What's in cigarettes

Cigarette smoke is a complex mixture of over 4000 chemicals.[1] These chemicals are present as:

- gases, such as carbon monoxide, hydrogen cyanide, nitrogen oxides,
- liquid vapours, such as formaldehyde, methane, benzene, ammonia, acetone,
- part of tiny solid particles, such as phenols, nicotine, and naphthalene.[1,2]

Thirty metals have been detected in tobacco smoke, as well as radioactive compounds such as polonium 210 and potassium 40.[1,3]

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.[1,3]

Once inhaled into the lungs, many of these chemicals pass through the lungs walls into the blood stream, and are pumped around the body.[2]

Tar, nicotine and carbon monoxide contribute to most smoking related diseases.[2,4] However, there are many other chemicals in tobacco smoke which also have a role in causing disease.[2]

Tar

'Tar' describes the solid particles inhaled when a smoker draws on a lit cigarette.[4] Each particle consists of a large variety of organic and inorganic chemicals, including a number of carcinogens (cancer causing substances).[1,4] Tar can vary between the smoke from different types of cigarettes: it may contain different ratios of carcinogens and other substances.[5,6] Tar is the sticky brown substance which can stain smokers' fingers and teeth yellow-brown. It also stains the lung tissue.[4]

Nicotine

Nicotine is the drug in tobacco which causes addiction in smokers.[7] 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.[7,8,9] This exception of tobacco is for political reasons, not because nicotine is deemed 'safe' in cigarettes.[5]

Nicotine, once inhaled, affects the body very quickly. Within seconds, nicotine reaches the brain releasing dopamine, a 'brain reward' chemical.[10] It causes changes to the structure and the working of the brain, which lead to, and maintain, nicotine addiction.[2,10] Nicotine also raises heart rate, blood pressure, releases hormones affecting the central nervous system, and constricts small blood vessels under the skin.[7] In the long term, nicotine may be a factor in causing coronary disease. It is believed to be involved in the development of gastrointestinal disorders and problems during pregnancy, and is linked with the development of cancers.[7]

Nicotine replacement products, used as quitting aids, are regulated. These safer forms of nicotine products, that is, nicotine gum, patches, lozenges, tablets, and inhalers, are sold by pharmacies.[8]

Carbon monoxide

Carbon monoxide is a poisonous gas which competes with oxygen in the blood.[2] This is the same gas which is found in car exhaust fumes. Carbon monoxide binds to red blood cells, making it harder for the body to carry oxygen to the muscles.[11] In large quantities, carbon monoxide is rapidly fatal. Smokers can have up to 10 times the amount of carbon monoxide in their bloodstream than non-smokers.[1,12]

Chemicals in cigarettes and disease

Cigarette smoke has many different effects on health. It causes or is associated with over thirty different diseases, including cancer, emphysema, heart disease and stroke.[13] A single disease may be caused by several different chemicals in cigarette smoke.[2]

Cancer

More than 60 carcinogens (cancer causing substances) have been identified in tobacco smoke.[6] Smoking causes cancer of the lung, throat, voice box, mouth, tongue, nose, nasal sinus, oesophagus, pancreas, bladder, stomach, liver, kidney, ureter, bowel, ovary, cervix, and bone marrow.[1,14, 25] Research shows that the greater the number of cigarettes and years a person smokes, the higher the risk of developing a smoking related cancer.[1,14] Carcinogens in tobacco smoke include poly aromatic hydrocarbons, N-nitrosamines, benzene, aldehydes, the metals nickel, arsenic, chromium and cadmium, and many more.[2,3]

Lung disease (other than cancer)

Hydrogen cyanide, acetaldehyde and acrolein directly damage cilia, the tiny hairs that have an important part in clearing the lungs of inhaled particles and substances.[1,2,3] When this cleaning system is impaired, toxic agents can build up in the lungs, and increase the likelihood of developing lung diseases.[15]

Other chemicals damage the lung by increasing the amount of mucus in the lungs which can lead to infection (chronic bronchitis), airway thickening and narrowing, and permanently damaging air sacs (emphysema). These include hydrocarbons, ketones, organic acids, phenols, nitrous oxides, and oxidising agents.[2]

Heart disease, stroke and diseases of the veins

Acting together, nicotine and carbon monoxide are believed to cause these diseases in smokers, by damaging blood vessel walls and reducing the supply of oxygen to the body.[2,7] Cigarette smoke also contains poly aromatic hydrocarbons which speed up the build up of fatty material on blood vessel walls, and are possibly assisted by hydrogen cyanide, nitrous oxides and some chemicals in tar.

