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# The presence of chemicals in tobacco and IQOS

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**Abstract.** Recently, the number of IQOS and nanotech cigarette users has increased dramatically, especially among young people. The impressive number of tobacco cigarette consumers cannot be neglected either.

This paper aims to highlight the types of harmful substances found both in cigarette smoke and in the vape vapours/vape steam and to raise an alarm signal regarding the risks to which IQOS users are subject, despite all the favorable advertisements.

Specialized studies have highlighted the presence of benzene and several of its compounds in the steam emitted by these vapes. Through the incomplete combustion of compounds rich in carbon, a toxic substance called benzene is obtained, the substance emitted during the burning of plastic

By inhaling vape steam, the users introduce into their body this substance responsible for the occurrence of extremely serious diseases.

**Keywords:** harmful substances, benzene, toxic substance, cigarette smoke, tobacco, IQOS.

## 1. Introduction

Tobacco cigarettes and IQOS are products with different characteristics, and the decision to use them belongs to each individual consumer. IQOS is considered a less harmful product than traditional cigarettes, but not without risks. [1]

Consumers of traditional cigarettes inhale the smoke produced by burning tobacco at a temperature of 8800C. Tobacco changes its initial composition resulting in a mixture of gases and non-condensed vapors. Combustion becomes incomplete towards the filter and releases a greater amount of harmful elements. 7000 chemicals are concentrated in the smoke from traditional cigarettes, out of which 250 are dangerous and 69 are carcinogenic.[2]

IQOS is an electronic device that heats a tobacco cartridge to a temperature of 250-3000C, releasing the aerosol, but without producing smoke. Users inhale this aerosol, which contains nicotine and flavors, but with fewer toxic substances than cigarette smoke. Although IQOS is considered by many to be a less harmful product compared to traditional cigarette smoking, it is not without its risks.

The smoke from the incomplete burning of the tobacco leaf is a heterogeneous, concentrated, dispersed aerosol in two phases. The solid phase consists of small particles, and the continuous phase consists of combustion gases and air. The composition of the smoke is influenced by the burning temperature, the type of tobacco, the porosity of the filter paper, the length of the cigarette and the quality of the sheet. Two types of smoke are created, a main one and a secondary one. Secondary smoke, which comes from the burning end, is dispersed directly into the air and has a higher concentration of harmful compounds than the main smoke that is inhaled by the smoker.[3]

The harmful substances identified in traditional cigarette smoke are: nicotine, CO, CO<sub>2</sub>, benzene, benzopyrene, phenols, aldehydes, nitrosamines, methyl alcohol, sterols, hydrocyanic acid, fatty acid esters, acrolein, pyridine and radioactive isotopes (Sr, K, Po, Pb).[4,5] The following were identified in tobacco leaves: nicotine, cellulose, starch, proteins, minerals, sterols and unsaturated hydrocarbons.

Specialized studies have shown that the smoke from traditional cigarettes combines with the air and forms nitrosamines. These compounds are dangerous for both active and passive smokers.

The aerosol from IQOS is made up of numerous chemical substances, among which we mention: nicotine, benzene, toluene, isocyanates, metals (Cr, Cd, Ni, Pb and St) and chemical flavors.

An IQOS cigarette is made up of the actual cigarette and three filters; a full one, an empty one in the middle - phantom filter that filters practically nothing and a filter made of plastic, which when burned releases benzene, a highly carcinogenic substance. The actual cigarette is made up of tobacco wrapped in a cigarette leaf and an aluminum lamella that does not burn together with the tobacco.[6]

Following numerous studies, it was found that both the smoke from classic cigarettes and the vapor from IQOS mainly contain benzene, nicotine and metals.[7]

Benzene is obtained from compounds rich in carbon that undergo incomplete combustion. It is obtained naturally from forest fires and from volcanoes, it is a flammable substance which explodes in contact with air. In reaction with different chemical substances ( $\text{HNO}_3$ ,  $\text{H}_2\text{SO}_4$ , halogens and oxidizing substances) it reacts violently, causing fires.

Benzene is an extremely toxic and harmful substance to the human body both through direct contact with the skin and through inhalation, even in small quantities.

