

# Paraffin: White Paper Document

## Abstract:

This whitepaper delves into the environmental and health implications of paraffin wax, a widely used material in candle production. Paraffin, a by-product of crude oil refining, is inexpensive and easy to obtain, making it a common choice for candles. However, its negative impact on sustainability, non-biodegradability, and potential health risks are explored. The paper discusses the environmental toll of crude oil extraction, the non-renewable nature of paraffin wax, and its adverse effects on indoor air quality. Additionally, it scrutinizes the toxic chemicals emitted when paraffin candles are burned, posing risks such as respiratory issues, headaches, and potential links to cancer and birth defects. The conclusion emphasizes the unsustainability and health concerns associated with paraffin wax, advocating for alternative, eco-friendly candle options.

## Introduction:

Paraffin wax, derived from the refining of crude oil, has long been a staple in candle production. Its affordability and ease of use have made it a preferred choice for manufacturers, but the environmental and health implications of this ubiquitous material are often overlooked. This paper aims to shed light on the darker side of paraffin wax, exploring its origins, sustainability concerns, and the potential health risks associated with its usage.

As a by-product of crude oil refining, paraffin wax's extraction contributes to the environmental toll of the petroleum industry. The paper highlights the non-renewable nature of crude oil, emphasizing the finite supply of this natural resource. The environmental impact extends to the refining process, causing pollution and energy consumption.

Moving beyond sustainability, the discussion delves into the health hazards posed by burning paraffin candles. Emitting harmful chemicals such as benzene and toluene, these candles can adversely affect indoor air quality, potentially leading to respiratory problems, headaches, and more severe health issues.

With a focus on the scientific findings regarding paraffin's impact on human health, the paper outlines the potential links to cancer, birth defects, kidney damage, and respiratory issues. The conclusion draws attention to the pressing need for awareness and consideration of alternatives, advocating for a shift towards sustainable and health-conscious choices in the candle industry.

# paraffin /pär'ə-fin/

noun

1. A waxy white or colorless solid hydrocarbon mixture used to make candles, wax paper, lubricants, and sealing materials

Most candles are made from paraffin. As paraffin occurs as a by-product of petroleum production, it is cheap and easy to obtain. Its low cost means it can be combined with more expensive waxes to make them go further. Paraffin wax is easier to dye than soy wax or beeswax, leading to brighter and longer lasting colours.

- Paraffin wax is derived from crude oil (petroleum)
- The abundance of paraffin wax is why it is available at much lower rates than many other waxes
- Paraffin wax is not biodegradable
- Paraffin wax has a higher melting point – this causes incomplete burning, which produces petro-soot in significant quantities. This petro-soot can be harmful to people around, pollutes the environment, and may stain the candle and the ceiling above it. (Dai, R, 2023)

## SUSTAINABILITY

Paraffin wax is a by-product of the crude oil refining process. Crude oil isn't automatically usable as soon as it is collected. It is made up of a lot of chemical compounds, so it has to be refined to remove those compounds and turn the oil into a usable product. Paraffin wax is just one of the chemical compounds that is naturally found in crude oil and the oil isn't usable with the wax in it. To remove it, crude oil has to undergo dewaxing. Once the wax has been removed from the crude oil, the wax undergoes further processing to be used for different products. The way that it is processed just depends on the particular product. (Citizensustainable, 2023)

Crude oil is a natural resource, but it is a non-renewable natural resource. What that means is that crude oil supplies will eventually run out if we keep collecting it and refining it at the same rate. If crude oil supplies run out, then so does paraffin wax since it is a result of the crude oil refining process. (Citizensustainable, 2023)

Since paraffin wax comes from crude oil, it is also not eco-friendly. Collecting crude oil can be devastating to natural habitats and cause pollution of other natural resources. (Citizensustainable, 2023)

Refining crude oil to remove all of those compounds (whether it be paraffin wax or something else) can also cause air and water pollution due to the amount of hazardous waste that is produced. Refining and processing natural resources also use energy. Since refining crude oil is

such an extensive process and the paraffin wax and other products that are derived still have to undergo further processing, quite a lot of energy is used. Greater energy use can also result in the depletion of natural resources depending on the source of the energy. Lastly, when you no longer have use for paraffin wax, you are limited as to how you can dispose of it. The disposal methods for paraffin wax are not the most eco-friendly options. (Citizensustainable, 2023)

