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Detection of Trace Metals among the Most Commonly Available Smoked and Smokeless Tobacco Products

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Abstract

Objectives:

The main objective of this study was detect the trace metals among the most commonly available smoked and smokeless tobacco products in Tamil nadu.

Materials and Methods

In the present study, four commonly used tobacco products were used and brands were purchased based on the common usage by the people from the commercially available products in the market. All samples were analyzed for trace metals like Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb by ICP-AES(Inductively coupled plasma atomic emission spectroscopy)

Results:

The observed average metals concentrations for cadmium ,Chromium,Arsenic,Nickel and Lead was measured to be below 0.1mg/kg in all the four samples.

Conclusion

The investigation may confirm that the level of trace metals contents like Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb from the above samples are significantly less toxic to cause any disease.

Key Words: tobacco, Health, Smoking, Toxic Metal

INTRODUCTION:

Some of the trace metals in biological samples have potentially toxic effects in living organisms. That is, pollution due to trace metals has acquired importance, since these metals are highly toxic for humans and for the whole ecology.

Chromium, Nickel, Arsenic, Lead and Cadmium, are metals with known toxic properties (1, 2). Nickel is usually present in high concentrations in the liquid wastes which are released directly into the environment without any pre-treatment (6). It is one of the stable and persistent environmental contaminants since it cannot be biologically or chemically degraded or destroyed unlike many other organic toxic pollutants. Therefore, the metal has become a serious worldwide environmental problem. Although nickel is a trace element required for living organisms, it is toxic when ingested in large amounts.

Epidemiologic and experimental studies of nickel related cancer evaluated and concluded that nickel compounds are also well recognized as carcinogens (7).

The environmentalist and government health organization are much more worried about high presence lead and cadmium as non-essential. These metals are potentially hazardous and carcinogenic even in small concentration. They also are a toxic trace metal that has no biological function in humans and plants but also has an accumulative metabolic poison (bio-accumulate) with physiological and neurological effects (10-12). According to Harrison and Laxen, (13) and WHO, (14,15) lead and cadmium are highly toxic metals and are capable of causing serious effects on the brain, kidneys, nervous system, intelligence quotient (16) and red blood cells. In these organs cadmium is bound to a small protein called metallothionin (17). Anyhow, acceptable concentrations of Pb and Cd in human blood are below 100 and 10 µg/l, respectively, depending on the subject's age and gender (18).

There are a number of inorganic toxic elements and essential element present in tobacco along with organic carcinogens. Tobacco plant is open to absorb and accumulate heavy metal species from the soil into its leaves (19) or deposited on tobacco leaves from air (20) In, cigarettes are used liberally for smoking or for pleasure. Many young or adult men and women enjoy smoking worldwide; therefore the monitoring of heavy metals in tobacco is essential for protection of the environment and of our health. In , whether nobody made data or it is inaccessible yet, hence, trace metal is dangerous for health on smokers and potential smokers.

MATERIALS AND METHODS:

Instrumentation and reagents

ICP-AES(Inductively coupled plasma atomic emission spectroscopy)was used to determine the presence of trace metals**.**A Sartorius analytical balance (Model A 120 S,), Filter Paper Circles 110 mm diameter (ashless-Germany), PTFE (Polytetrafluoroethylene) vessel, microwave (VT 6130 M, Heraeus instruments,) were employed throughout the procedure.

Agate ball mixer mill (MM-2000 Haan,) such as Wiley mill, was used for grinding the cigarette tobacco. Sieves made of nylon with mesh sizes of Ø <65 were used to study the influence of particle size on extraction.

The Teflon boxes and plastic boxes were washed with 200 ml acid acetic 65% plus 5000 ml bidistilled water, and

volumetric flasks with 50 ml acid acetic 65% plus 5000 ml distilled water, then they were washed two times with distilled water to remove any contamination.

Preparation of samples

Four different brands of commonly sold tobacco products in the market were randomly purchased . For analysis of trace elements in cigarette tobacco, we separated all components of cigarette, tobacco, filter and wrapping paper of cigarettes.. As soon as practicable after collecting, tobacco samples are commonly dried in a beaker, then grounded in an agate grinder (300 rpm) and sieved to obtain a < 65 µm fraction. Appropriate quality-assurance procedures and precautions were taken to enhance the reliability of the results. Samples were carefully handled to avoid cross-contamination. Glassware was properly cleaned and all reagents used were of analytical grade. Blank samples of deionised water were run to calculate the limits of detection and limits of quantification. Blank procedural reagent samples were also used to subtract the results of all tested metal standards and samples injected into the ICP-AES system and the results were calibrated

RESULTS

The results showed the presence of trace metals namely Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb by ICP- AES(Inductively coupled plasma atomic emission spectroscopy) are described below:

Sample-1 (Gutka):

