Additives in tobacco products

Introduction

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

The tobacco industry is made up of many companies that make and sell different types of tobacco products. Whether it is smoked, chewed, sniffed or inhaled second-hand, the use of these tobacco products can and does cause debilitating and life-threatening diseases, as well as premature death. The cigarette is the single most commonly used tobacco product in the European Union (EU). Most people are aware that smoking cigarettes is harmful, as thousands of compounds are produced and released in the smoke, some of which (hundreds) are toxic. But what people may not be aware of is that most tobacco manufacturers add ingredients other than tobacco to cigarettes that affect the chemical make-up of the smoke. These ingredients are known as tobacco additives and are reportedly used, for example, to:

- give a cigarette a particular flavour;
- control the way the cigarette burns;
- keep the tobacco moist thus preventing it from drying out.

To some people, the reasons for adding these substances to a consumer product may appear perfectly reasonable. They may argue that this is not necessarily a bad thing as it makes for a better consumer experience. However, helping people to better tolerate and enjoy a product like cigarettes, which is well known to be toxic and carcinogenic, is an entirely different issue and a matter of great concern.

Additives can make cigarettes more attractive by disguising some of the undesirable effects of inhaling burnt tobacco. For example, they:

- mask the bitter taste and harsh smell of the smoke that is inhaled;
- make the inhaled smoke milder, reducing the irritation of the airways (which essentially silences any warning that the smoke is dangerous);
- turn the ash and smoke white;
- improve the appearance of cigarettes.

Ultimately, by using additives, tobacco manufacturers encourage cigarette use in people who may otherwise be deterred from smoking due to the unfavourable characteristics of raw tobacco. The more pleasant the cigarette, the easier it is for a smoker to sustain their habit, and therefore the more likely it is that they could become addicted.

Studies have also shown that burning tobacco additives can result in the formation of harmful compounds. However, it is very difficult to consider the effects of a single additive in isolation due to the overall combined effect of all the chemicals present in the tobacco smoke. Moreover, the burnt derivatives of some additives are also known to indirectly boost the effects of nicotine on the brain (nicotine being the main reason why people become addicted to smoking).

Despite this, the tobacco industry is allowed to use additives and continues to do so, on the basis that they have been considered safe for use in food or cosmetics by relevant regulatory authorities. However, this is not a sufficiently scientific basis upon which to justify their use in tobacco products. This is because people do not generally consume/use these food and cosmetic products in a state where the additives are burnt (from being exposed to very high temperatures) and then inhaled. In food and cosmetic goods, consumers are exposed to these additives in a completely different way to how they would be exposed to them through smoking tobacco products. Therefore, these additives should not be considered to have comparable effects on the body when consumed in this way. Furthermore, the fact that these additives can make tobacco products more attractive and increase their use is particularly concerning given the toxic and addictive nature of tobacco products.

Tobacco manufacturers also market 'natural' or 'clean' cigarettes that reportedly have no chemicals or additives. However, potential consumers of these cigarettes are reminded that there is no such thing as a safe cigarette, because the smoke that is produced still contains carcinogens and other toxic compounds that come from the tobacco itself.

Take home message

Tobacco manufacturers make cigarettes more attractive, which encourages their use, and makes it easier for anyone smoking to become addicted.

This is a series of 14 fact sheets on tobacco additives written in the context of the EU project Public Information Tobacco Control (PITOC). The fact sheets aim to inform the public on the general uses, tobacco industry uses and harmful health effects of selected tobacco additives.

Seven of these fact sheets have been created by the German Cancer Research Center (DKFZ), Heidelberg, Germany, and seven by the National Institute for Public Health and the Environment (RIVM), Bilthoven, the Netherlands. The introduction is a common product. The electronic versions of the fact sheets can be found on the DKFZ website http://www.dkfz.de/de/tabakkontrolle (carob, cellulose, guar gum, liquorice, menthol, prune juice and vanillin) and the RIVM website http://www.tabakinfo.nl (2-furfural, ammonium compounds, cocoa, glycerol, propylene glycol, sorbitol and sugars; additionally, the fact sheet on the tobacco smoke compound acetaldehyde is available).

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

dkfz.
GERMAN CANCER RESEARCH CENTER
IN THE HELMHOLTZ ASSOCIATION

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Additives in tobacco products

Carob Bean Extract and Gum

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Carob, which is also referred to as the carob pod or carob bean, is the fruit of the evergreen carob tree. Each carob pod contains seeds that sit in the pod's pulp. The pulp is rich in sugars and therefore is naturally sweet and tastes and looks like chocolate. It can be ground into fine powder or used in the form of an extract. The seeds also provide a source of gum.