#### IS PARAFFIN WAX A NATURAL PRODUCT?

Since paraffin wax comes from crude oil – which is a natural resource – it can be considered a natural product. But it is important to remember that just because a product is natural, it doesn't mean that it is eco-friendly or sustainable. It all boils down to how the product is collected, produced, and disposed of. As far as paraffin wax is concerned, we can determine that it is not an eco-friendly natural product. (Citizensustainable, 2023)

#### IS PARAFFIN WAX BIODEGRADABLE?

In most forms, paraffin wax is not biodegradable since it is a by-product of crude oil. The wax itself can take years to biodegrade, especially in large quantities. In addition to taking a long time to biodegrade, paraffin wax has the potential to release harmful chemicals into the environment. This is due to the extra processing that paraffin wax has to undergo in order to be made into useful products. It is entirely possible that some paraffin wax products are more hazardous to biodegrade than others, but the biodegradability of paraffin wax products also depends on other chemicals that are added to it. (Citizensustainable, 2023)

#### IS PARAFFIN WAX COMPOSTABLE?

Since paraffin wax isn't biodegradable, it also isn't compostable for many of the same reasons. Again, a lot of it depends on the particular product as well as other chemicals and additives that the product contains. The safest thing to do is not to try to compost paraffin wax products. (Citizensustainable, 2023)

#### IS PARAFFIN WAX RECYCLABLE?

Paraffin wax is not recyclable, although it comes from crude oil just like plastics do. The stickiness of paraffin wax is not ideal for being processed through the machines needed for proper recycling. It is not efficient and could cause damage to the machines. Even if there was a way to work around the stickiness, it would require more money on the part of the recycling center to make machines that were capable of recycling paraffin wax. (Citizensustainable, 2023)

## THE DARK SIDE OF PARAFFIN

When you light a paraffin candle you initiate an oil combustion similar to when you start a car engine. Paraffin candles emit about 3,5 kilos of carbon dioxide per kilo. (Chemically Clever Island)

Carbon dioxide (CO<sub>2</sub>) is naturally present in the air we breathe at a concentration of about 0.037% and is not harmful to health at low concentrations. As the concentration of CO<sub>2</sub> in air rises it can cause headaches, dizziness, confusion and loss of consciousness. (HSE, n.d.)

The main concern about the toxicity of paraffin wax comes when paraffin wax is burned. When candles are made of paraffin wax and the wax is burned, it releases harmful chemicals such as **benzene and toluene** into the air. **Both benzene and toluene are found naturally in crude oil** and are used as chemical solvents. So, if your candles are paraffin-based, you are breathing in these dangerous chemicals when you burn them which can cause other health problems in addition to cancer. (Citizensustainable, 2023)

These are the same chemicals found in diesel fuel emissions and are known to cause allergies, asthma attacks and skin problems. A study by the University of South Florida showed that candles made of paraffin wax **emit low levels of benzene even when they are not lit.** (IQAir)

In addition to releasing toxic chemicals, burning paraffin wax produces soot with particles that can remain suspended in the air for hours. The University of South Florida study showed that these ultrafine soot particles are like diesel exhaust in both their size and composition. They penetrate deeply into the lungs and are absorbed into the bloodstream. Ultrafine particles are associated with allergies, asthma, and other respiratory diseases, as well as heart attacks, strokes and even cancer. A study by the U.S. Environmental Protection Agency showed that soot emissions from candles containing fragrances are significantly higher than those from non-scented candles. (IQAir)

In 2014, the Norwegian Institute of Public Health issued a warning where they drew parallels between cozy candlelight and passive smoking. The combustion of paraffin for instance emits toluene and benzene, both of which have been connected to increased risk of cancer and asthma. Especially blowing out the light releases large amounts of soot particles. **Asthmatics and allergics are most affected, but these substances are harmful to all of us.** (Chemically Clever Island)

## POTENTIAL HEALTH ISSUES CAUSED BY CHEMICALS FOUND IN PARAFFIN WAX

Paraffin wax is commonly used to make candles and wax melts because it is generally cheaper to produce than soy wax. Since paraffin wax is derived from petroleum, coal, or shale oil, it has been found to contain known carcinogens (cancer-causing agents) such as benzene. CNN reports that researchers at South Carolina State University found that melting **paraffin wax-based candles emitted toxic toluene and benzene**, while soy candles & wax did not. (Happywax, 2020)

**Toluene** is a colorless, water-insoluble liquid that occurs naturally in crude oil. It is emitted from gasoline fumes, vehicle exhausts, and cigarette smoke. Toluene is used as a solvent to make paint products, nail polish, lacquers, glue, and adhesives. **Benzene** is also a colorless liquid derived from natural gas & crude oil that is used as a solvent. (Happywax, 2020)

According to Sensitive Choice, people with respiratory problems such as asthma, young children, older people, and those with heightened sensitivity to chemicals may be more susceptible to irritation and symptoms.