Highly reactive chemicals in smoke (free radicals) can damage the heart muscles.[2]

Agricultural chemicals and additives

In Australia, tobacco is not classified as a food or a drug,[9,16] and so there are no standards or controls on what may be used or left on tobacco, including agricultural chemicals and additives.[17]

Herbicides, insecticides, fungicides, fertilisers and other agricultural chemicals are routinely used in tobacco growing.[3,17] As Australia imports much of its tobacco,[18] 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.[2,3] 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.[19]
- To lessen the irritating effects of smoke. Menthol and eugenol numb the throat.[19]
- To change the chemistry of nicotine. Ammonium salts and acetaldehyde (in burnt sugar) increase nicotine's addictive potential.[2,19]
- 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 change the chemistry of smokers' brains to make them more receptive to nicotine.[19]
- 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 passive smoking.[19,20]
- To keep the tobacco moist, to control the burn temperature, and to treat the cigarette paper.[3,17]

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.[19]
- The health effects of additives on smokers are not made public by the tobacco companies, and many may not be known at all.[19]
- 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.[19]

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

Disclosure of additives

In Australia, there are no regulations to require tobacco companies to make public what they add to their cigarettes. The tobacco companies had a Voluntary Agreement with the Australian Department of Health and Ageing, where they provided a list of additives for each brand. However the terms of this agreement protected "the confidentiality of tobacco manufacturers' trade secrets": they could choose not to list specific additives they did not wish to make public.[21]

Other countries such as Canada, New Zealand and the state of Massachusetts USA, have regulations requiring companies to inform the governments of all additives they use.[22, 23, 24]

How much do smokers inhale?

Addiction to nicotine is a major reason for remaining a smoker.[7] In general, smokers will absorb between 0.2mg to 2mg of nicotine per cigarette: the average dose is about 1mg per cigarette.[2] Most cigarettes are designed by tobacco companies to deliver as much nicotine as the smoker needs to maintain their addiction, regardless of how weak or harsh the cigarette tastes.

Weaker tasting cigarettes (previously branded as variations of 'light' or 'mild' and also known as 'low tar' cigarettes) have holes in the filter that let in air to dilute the smoke. Smokers who switch to weaker tasting cigarettes generally end up inhaling the same amount of chemicals as they do from stronger tasting cigarettes.[2, 6] In order to maintain the level of nicotine they are used to, they tend to do the following:

1. Smokers take larger and longer puffs, and take more puffs from a cigarette. More intensive smoking also increases the ratio of tar to nicotine.[6]
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.[6] In a sample of 13 Australian 'low tar' cigarettes tested in 1992, there was a 2 to 9 fold rise in tar and nicotine when all the air holes were blocked.[26]
3. Some smokers will smoke more cigarettes per day.[6]

Health risks of weaker tasting cigarettes

There is no evidence that smokers of weaker tasting ("low tar") cigarettes have less risk of smoking related diseases than smokers of other cigarettes, except possibly a small decrease in risk for lung cancer.[6]

In 2005, the Australian Competition and Consumer Commission (ACCC) determined that 'light' and 'mild' labeling of cigarette varieties was misleading conduct, and obtained undertakings from the Australian cigarette manufacturers to remove such labeling. In 2006, tar, nicotine and carbon monoxide figures were also removed.[27] In 2011, the Australian government passed legislation for

the introduction of plain packaging, which removes any labeling which may mislead consumers into thinking any cigarette is less harmful than another.

In summary, there is no safe cigarette and no safe level of consumption.[4]

Useful Websites:

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