moritz (08), Excell (09), Pall Mall filter (10), Dorchester (11), Dunhill (12) and Pall Mall Menthol (13) were purchased from Makurdi

Table 1. Concentration (ppm) of heavy metals in the sample.

Sample	Heavy	Metals	
	Cr	Cd	Pb
Tobacco leaves	0.216	0.056	0.052
Ash tobacco leaves	0.037	0.017	0.025
Code 04	0.158	0.031	0.011
Code 05	0.230	0.029	0.015
Code 06	0.161	0.030	0.011
Code 07	0.173	0.028	0.001
Code 08	0.157	0.029	0.016
Code 09	0.122	0.014	0.001
Code 10	0.299	0.013	0.090
Code 11	0.041	0.011	0.008
Code 12	0.017	0.009	0.069
Code 13	0.125	0.011	0.021

metropolis. Composite samples of each brand were made by removing the papers and filters of the cigarette taken randomly from a pack of 20 cigarettes. About 0.5 g of finely ground plant tissues of the cigarette was placed into a quartz crucible. This was then placed in muffle furnace set at 500°C for 2 h. The ignited residues were moistened with water carefully added 5.0 ml of 4N HCl. The mixture was filtered through Whatman No.40, 9 cm filter paper into 50 ml volumetric flask and diluted to the mark awaiting analysis using AAS (model Pye Unicam 969).

RESULTS AND DISCUSSION

This work focuses on three toxic heavy metals (Cr, Cd and Pb) in tobacco leaves and some selected cigarettes from Guma local government area of Benue state. Table 1 shows the mean concentration of triplicate analysis of the samples using AAS techniques.

Cr: the mean concentration of Cr was 0.037 ppm and 0.216 ppm in the ashed and tobacco leaf, respectively. Sample code 10 recorded the highest value of Cr concentration (0.299 ppm) while code 12 was the least (0.017 ppm). Generally, the mean concentration (0.121 ± 0.02 ppm) of Cr was higher than the other two metals (Cd and Pb) investigated. However, the level is higher or lower than recommended limit in plant 0.23 ppm and human 011 ppm (Elinder, 2010). The motives could be attributed to the nature as well as physiochemical properties of the soil where the tobacco leaves were grown.

Cd: the mean concentration of Cd was 0.017 and 0.056 ppm in the ashed and tobacco leaf, respectively. Sample code 9 recorded the highest value of Cd concentration (0.014 ppm) while code 12 was the least (0.009 ppm). Generally, the mean concentration (0.012± 0.02 ppm) of Cd was lower than the other two metals (Cr and Pb) investigated. However, the level is higher or lower than recommended limit in plant 0.6 ppm) and human 0.52 ppm, (Elinder, 2010). The motives could be attributed to the nature as well as physiochemical properties of the soil where the tobacco leaves were grown. Nnorom et al. (2005) reported that some species of plant have been observed to accumulate high concentration of metals, most especially Cd, in leaf tissue rather than in roots. The processing, packing, and other technological processes (including the use of additive) used to bring raw food items to the consumers can significantly increase heavy metal contents in cigarette tobacco (Stephen et al., 2003).

Pb: the mean concentration of Pb was 0.025 ppm and 0.052 ppm in the shed and tobacco leaf, respectively. Sample code 12 recorded the highest value of Pb concentration (0.09 ppm) while code 9 was the least (0.001 ppm). Generally, the mean concentration (0.038 ± 0.07 ppm) of Pb was higher than Cd but lower than Cr. However, the level is higher or lower than recommended limit in plant 2.7 ppm) and human 1.20 ppm, (Elinder, 2010). The motives could be attributed to the nature as well as physiochemical properties of the soil where the tobacco leaves were grown.

This result when compared with WALOH standard in Table 2 shows that the concentration of chromium is higher in plant (0.23 and 0.2 ppm) than in the average of the various cigarette samples analysed which is 0.120 ppm. However, the concentration of chromium in fresh water (0.0018 ppm) is lower than its concentration in the cigarette samples analysed (0.120 ppm). This shows that the average value obtained from this work was found to be below the standard value for plant.

Cadmium has its highest concentration of 0.014 ppm in

Table 2. Comparison with WALOH standard.

Heavy metals	This work	Land plant	Marine plant	Fresh water
Cr	0.121	0.23	0.2	0.0018
Cd	0.012	0.6	0.15	0.0011
Pb	0.038	2.7	-	-

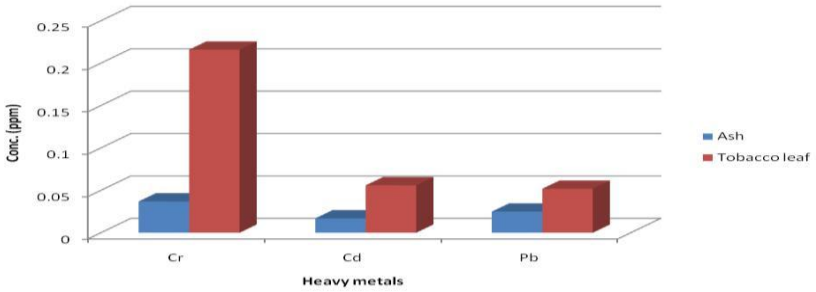

Figure 2. Heavy metal concentration level of tobacco leaves obtained from the study area.