### HEADACHES

If your candle is made of paraffin wax, the headache could be because of the **toluene** found in the paraffin. The chemical toluene found in paraffin wax mainly affects the central nervous system in the brain. Toluene enters your body when it evaporates into the air that you breathe.

According to The Department of California's Hazard Communication Standard/OSHA regulation, toluene can cause damage to the central nervous system, resulting in headaches, nausea, dizziness, and insomnia. The Environmental Protection Agency (EPA) also reports that even the mildest level of exposure to toluene can cause frequent headaches, nausea, and fatigue.

### CANCER

The American Cancer Society reports that **benzene** is known to cause cancer. Rates of leukemia—particularly acute myeloid leukemia—have been found to be higher in studies of workers exposed to high levels of benzene, such as those in the chemical, shoemaking, and oil-refining industries.

Some studies by the American Cancer Society also suggest links to childhood leukemia, as well as acute lymphocytic leukemia and other blood-related cancers in adults. The American Cancer Society also reports that benzene has been shown to cause chromosome changes in bone marrow cells in the lab.

The National Toxicology Program (NTP), which is formed from parts of several different US government agencies, including the National Institute of Health (NIH), the Centers for Disease Control and Prevention (CDC), and the Food and Drug Administration (FDA), has also classified benzene as “known to be a human carcinogen.”

### *KIDNEY DAMAGE*

The National Institute of Health (NIH) reports that toluene exposure through inhalation or skin contact can cause long-term damage to the kidneys. When you breathe **toluene**, it is taken directly into your blood from your lungs. Following absorption, toluene is rapidly distributed throughout the body.

### *BIRTH DEFECTS*

Inhalation of **toluene**—and subsequent distribution throughout the bloodstream—can also cause effects to the fetus in pregnant women. According to the Administration of Public Health in England, toluene can cross the placenta and is found in the fetus at concentrations of approximately 75% of that present in the maternal blood.

According to the US National Library of Medicine and the National Institute of Health (NIH), a number of case reports describe neonatal effects that have been attributed to **toluene** abuse during pregnancy. What's more, the National Institute of Health (NIH) reports that exposure to **toluene** during pregnancy can cause growth retardation, premature delivery, congenital malformations, and postnatal developmental retardation.

The Centers for Disease Control reports that animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed **benzene**.

### *BONE MARROW DAMAGE*

According to the National Institute of Health (NIH), excessive exposure to **benzene** has been known for more than a century to damage the bone marrow, resulting in decreasing numbers of circulating blood cells and, ultimately, anemia. The American Cancer Society reports that **benzene** has been shown to cause chromosome changes in bone marrow cells in the lab. The Centers for Disease Control (CDC) also reports that **benzene** works by causing cells not to work correctly. For example, it can cause bone marrow not to produce red blood cells, which can lead to anemia.

### *RESPIRATORY ISSUES*

Just like South Carolina State University reported earlier, OSHA also reports that you can be exposed to **toluene** by breathing it in. OSHA then states that repeated exposure to toluene can cause respiratory depression.

Acute exposure to **toluene** vapor can irritate the mucous membranes of the respiratory tract. With repeated exposure, the Agency for Toxic Substances & Disease Registry reports that accumulation of fluid in the lungs and respiratory arrest may ensue.

### *NAUSEA*

Paraffin wax is the nasty by-product of gas and oil refineries with potentially severe consequences. Researchers at South Carolina State University found that two harmful chemicals, **toluene & benzene**, are released into the air when melting paraffin wax-based candles.

The Centers for Disease Control performed a study that found that chronic **toluene** exposure at less than 200 parts per million (ppm) has been associated with headache, fatigue, and nausea. Workers repeatedly exposed at 200 to 500 ppm have reported a loss of coordination, memory, and appetite.

