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Estimating lead levels in some types of incense available in local markets

Huda J. Hussein

Department of evaluation of goods and the performance of services, Center for market research and consumer protection , University of Baghdad, Baghdad, Iraq
Email: hudajaber@mracpc.uobaghdad.edu.iq

ABSTRACT

This study investigates the concentrations of lead (Pb) in various incense samples commercially available in Baghdad markets using Flame Atomic Absorption Spectroscopy (FAAS). Ten brands of direct-burning incense were analyzed after acid digestion with aqua regia. The results revealed substantial variations in Pb levels, ranging from 0.06 ± 0.01 µg g^{-1} (sample B4) to 6.40 ± 0.40 µg g^{-1} (sample B5). Three samples (B5, B6, and B10) exceeded the European Commission's recommended safety threshold of 2 µg g^{-1} for consumer products, suggesting a potential public health risk. The observed variation in Pb content is likely associated with differences in raw materials or production practices. These findings emphasize the necessity of strict monitoring and quality control of incense products to mitigate potential health hazards, particularly in indoor environments where incense burning is frequent.

KEYWORDS: Incense, Lead, Heavy metals, Atomic Absorption Spectroscopy.

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INTRODUCTION

Incense burning is a prevalent cultural and religious practice in many regions, particularly across Asia and the Middle East. It is commonly used during religious rituals, social gatherings, and domestic activities to produce a pleasant aroma and create a spiritual atmosphere. In some countries, such as Ethiopia, the burning of oiling seeds (e.g., mustard Brassica carinata and castor beans) is also a widespread tradition for household purposes.

Although incense has cultural and spiritual value, concerns regarding its impact on indoor air quality have been increasing. The combustion of incense produces not only fragrant smoke but also releases a mixture of potentially harmful substances, including volatile organic compounds (VOCs), particulate matter, carbon monoxide, nitrogen oxides, and trace toxic metals (Lin et al., 2007). Raw materials used in incense production—such as resins, aromatic woods, herbs, seeds, flowers, and even synthetic additives—can serve as a source of these pollutants (Lee & Wang, 2004). Several studies have confirmed that hazardous metals such as lead, cadmium, arsenic, and mercury may be present in incense products and contribute to environmental and health concerns (Al-Rashidi et al., 2015; Jetter et al., 2002).

Heavy metals are of particular concern because of their persistence, bioaccumulation, and toxicity even at trace concentrations. For example, Pb has no safe threshold of exposure according to the World Health Organization (WHO, 2017), and chronic exposure can lead to serious neurological, renal, and cardiovascular effects. Similarly, cadmium is recognized for its nephrotoxicity and cumulative nature in human tissues. Despite these risks, regulatory frameworks specifically addressing heavy metal limits in incense are still lacking in many countries, including Iraq.

Given the widespread use of incense in Iraqi households, it is crucial to evaluate its potential contribution to heavy metal exposure. This study aims to estimate Pb levels in commonly used incense brands available in Baghdad markets, using Flame Atomic Absorption Spectroscopy (FAAS). The results are compared with international guidelines to assess potential health implications and highlight the importance of routine monitoring and quality control in consumer safety.

MATERIALS AND METHODS

2.1. Sample Collection and Preparation

Ten widely available brands of incense were purchased from local markets in Baghdad. All selected products were classified as direct-burning incense, meaning they are ignited by a flame and continue to smolder until fully consumed. Each sample was air-dried, finely ground, and stored in clean, sealed containers prior to analysis. For digestion, approximately 0.5 g of powdered incense was treated with freshly prepared aqua regia ($HCl:HNO_3$, 3:1, v/v). The mixture was heated on a hot plate at 95–120 °C until near dryness. The residues were subsequently diluted with deionized water and filtered into 25 mL volumetric flasks. Procedural blanks were prepared in parallel to account for potential contamination.