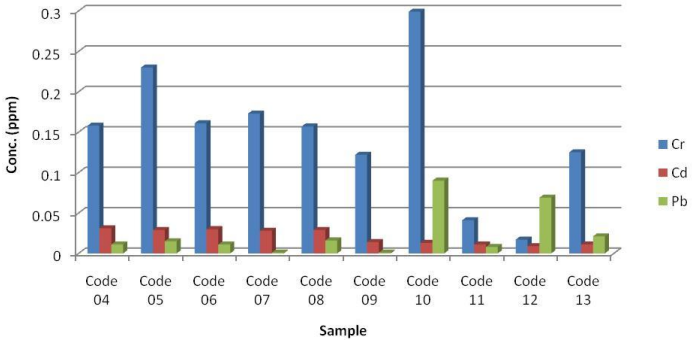

Figure 3. Heavy metal concentration level of cigarette samples obtained from the study area.

sample code 09 and lowest concentration of 0.009 ppm in sample code 12 with an average of 0.0116±0.02 ppm. This result when compared with WALOH standard in Table 2 shows that the concentration of cadmium is higher in plant (0.6<0.8 and 0.15 ppm) than in the average of the various cigarette samples analysed which is 0.0116ppm. However, the concentration of cadmium in fresh water is 0.0011ppm. This shows that the average value obtained from this work was found to be below the standard value of plant.

Lead has its highest concentration of 0.090 ppm in sample code 10 and lowest concentration of 0.001ppm in sample code 09 with an average concentration of 0.0378±0.07 ppm. This result when compared with the WALOH standard in Table 2 shows that the concentration of lead is higher in land plant (2.7 ppm) than in the average of the various cigarette samples analysed which is 0.0378 ppm. However, the concentration of lead in marine plant and fresh water was not obtained. This shows that the average value obtained from this work was found to be below the standard value of land plant.

Conclusion

The result generally shows that the concentrations of Cr, Cd and Pb were high in tobacco leaf's compared to ahed leaves (Figure 2). Similarly, sample code 10 contains the highest levels of Cr, Cd and Pb while sample code 11 contains the least level of the three metals investigated (Figure 3).

Finally, the level of Cr, Cd and Pb were found to be

below WALOH standard, however, the accumulation of this level consecutive could be determined to human health.

ACKNOWLEDGEMENT

We appreciate the efforts of the following undergraduate students namely: Ayim Dennis, Ogoh Owoicho Emmanuel, Kwaghshir Termbur Bartholomew and Targuma Sarem during the sampling and samples preparations. Our thanks go to Pastor I. Gundu (NARICT) for AAS analysis. Finally, we appreciate the various comments/suggestions of the anonymous reviewers.

REFERENCES

Dauwe HO, Grain KO, Sail MO, Drill GG (2004), Soil and Plant Analysis . interscience , New York, pp. 241-260

Ebisike K, Ayejuyo OO, Sonibare J.A, Ogunkole OA, Ojumo TV (2004). “Pollutions Impact of Cigarette

Consumption on Indoor Air Quality in Nigeria”. J. Appl. Sci., 4(4): 623-629.

Elinder Oliveira (2010). Smokeless Tobacco and Oral Cancer; J. Botany, 10 : 230.

El-Agha O, Gorkmen IG (2002).”Smoking Habits and Cadmium Intake in Turkey”. Biol. Trace Element Res., 88(1):31-43.

Fowles SI, Dybing GL, (2003), Environmetal Pollution: Causes and Effects. J. Adv. in Med., 11,1: 9-25.

Hynes DR (2007). Trace Element in Vegetables and Soil in Domestic Gardens around Smelting Complex, Environmental Pollution 9: 211-221.

Nnorom IC, Osibanjo O, Oji-Nnorom CG (2005).“Cadmium Determination in Cigarettes Available in Nigeria”. Afr. J. Biotechnol., 40(10):1128 – 1132.

Noler BN, Mayes TL, Raite UY, Sail SS (2006). Quality Assessment of Contamination of Water and Air with Heavy metals, Afr. J. Biotechnol., 8 : 67-77.

Oladipo MOA, Ajayi OO, Elegba SO, Alonge SO, Adeleye SO (1993). “The Determination of Minor and Trace Elements in some Cigarettes and Raw Tobacco using Inductively Coupled Plasma Mass Spectrometry. Pakistan Res. J., 11 (23), 19-32.

Philip Morris information sheet ; Stamford .edu. Archived from the original on 2008 – 04 -05 .

Rodgman PP, Perfetti OL (2009), Heavy Metals Toxicity: Consequences and Elimination, J Plants Nutr., 6,(5): 45-55.

Scherer G, Barkemeyer H (2002). Cadmium Concentration in Tobacco and Tobacco Smoking. Ecotoxicol. Environ. Saf., 1: 71-78.

Sharad, V.K; (2000), Analysis of Hg, Ni, Cr, Pd and Cd in Plant and Soil in Part of Austria. Afr. J. Biotechnol., 6: 41-57.

Stephen NM, Goom LK, Flora MB, Holow CD, Andy XJ (2003). Contamination of Sedimentby leads, cadmium and zinc. Environ. Pollut., 2, 60-79.

WHO Report on the global tobacco epidemic (2008) (foreword and summary). World Health Organization. 2008. 8.

Zhang VB, Xenon FO, Flow AA (2005). Quality Assessment of Worldwide Contamination of Air, Water and Soil with Pb, Cd, Hg, and Cr , Pakistan Res. J., 132:144-160.