Nicotine is a liquid substance, colorless, with a bitter, irritating taste and axifying smell. In contact with light and the atmosphere, it turns brown and the color is observed on the surface of the cigarette filter.

Metals present in cigarette smoke or in aerosols are harmful to the human body when inhaled or ingested, even in small concentrations.

## **2. Results and discussion**

Following numerous studies, the major risks to which both tobacco cigarette smokers and IQOS users are exposed have been identified. The World Health Organization as well as the Centers for Disease Control and Prevention are sounding the alarm about the large number of users of IQOS and traditional cigarettes and the awareness of the risks they are subject to.[8]

### **2.1. The risks to which smokers of tobacco cigarettes are exposed**

It was discovered that nicotine is a poisonous compound, it reaches the brain in 7 seconds, stimulating the cells and blocking the nerve impulse. This poison increases the heart rate, and users have twice the risk of developing heart disease than non-smokers.[9] If an amount of 60 mg were injected into the bloodstream, it would have the ability to kill a man in a few minutes. 60 mg of nicotine is the equivalent of 4 cigarettes. At the same time, nicotine induces a state of hyperglycemia and increases the level of lipids metabolized in the body.

Benzene can affect the production of blood cells in the bone marrow, leading to anemia and other blood disorders. The existence of benzene in the body can affect the liver and kidneys, increasing the risk of liver and kidney damage. Inhaling benzene vapors can irritate the airways and cause symptoms such as coughing, a burning sensation in the throat and difficulty breathing.[10] Pregnant women exposed to benzene may be at increased risk of complications during pregnancy and may affect fetal development.[11]

Tar, arsenic, cadmium and heavy metals are toxic substances that cause different types of cancer: esophageal, laryngeal, lung, pancreatic and stomach.

Carbon monoxide decreases the amount of oxygen delivered to tissues and causes hypoxia.

Ammonia is added to cigarettes to increase the effectiveness of nicotine, causing respiratory diseases to worsen.

During the incomplete combustion of organic materials, polycyclic aromatic hydrocarbons are formed, they are inhaled together with cigarette smoke and reach the lungs where they increase the risk of cancer.

Also during the burning of tobacco, formaldehyde is formed, a toxic, carcinogenic substance, irritating to the eyes, throat and lungs.

## 2.2. The risks to which IQOS users are subject

Compared to traditional smoking, IQOS is considered a product less harmful to health, but not without risks. Nicotine is present in the aerosol produced by IQOS, it is responsible for the addiction to tobacco like a drug and can cause sensations of pleasure and satisfaction.[12]

Glycerol and propylene glycol are the substances used to create the aerosol in IQOS, being considered less harmful than the substances in cigarette smoke. Inhaling the aerosol generated when tobacco is heated can lead to the development of lung diseases and impairment of respiratory function.

It is important to note that the exact composition of the aerosol produced by IQOS can vary depending on several factors, including the type of tobacco cartridges used and the heating temperature.

Ultimately, the choice between IQOS and tobacco cigarettes is a personal decision and should be considered in the context of individual preferences, costs, health impacts and local regulations.

Currently, the exact percentage of traditional smokers may vary by country, region, and other demographic factors.

According to the World Health Organization (WHO), approximately 1.3 billion people smoke tobacco worldwide. It is important to note that this figure includes both traditional cigarette smokers and users of other tobacco products. In 2022, it was established that 48.3% of users are young. Adolescents, in general, become interested in different types of cigarettes after watching online or offline advertisements.

Also following the surveys, it was established that 8.2% of smokers are IQOS users and 8.6% consume traditional cigarettes.

## 3. Conclusions

Tobacco cigarette smoke contains 7,000 chemicals, 250 being dangerous and 69 carcinogenic.

The chemicals present in cigarette smoke are dangerous for both active and passive smokers. About 50% of smokers die prematurely (on average 14 years earlier than normal).

Benzene, being present in both types of cigarettes and also an extremely toxic substance, is responsible for the alarming number of illnesses among young people.

More studies are needed on the risks to which IQOS users are subject, but until then their consumption by teenagers, young people and pregnant women should be restricted and the consumption should also be banned in closed spaces.

It is important to continue efforts to reduce tobacco consumption and IQOS and to promote a healthy lifestyle, as smoking remains one of the leading preventable causes of disease and death worldwide.

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