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Original article

Estimation of Residual Organic Matter and Heavy Metals in Some Hookah (Waterpipe, Argileh) Samples

Hamad Hasan[1], Moftah Al Jamal[2], Ahlam Mahmoud[1], Gibril Al Daik[1]

[1]*Department of Chemistry, Faculty of Science, Omar Al Mukhtar University, Albayda, Libya*
[2]*Department of Biology, Faculty of Education, Ben Walid University, Libya*
Corresponding email. *hamad.dr@omu.edu.ly*

Abstract
The residual of organic matter and some heavy metals were estimated in the water of shisha, Hookah samples which were collected from some cafes at Albayda city, the samples including types of shisha Tobacco as Apple normal, Apple vakher, Mint, Salloum, and Blueberry. The spectrophotometer instrument was used to estimate the total organic matter by using potassium hydrogen phthalate (KHP) as a standard, while the heavy metals were determined by atomic absorption. The results of this study showed that the concentrations of organic matter in hookah samples were as follows: the minimum organic matter level was observed in the Apple normal sample (141.41mg/g), while the maximum organic matter level was observed in the Blueberry sample (47.023mg/g). The results indicated that the studied hookah (water pipe or water shisha) samples contained different values of nickel, iron, and copper and ranged between (0.13 - 9.87 mg/g) and (0.24 – 2.32 mg/g), and (0.4 – 40 mg/g), respectively. The study concluded that the presence of high values of organic matter and heavy metals gave an indicator for these compounds directly affecting human health, where most of the organic compounds present in tobacco have carcinogenic effects.
Keywords. Shisha Water, Organic Matter, Heavy Metals.

Introduction

Shisha (also known as 'Hookah', 'Narghile' or 'Water pipe') is one of the popular smoking devices after cigarettes. It is smoked in several South Asian and Middle Eastern countries, but has gained popularity among several Western countries as well [1]. The use of a water pipe to smoke tobacco is an ancient tradition in many parts of the world [2]. The water pipe bears a number of different names depending on the setup and region of origin; some typical names are Hubbly-Bubbly, Narghile, Goza, Shisha, and Hookah. The tobacco mixtures used in water pipes vary widely and differ from other available types of tobacco. Commonly referred to as 'Moassel', the mixture usually contains around 30% tobacco, and the remaining 70% is a concoction of flavourings, glycerol, and sweeteners (e.g., molasses and honey) [3]. There are clear differences between water pipe and cigarette smoking. According to the WHO report on water pipe use, a typical session of smoking, which can last up to an hour, exposes the user to 100 –200 times the volume of smoke inhaled in a single cigarette. The smoke contains a mixture of toxicants, including carbon monoxide and metals. A number of the toxicants present are known carcinogens [2]. In regions where water pipe tobacco smoking has been adopted into the culture, there is a common yet unfounded belief that water pipe smoke is made less harmful when bubbled through water before inhalation [4,5]. Exposure to elevated concentrations of heavy metals is known to cause adverse effects to humans [6]. The use of tobacco mixtures in water pipes may be a route of exposure to toxic metals in humans [7]. Trace elements can be taken up and accumulated by plants [8]. Therefore, the environment in which tobacco plants are grown (in terms of soil and water) significantly affects the concentrations of trace metal elements in the leaves.

There have been a number of studies investigating the exposure of water pipe users to a variety of harmful substances. Some examples include poly aromatic hydrocarbons, volatile organic compounds, carbon monoxide, nicotine, particulate matter, volatile aldehydes, tobacco-specific nitrosamines, and radio nuclides [9]. However, few studies have focused on the study of metals in water pipe tobacco [3]. Using a hookah to smoke tobacco poses serious health risks to smokers and others exposed to the smoke from the hookah. The charcoal used to heat the tobacco can raise health risks by producing high levels of carbon monoxide, metals, and cancer-causing chemicals [10-13]. Even after it has passed through water, the smoke from a hookah has high levels of these toxic agents. Hookah tobacco and smoke contain several toxic agents known to cause lung, bladder, and oral cancers [10-13]. Tobacco juices from hookahs irritate the mouth and increase the risk of developing oral cancers [16,17]. The present investigation focused on the analysis of the water in the shisha devices, which is usually believed to be a medium to filter out toxic substances from the tobacco smoke. The shisha water is discarded into the drains after every smoking session of several minutes. The time of the smoking session depends on the size of the shisha and the amount of tobacco burnt. Charcoal is used to burn the tobacco using a clay head. This study aims to evaluate the contents of organic matter and some heavy metal contents in water shisha samples collected from some Libyan cafes.

