

What's in cigarettes & roll-your-own tobacco

Cigarette smoke is a complex mixture of over 7000 chemicals.¹ These chemicals are present as:

- gases, such as carbon monoxide and hydrogen sulphide
- volatile organic compounds (VOCs), such as benzene, acetone and hydrogen cyanide
- part of tiny solid particles, such as nicotine and naphthalene.¹

Many of the chemicals in cigarette smoke come from burning tobacco; the remainder come from burning cigarette paper, agricultural chemicals left on the tobacco leaves, and chemicals added during the cigarette making process.¹⁻⁴

Once inhaled into the lungs, many of these chemicals pass through the lungs walls into the blood stream and go to every part of the body.⁵

Roll-your-own (RYO) tobacco

Some roll-your-own smokers believe that roll-your-own tobacco is more 'natural' and does not contain additives like factory-made cigarettes do.⁶ Because of this, they believe that roll-your-own tobacco is less harmful.^{7, 8}

None of these beliefs are true.

- Tobacco companies add similar additives to roll-your-own tobacco as they do to cigarettes, often in higher amounts than in factory-made cigarettes.⁶
- Most of the toxic chemicals in tobacco smoke come from burning the tobacco.⁴ Even smoking tobacco without any additives would be very harmful.
- Research suggests that roll-your-own tobacco is at least as harmful, or possibly more harmful, than smoking factory-made cigarettes.⁹⁻¹²

Tar

Tar is the sticky brown substance which can stain smokers' fingers and teeth yellow-brown.^{4, 13} It also stains the lung tissue.^{1, 14}

'Tar' describes the solid particles a smoker inhales when he or she draws on a lit cigarette.¹⁵ Each particle consists of a large variety of chemicals, including a number of cancer causing substances (carcinogens). The make-up of tar in smoke can vary between different types of cigarettes: it may contain different ratios of carcinogens and other substances.^{1, 16, 17}

Nicotine

Nicotine is the drug in tobacco which causes addiction in smokers.¹ It is a highly toxic chemical and its manufacture, use and sale is controlled under the State Poisons Acts, except where it occurs in tobacco.^{18, 19} This exception of tobacco is for political reasons, not because nicotine is deemed 'safe' in cigarettes.²⁰

Nicotine, once inhaled, affects the body very quickly. Within seconds, nicotine reaches the brain releasing dopamine, a 'brain reward' chemical. It causes changes to the structure and the working of the brain, which lead to and maintain nicotine addiction.^{1, 21}

Nicotine also raises heart rate, blood pressure, releases hormones affecting the central nervous system and affects the immune system.^{1, 18} It constricts small blood vessels under the skin so that smokers' fingertips lose warmth after having a cigarette.¹ In the long term, nicotine plays a role in causing heart disease and other diseases of the blood vessels. It contributes to problems during pregnancy and affects the development of the baby's brain and lungs. Nicotine also harms the developing adolescent brain.¹⁸

Nicotine replacement therapy products, used as quitting aids, are regulated.¹⁹ These safer forms of nicotine, that is nicotine gum, patches, lozenges, mouth spray and the inhalator, are sold by pharmacies and some supermarkets.

Carbon monoxide

Carbon monoxide is a poisonous gas which is also found in car exhaust fumes. In large quantities, carbon monoxide quickly causes death. It is created when burning something containing carbon, such as tobacco.^{1, 22}

Carbon monoxide binds to red blood cells replacing some of the oxygen they normally carry. It also makes it harder for red blood cells to release oxygen to cells in the body. This means it harder for the body to get oxygen to the organs and muscles. Smokers can have up to 10 times the amount of carbon monoxide in their bloodstream than non-smokers.^{1, 23}

Metals

Several metals have been detected in tobacco smoke.¹ Some are known to cause cancer including cadmium, arsenic, beryllium, chromium, nickel, cobalt, lead, and the radioactive element polonium 210.²

For more information about the chemicals in cigarettes, you can read Chapter 3, A report of the U.S. Surgeon General. How tobacco causes disease. Available at <https://www.ncbi.nlm.nih.gov/books/NBK53017/>

Chemicals in tobacco smoke and disease

Tobacco smoke has many different effects on health. It causes or is associated with over forty different diseases or conditions, including cancer, emphysema, heart disease and stroke.^{5, 15, 18} A single disease may be caused by several different chemicals in cigarette smoke.¹