2.2. Instrumentation and Analysis

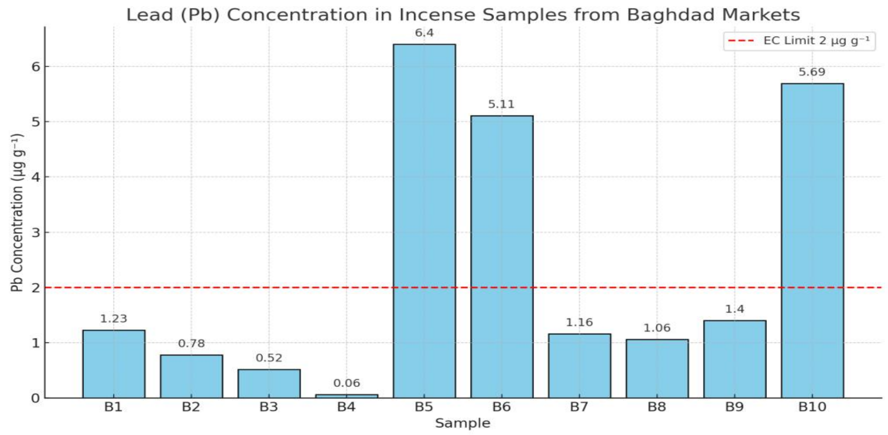
Lead concentrations were determined using Flame Atomic Absorption Spectroscopy (FAAS) under standard operating conditions (air–acetylene flame; Pb resonance line at 217.0 nm). Calibration was performed using a series of Pb standard solutions prepared in 1% HNO_3. Method validation included the use of reagent blanks, spike recovery experiments, and replicate analyses to ensure accuracy, reproducibility, and precision (U.S. EPA, 1996).

RESULTS AND DISCUSSION

The concentrations of Pb in the ten incense samples analyzed are presented in Table 1. The results demonstrated significant variability among the different brands, with Pb levels ranging from 0.06 ± 0.01 µg g^{-1} in sample B4 to 6.40 ± 0.40 µg g^{-1} in sample B5. Elevated concentrations were also observed in samples B6 (5.11 ± 0.41 µg g^{-1}) and B10 (5.69 ± 0.78 µg g^{-1}). In contrast, samples B1–B4 and B7–B9 exhibited comparatively lower Pb levels (≤ 1.40 µg g^{-1}).

Table 1. Lead concentrations in incense samples from Baghdad markets (mean ± SD, µg g^{-1}, n = 3).

Sample	Pb (µg g^{-1})
B1	1.23 ± 0.03
B2	0.78 ± 0.06
B3	0.52 ± 0.04
B4	0.06 ± 0.01
B5	6.40 ± 0.40
B6	5.11 ± 0.41
B7	1.16 ± 0.14
B8	1.06 ± 0.02
B9	1.40 ± 0.21
B10	5.69 ± 0.78



Fig(1) Concentration of lead in Incense samples from Baghdad market

The variation in Pb concentrations among brands likely reflects differences in raw materials, production processes, or the use of additives. Three incense brands (B5, B6, and B10) exceeded the European Commission consumer product safety limit of 2 µg g^{-1} (European Commission, 2008). Considering that the World Health Organization (WHO, 2017) and the U.S. Environmental Protection Agency (USEPA) emphasize that no safe threshold exists for Pb exposure, the presence of elevated concentrations in these products is of concern, particularly for consumers who use incense frequently in enclosed spaces.

The findings are consistent with previous studies reporting that incense combustion can be a source of toxic metals contributing to indoor air pollution (Lin et al., 2007; Lee & Wang, 2004; Al-Rashidi et al., 2015). Continuous inhalation of Pb-containing smoke may lead to its accumulation in human tissues, resulting in long-term health risks including neurotoxicity, nephrotoxicity, and cardiovascular complications. Overall, the results highlight the heterogeneity in the quality of incense products sold in Baghdad markets. Brands with elevated Pb concentrations (B5, B6, and B10) represent a clear safety concern, suggesting the absence of strict manufacturing standards or effective monitoring in the local market.

CONCLUSION

The present study demonstrated that lead concentrations in incense samples from Baghdad markets vary considerably among different brands. Some samples (B5, B6, and B10) exceeded the European Commission recommended limit of 2 µg g^{-1}, indicating a potential health risk for consumers who use incense frequently in enclosed spaces. Cadmium was detected at trace levels, with the highest concentration observed in B5, highlighting that even low levels of toxic metals may pose cumulative health concerns. The variation in metal content reflects differences in raw materials and production practices. These findings emphasize the need for regular monitoring and quality control of incense products to reduce exposure to hazardous metals.

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