Methods

Sampling

Five samples of hookah (water shisha) were collected from the local cafes in Al-Baida City. The samples were illustrated in the following Table 1.

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Table1. The Types of the studied samples.

Sample properties	Colour	Source
Apple normal	Brown	Egyptian
Apple vakher	Brown	Egyptian
Mint	Colourless	Egyptian
Salloum	Dark Brown	Egyptian
Blueberry	Brown	Egyptian

Standard preparation

The standard stock solution was prepared by dissolving the amount in one liter of water to give a concentration of 1000 ppm. Then, different concentrations were prepared by diluting the stock solution, where different concentrations, including 100, 300, and 500 ppm of Potassium hydrogen phthalate. Also, different standard solutions of the studied elements were prepared.

Sample preparations and Heavy metal analysis:

The samples were prepared before the analysis by a designed method. Aliquots of 1000 mL of each sample were prepared with 5 mL of concentrated nitric acid until full evaporation, then about 20 ml of distilled water was added. The samples were heated, and then filtered, and the volume then completed in a measuring flask to 100 ml. Then the contents of heavy metals were determined by atomic absorption spectrophotometer (AAS) at the central lab of Omar Al Mukhtar University, Libya [18-52].

Analysis of organic matter (OM)

To estimate the OM in the studied samples, the KHP method was used; different concentrations (100,300, and 500 ppm) were used. The λmax of the (KHP) was determined by scanning the standard solutions. The contents of O.M. of the samples were estimated from the calibration curve of O.M.

Results

The heavy metals (Iron, Nickel, and copper)

The results of nickel, iron, and capper were shown in Table 2. The results indicated that the studied hookah (water pipe or water shisha) samples containing different values of nickel, iron and cupper and ranged between (0.13 - 9.87 mg/g) and (0.24 – 2.32 mg/g) and (0.4 – 40 mg/g), respectively (Table 2).

The high content of nickel was recorded in the Blueberry sample, whereas the low content was recorded in the Apple. Also, the results showed that the highest value of iron was recorded in the Salloum species, whereas the lowest value was recorded in the Apple. On the other side, the high value of copper is recorded in Blueberry, and the low value in Apple.

Table 2. The concentration (mg/g) of the heavy metals in the studied sample

Sample	Ni mg/g	Fe mg/g	Cu mg/g
Apple normal	0.13	0.29	0.40
Apple vakher	0.16	0.24	0.80
Mint	0.33	0.41	1.80
Salloum	0.20	2.32	2.60
Blueberry	9.87	0.47	40.00

The organic matter (OM)

The maximum wavelength (nm) (**λ max**) and the standard curve values were given the Figures 1 and 2, respectively, where the maximum wavelength (nm), **λ max** of organic matter, was obtained for KHP at 279 nm.

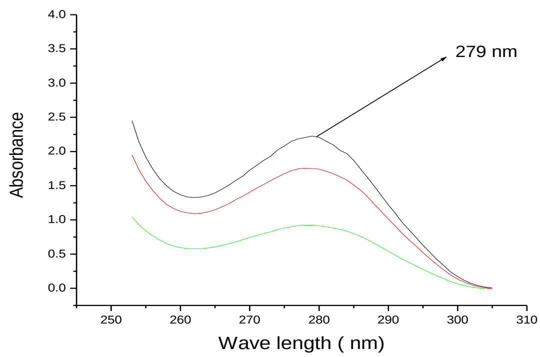

Figure 1. λ max of organic matter KHP.