Cancer

More than 70 carcinogens (cancer causing substances) have been identified in tobacco smoke.¹⁵ Smoking causes cancer of the lung, throat, voice box, mouth, tongue, nose, nasal sinus, oesophagus, pancreas, bladder, stomach, liver, kidney, ureter, cervix, ovary, bowel and bone marrow.^{5, 15, 18} Research shows that the greater the number of cigarettes and years a person smokes, the higher the risk of developing a smoking related cancer.^{5, 15} Carcinogens in tobacco smoke include polycyclic aromatic hydrocarbons (PAHs), N-nitrosamines, aromatic amines, benzene, aldehydes, metals, and more.^{2, 15}

Heart disease, stroke and diseases of the blood vessels

These diseases result from chemicals in tobacco smoke damaging blood vessel walls, causing blood clots and reducing the supply of oxygen to the body. Tobacco smoking speeds up the build-up of fatty material on blood vessel walls, which over time blocks the blood vessels.^{1, 5}

Chemicals in tobacco smoke responsible for these diseases include carbon monoxide, nicotine, nitrous oxides, oxidising chemicals, free radicals and the particles of tar.¹

Lung disease (other than cancer)

Chemicals in tobacco smoke damage the lungs' cleaning system. Every time we breathe, we inhale particles including dust, toxic substances, viruses and bacteria.¹ These particles become trapped on a blanket of mucus on the surface of the airways and are swept out of the lung by tiny hairs (cilia) beating together like a wave. Chemicals in smoke directly damage cilia and affect the mucus layer.²⁴⁻²⁶ When this cleaning system is impaired, it increases the risk of infection and allows toxic substances to build up in the lungs over time.¹

Tobacco smoke also damages the protective layer of lung cells under the mucus layer and impairs the immune system. This leads to the lungs becoming inflamed and also increases the risk for infection.^{1, 14, 27}

Smokers are more likely to develop chest illnesses such as bronchitis, influenza, legionnaires disease and pneumonia.^{5, 28} Long term lung disease caused by smoking includes chronic bronchitis (coughing with phlegm) and chronic obstructive pulmonary disease (COPD) where it becomes increasingly difficult to breathe. COPD is caused by narrowing and thickening of the small airways and permanently damaged air sacs (emphysema).¹ Smoking also worsens asthma.¹⁸

Chemicals in smoke involved in lung disease are many, and include hydrogen cyanide, formaldehyde, acrolein, nitrous oxides, cadmium, free radicals, and oxidising agents.¹

Agricultural chemicals and additives

In Australia, tobacco is not classified as a food or a drug.^{19, 29} Therefore there are no standards or controls on what may be used or left on tobacco, including agricultural chemicals and additives.

Herbicides, insecticides, fungicides, fertilisers and other agricultural chemicals are routinely used in tobacco growing.^{3, 30, 31} As Australia imports all of its tobacco,³² it is unknown which agricultural chemicals may be present in cigarettes made and sold here.

Additives are chemicals added to cigarettes in the manufacturing process.¹⁸ They serve a number of different purposes.

- To add flavour. Flavourings include sugar, honey, liquorice, cocoa, and chocolate liquor. These sweeteners lessen the harshness of the smoke.^{1, 33} Tobacco companies also put flavour 'capsules' in the filters of some cigarettes, which release a burst of flavour when crushed by the smoker.^{34, 35} They appear to be a marketing tool which tends to appeal to younger smokers.^{34, 36}
- To lessen the irritating effects of smoke, especially for new smokers. Menthol and eugenol numb the throat.^{1, 33, 37}
- To change the chemistry of nicotine. Ammonium salts and acetaldehyde (from burning added sugar) increase nicotine's addictive potential.^{1, 33}
- To change smoker's bodies. Chemicals in liquorice and cocoa act to open the airways, so that more nicotine and tar goes deeper into smokers' lungs. Other additives affect smokers' brains to make them more receptive to nicotine.³³
- To mask the smell and visibility of smoke from the end of a burning cigarette. This might reduce other people's annoyance, but it doesn't reduce the health risks of secondhand smoke.^{33, 38}
- To keep the tobacco moist, to control the burn temperature, and to treat the cigarette paper.^{1, 3}

There are a number of problems with additives:

- Additives such as sugar and honey might seem harmless because we are used to eating them. But when additives in cigarettes are burnt, they can change into different chemicals, and some are toxic. For example, liquorice and sugar produce cancer-causing chemicals when burnt. Also, these substances are inhaled into the lungs, which are delicate and much more vulnerable to harm than the stomach and intestines.^{1, 33} Blood carrying harmful substances coming from the gut is detoxified by the liver before being sent around the body. However, blood from the lungs goes straight into the body without passing through the liver first.¹
- The health effects of additives on smokers are not made public by the tobacco companies, and many may not be known at all.³³
- Some additives make tobacco smoke less harsh and taste better. It may make it easier for children to learn to smoke, and make smoking more agreeable to smokers.^{1, 33}

Cigarettes that claim to have no additives are not necessarily safer than those that have them. The cigarette smoke will still contain agricultural chemicals, carbon monoxide, cancer-causing tar, and more.^{1, 3}

Disclosure of and restrictions on additives

In Australia, there are no regulations to require tobacco companies to make public what they add to their cigarettes. The tobacco companies have a Voluntary Agreement with the Australian Department of Health and Ageing, where they provide a list of additives they use in their cigarettes.³⁹ This agreement has been extended indefinitely.⁴⁰

Other countries such as New Zealand, the United States and the European Union have legislation requiring companies to inform the governments of all additives they use.^{18, 41, 42} Canada and Brazil restrict which additives tobacco companies are allowed to use.⁴³⁻⁴⁶

Most Australian states and territories have legislation that allows the ban of tobacco products with an obvious 'fruity, sweet or confectionary-like character'.⁴⁷⁻⁵³ The legislation doesn't ban any particular additive, menthol flavoured products or products with subtle flavours or sweeteners.

Cigarette design

How much do smokers inhale?

There is no 'set' amount of nicotine, tar and other chemicals delivered by any cigarette to a smoker. Different smokers can inhale very different amounts of chemicals from a similar cigarette, depending how they smoke it. This means they can inhale high amounts of chemicals from a cigarette that tastes less harsh or weaker than others.^{1, 16, 54}

Nicotine

Addiction to nicotine is a major reason for remaining a smoker.¹ In general, smokers will absorb between 0.3mg to 2mg of nicotine per cigarette: the average dose is about 1 mg to 1.5 mg per cigarette.^{55, 56} Most cigarettes are designed by tobacco companies to deliver as much nicotine as the smoker needs to maintain their addiction, regardless whether the cigarette tastes weak or harsh.^{54, 57}

Weaker-tasting cigarettes

The main way to make a cigarette taste weaker is to dilute the cigarette smoke with air, by putting air vent holes in the filter.^{16, 54} Most cigarette brands in Australia have air vents in the filter.⁵⁷ Tests show that in brands of weaker-tasting cigarettes it is common for up to half of the 'smoke' to be made up of air sucked in via the vents (when they are not blocked). For the weakest-tasting cigarettes, most of the 'smoke' is made up of air from the vents.⁵⁸

Smoking behaviour and smoke intake

In order to get the nicotine they need, smokers who switch to weaker-tasting cigarettes may increase the amount of smoke they inhale by doing the following:

1. Smokers learn to compensate by taking larger and longer puffs, and by taking more puffs from a cigarette. More intensive smoking also increases the ratio of tar to nicotine.⁵⁴
2. Smokers can easily block the air vent holes in the filter, usually by accident with their lips and fingers, and so they receive more smoke and less air.⁵⁴
3. Some smokers will smoke more cigarettes per day.⁵⁴

In this way, smokers of weaker-tasting cigarettes can inhale just as much toxic chemicals as smokers of harsher cigarettes.

Health risks of weaker-tasting cigarettes

There is no evidence that smokers of weaker-tasting cigarettes have less risk of smoking-related diseases than smokers of other cigarettes.^{18, 54} Research estimates that two in three lifetime smokers will die from their addiction.⁵⁹⁻⁶²

In 2005 the Australian Competition and Consumer Commission (ACCC) ruled that labelling cigarette packets 'light' or 'mild' was misleading conduct, as such descriptions may mislead consumers into thinking they are less harmful. The ACCC obtained undertakings from the tobacco companies to remove these descriptions on cigarette packets.⁵⁷ However, the tobacco companies now use other words and phrases on some packs which continue to suggest that some cigarettes may be safer than others.⁶³ They include white, yellow, silver, gold, ultimate, fine, subtle, and phrases such as "infinite white" or "silver fine scent".⁶⁴

In summary, there is no safe cigarette and no safe level of use.¹

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