Sample 1 showed less than 0.1 mg /kg of Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb

S.NO	TEST PARAMETERS	METHOD	RESULTS
1	Cadmium as Cd	Instrument used ICP-AES	Less than 0.1 mg/kg
2	Chromium as Cr		Less than 0.1 mg/kg
3	Arsenic as As		Less than 0.1 mg/kg
4	Nickel as Ni		Less than 0.1 mg/kg
5	Lead as Pb		Less than 0.1 mg/kg

SAMPLE 2 (CHAINI)

Sample 2 showed less than 0.1 mg /kg of Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb

S.NO	TEST PARAMETERS	METHOD	RESULTS
1	Cadmium as Cd	Instrument used ICP-AES	Less than 0.1 mg/kg
2	Chromium as Cr		Less than 0.1 mg/kg
3	Arsenic as As		Less than 0.1 mg/kg
4	Nickel as Ni		Less than 0.1 mg/kg
5	Lead as Pb		Less than 0.1 mg/kg

SAMPLE 3(CIGARETTE)

Sample 3 showed less than 0.1 mg /kg of Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb

S.NO	TEST PARAMETERS	METHOD	RESULTS
1	Cadmium as Cd	Instrument used ICP-AES	Less than 0.1 mg/kg
2	Chromium as Cr		Less than 0.1 mg/kg
3	Arsenic as As		Less than 0.1 mg/kg
4	Nickel as Ni		Less than 0.1 mg/kg
5	Lead as Pb		Less than 0.1 mg/kg

SAMPLE 4(BEDI)

Sample 4 showed less than 0.1 mg /kg of Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb

S.NO	TEST PARAMETERS	METHOD	RESULTS
1	Cadmium as Cd	Instrument used ICP-AES	Less than 0.1 mg/kg
2	Chromium as Cr		Less than 0.1 mg/kg
3	Arsenic as As		Less than 0.1 mg/kg
4	Nickel as Ni		Less than 0.1 mg/kg
5	Lead as Pb		Less than 0.1 mg/kg

DISCUSSION:

The results showed that there was less than 0.1 mg/kg of Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb in all the four tobacco samples.According to FAO/WHO established a PTWI of Pb in adults and children as 25 µg/kg/week[21]. According to the Joint FAO/WHO Expert Committee on Food Additives (JECFA) the accumulation of Pb in the body was based on net absorption of Pb — 40% from dietary sources, 10% from food and drinking water, and up to 50% from inhalation of Pb compounds. This implies that at an intake of 5 µg/kg bw/day, retention of Pb in the body leads to an increased

blood Pb level, thereby impacting the hematic and immune system. It was found that in group A (gutkha), the Pb was less than 0.1 mg/kg as shown in Table 1, when an average 10 pouches were consumed per day.

Arsenic — In 1990, the JECFA set the As level to 2.1 µg/kg bw/day. PTWI for As according to the FAO/WHO in adults is 15 µg/kg/week[22]. All the groups showed less than 0.1 mg/kg of Arsenic .

Cadmium — Cd was found below the permissible level in all groups. According to WHO-JECFA(23), the recommended value of Cd is 3.5 µg/kg bw/week for adults. Considering the accumulation property and the long biological half-life of Cd, a level of 0.2–1 µg/kg bw/day has been set[24]. This equals 30 µg Cd/day for a 60-kg body weight individual. The following oral exposure of Cd is likely to depend on physiological status, such as age and levels of Fe, Ca, and Zn stored in the body. According to IPCS 1992[24], ingested Cd from daily food and water is about 12–25 µg, from which the actual absorbed amount of Cd is 0.6–1.3 µg/day, and total inhalatory intake from the atmosphere is 0.15 µg/day of which the actual absorbed amount of Cd is 0.04 µg/day. • weighing 70 kg and drinking 1.5 l of water per day, eating 1.5 kg of food per day, and inhaling 20 m3 /day is 0.01– 0.06 µg/kg, 31.4 µg/kg A number of factors influence the actual level of elements found in plants that include type of plant tissue, level of elements in soil, soil and leaf residues resulting from application of metal-containing pesticides, insecticides[25], and soil amendments including fertilizers and municipal sludge[26]. It also depends on the distance of the plant from the source of the element, the season, the climatic condition, and the foliar uptake from settled aerosols[27]. Also, it is possible that the source of metals may be due to the addition of various ingredients as shown in Table 4. Certain spices, such as mint, saffron, etc., used in the flavoring of STPs might also contribute to the heavy metal content[28].

CONCLUSION:

Thus from our present study we conclude that the presence of trace elements namely Cadmium Cd, Chromium Cr , Nickel Ni, Arsenic Ar and Lead Pb was less than 0.1 mg/kg in all the four samples which is lesser than the amount of metals to cause disease and have an impact on oral health.

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