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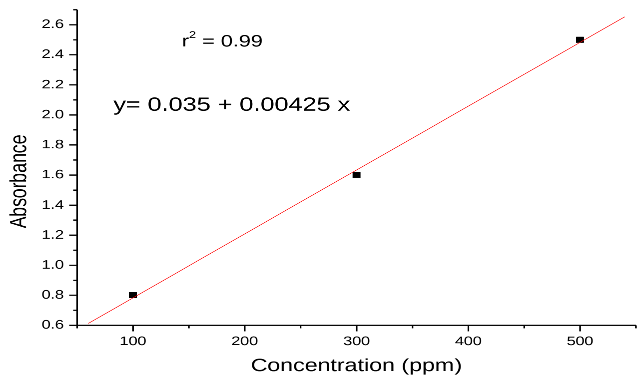

Figure 2. Stander curve of organic matter

The absorbance of OM in water shisha samples was shown in Table 3, and the concentrations of OM in water shisha samples was shown in Table 4.

Table 3. The absorbance of OM in samples

Sample	***Absorbance***
Apple normal	***0.636***
Apple vakher	***1.32***
Mint	***0.911***
Salloum	***0.554***
Blueberry	***2.01***

Table 4. The concentration of OM in samples

Sample	***C ppm***
Apple normal	*141.41*
Apple vakher	*302.32*
Mint	*2085.71*
Salloum	*1235.71*
Blueberry	*47.023*

Discussion

The results of this study which conducted on the water shisha (hookah) showed variations in the contents of the studied heavy metals, The high content of nickel was recorded in Blueberry sample, whereas the low content was recorded in Apple, also the results showed that the highest value of iron was recorded in Salloum species whereas the low value was recorded in Apple. on the other side, the high value of copper is recorded in Blueberry and the low value in Apple. On the other side, the results of organic matter were illustrated in Table 4, the minimum organic matter level was observed in the Apple normal sample (141.41 mg/g), while the maximum organic matter level was observed in the Blueberry sample (47.023 mg/g). Hookah tobacco and smoke contain many toxic agents that can cause clogged arteries and heart disease [10,13]. Infections may be passed to other smokers by sharing a hookah [11]. Babies born to women who smoked water pipes every day while pregnant weigh less at birth (at least 3½ ounces less) than babies born to nonsmokers [14,17]. Babies born to hookah smokers are also at increased risk for respiratory diseases [17]. While many hookah smokers may think this practice is less harmful than smoking cigarettes, hookah smoking has many of the same health risks as cigarette smoking [10,11]. Water pipe smoking delivers nicotine, the same highly addictive drug found in other tobacco products [11]. The tobacco in hookahs is exposed to high heat from burning charcoal, and the smoke is at least as toxic as cigarette smoke [10,11]. Because of the way a hookah is used, smokers may absorb more of the toxic substances also found in cigarette smoke than cigarette smokers do [10,11]. An hour-long hookah smoking session involves 200 puffs, while smoking an average cigarette involves 20 puffs [11,12]. The amount of smoke inhaled during a typical hookah session is about 90,000 milliliters (ml), compared with 500–600 ml inhaled when smoking a cigarette [14]. Hookah smokers may be at risk for some of the same diseases as cigarette smokers. These include Oral cancer, Lung cancer, and stomach cancer [13,14]. Cancer of the esophagus, reduced lung function, and decreased fertility. Beside that the heavy metals are still taken place in many of different samples, water, plants, fishes and others [18-28], due to their toxicity, but appear them in water shisha is very danger and has high risk for human health because this indicate that these heavy metals have high contents in the original shisha tobacco comparing to their values in water. This study of the contents of heavy metals and their impacts was carried out in different samples as water, aquatic samples, vegetables, and soils. Also, many studies have taken place for treating the hazardous compounds in Libya in the past twenty years [18–25].

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Conclusion

This study aimed to quantitatively determine heavy metals and residual organic matter in the water pipe smoking (Shisha) or Hookah. The study recorded high quantities of heavy metals in organic matter, which shows a high exposure of toxic metals to health.

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