## CONCLUSION

In conclusion, the comprehensive exploration of paraffin wax presented in this whitepaper underscores its dual threat to both environmental sustainability and public health. Originating as a by-product of crude oil refining, paraffin's unsustainable nature contributes to the depletion of non-renewable resources and poses significant environmental risks throughout its production and disposal. Moreover, the revelation of health concerns, ranging from respiratory issues to potential carcinogenicity, strongly advocates for a conscientious shift towards alternative and eco-friendly materials in the candle-making industry to ensure both the well-being of consumers and the planet.

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## REFERENCES:

Agency for Toxic Substances and Disease Registry, Toluene, 10.02.2021 (Online), Available: <https://wwwn.cdc.gov/TSP/substances/ToxSubstance.aspx?toxid=29>

Agency for Toxic Substances and Disease Registry, TOXICOLOGICAL PROFILE FOR TOLUENE, June 2017 (Online), Available: <https://www.atsdr.cdc.gov/toxprofiles/tp56.pdf>

American Cancer Society, Benzene and Cancer Risk, 01.02.2023 (Online), Available: <https://www.cancer.org/cancer/risk-prevention/chemicals/benzene.html>

Centers for Disease Control and Prevention, Facts About Benzene, 04.04.2018 (Online), Available: <https://emergency.cdc.gov/agent/benzene/basics/facts.asp>

Chemically Clever Island, n.d., (Online), Available: <https://www.chemicallyclever.com/rooms/livingroom/light-candles-made-stearin>

Citizensustainable, Is Paraffin Wax Sustainable?, 2023 (Online), Available: [https://citizensustainable.com/paraffin-wax-sustainable/#Is\\_Paraffin\\_Wax\\_Made\\_Sustainably](https://citizensustainable.com/paraffin-wax-sustainable/#Is_Paraffin_Wax_Made_Sustainably)

CNN, Study: Some types of candles may pollute indoor air, n.d. (Online), Available: <https://edition.cnn.com/2009/HEALTH/08/21/candles.air.pollution/>

Dai R, What is the Difference between Soy Wax and Paraffin Wax?, 01.01.2023 (Online), Available: <https://www.linkedin.com/pulse/what-difference-between-soy-wax-paraffin-raymond-dai/>

Donald et al, Reproductive and developmental toxicity of toluene: a review, August 1991 (Online), Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1567945/>

Happywax, 7 Health Issues Caused by Chemicals Found In Paraffin Wax, 10.04.2020, (Online), Available: <https://happywax.com/blogs/from-the-blog/7-health-issues-caused-by-paraffin-wax>

HSE, General hazards of Carbon Dioxide, n.d. (Online), Available: <https://www.hse.gov.uk/carboncapture/carbondioxide.htm>

IQAir, 2020, The hidden dangers of scented candles (Online), Available: <https://www.iqair.com/cn-en/newsroom/hidden-dangers-scented-candles>

California Environmental Protection Agency. Indoor air pollution: volatile organic compounds. 26 April 2023, (Online), Available: <https://www.arb.ca.gov/research/indoor/voc.htm>

Occupational Safety and Health Administration, Toluene, n.d. (Online), Available: <https://www.osha.gov/toluene>

Public Health England, Toluene Toxicological Overview, May 2015 (Online), Available: [https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/427529/Toluene\\_TO\\_PHE\\_130515.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/427529/Toluene_TO_PHE_130515.pdf)



Sensitive Choice, Volatile Organic Compounds (VOCs), 2023 (Online), Available: <https://www.sensitivechoice.com/resource/volatile-organic-compounds-vocs/>

Snyder, R, Leukemia and Benzene, 14.08.2012 (Online), Available: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3447593/>

The Department of California's Hazard Communication, Toluene (Toluol), May 1995 (Online), Available: <https://www.cdph.ca.gov/Programs/CCDCPHP/DEODC/OHB/HESIS/CDPH%20Document%20Library/toluene.pdf>

The National Toxicology Program, Report on Carcinogens, Fifteenth Edition, 2021 (Online), Available: <https://ntp.niehs.nih.gov/sites/default/files/ntp/roc/content/profiles/benzene.pdf>

US EPA, Toluene, July 2012 (Online), Available: <https://www.epa.gov/sites/default/files/2016-09/documents/toluene.pdf>