General uses

Carob bean extract and gum have many uses, especially in the food and flavouring industry where it is used as a chocolate or cocoa substitute, or as a thickener and food stabiliser. It is also used in non-food industries such as the textile, cosmetic, and pharmaceutical industry.

Reported tobacco industry uses

Carob bean extract and gum are used as a flavouring material in commercial cigarettes. It imparts a sweet and nutty taste that enriches the smoke flavour. The extract and gum is applied to either the filter or the tobacco and makes up to 0.2 % of the total weight of the tobacco used in one cigarette.

Harmful health effects

Carob bean is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. Almost the entire carob bean extract and gum that is added to the cigarette is burnt while smoking. This results in the formation of several harmful compounds, such as benzene. The sugars that are present in the extract can produce compounds such as polycyclic aromatic hydrocarbons, and formaldehyde. These breakdown products of sugars have been classified as human cancer-causing agents by the International Agency for Research on Cancer (a leading expert cancer organisation).

The sugars also produce acidic compounds, which make it harder for the nicotine in the cigarette smoke to reach the brain. This forces smokers to inhale deeper, and consume more cigarettes to get their nicotine fix. Furthermore, the use of carob bean extract and gum may be indirectly harmful due to the formation of compounds called aldehydes (e.g. acetaldehyde), which can make cigarettes more addictive by enhancing the addictive potential of nicotine. Aldehydes are very reactive and produce other compounds such as the substance harman, which can also make cigarettes more addictive due to its mood-enhancing effect on the brain.

The addition of carob bean extract and gum to cigarettes help mask the naturally harsh and irritating nature of tobacco smoke by making it more pleasant and milder. In doing so, this essentially silences the body's natural cough response, which would warn that the smoke is dangerous. The flavour and attractiveness of smoking is also enhanced by the caramel flavours that are produced when the sugars are burnt.

Overall, by adding more desirable flavours such as carob bean extract and gum to cigarettes, tobacco manufacturers make it easier for smokers to become addicted. This can ultimately lead to more cigarettes being smoked and thus greater exposure to the toxic substances in cigarette smoke.

Additives in tobacco products
e.g. carob bean extract

can **increase**
- attractiveness,
- addictiveness and
- toxic emissions

therefore **increase** smokers' exposure to toxic smoke emissions

Increase
- **health risk,**
- **cancer risk,**
- **morbidity and**
- **mortality**

Lifetime smokers lose an average of 14 years of life

Smokers die younger

http://ec.europa.eu/health/tobacco/law/pictorial/index_en.htm

Additives in tobacco products

Cellulose Fibre

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Cellulose fibre is the basic structural material of most plants, and can be obtained from various natural plant-based sources such as wood pulp, cotton, flax and hemp.

General use

Cellulose fibres are used to make many different products that include paper, textiles, and cardboard. The cellulose that makes up these fibres (or a modified version) is also used in the food industry as anti-caking agents, emulsifiers, formulation aids, stabilizers, thickeners and texturizers, and also in the pharmaceutical and cosmetic industries where it performs similar roles.

Reported tobacco industry uses

The tobacco part of most cigarettes (i.e. the shredded brown interior) is a mixture of the tobacco leaf and a paper-like product called 'reconstituted tobacco'. Reconstituted tobacco is made up of mashed tobacco stems and other parts of the tobacco leaf that would otherwise be discarded. Tobacco manufacturers add cellulose fibre to help bind and fill this reconstituted tobacco in cigarettes.

Tobacco manufacturers also use cellulose to prepare both the cigarette paper that wraps the tobacco, and the filter (both the inner and outer layers). The cigarette paper is a very important part of a cigarette. It controls how the tobacco burns, and the amount of smoke. Generally, the more cellulose used the greater the amount of smoke that is produced.

Cellulose fibres are naturally present in tobacco (at levels ranging from about 5 % to 12 %). The maximum amount of cellulose fibres that is further added is about 6 % of the total weight of the tobacco used in one cigarette.

Harmful health effects

Cellulose Fibre is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. The entire cellulose fibre added to the cigarette is burnt while smoking. Many harmful compounds are formed that can either irritate the eyes and upper parts of the airways (e.g. acrolein), or cause cancer, such as polycyclic aromatic hydrocarbons, benzo[a]pyrene, benzene, furan, and formaldehyde. These compounds have been classified as human cancer-causing agents by the International Agency for Research on Cancer, (a leading expert cancer organisation).

The use of cellulose fibres may be indirectly harmful due to the formation of compounds called aldehydes (e.g. acetaldehyde), which can make cigarettes more addictive by enhancing the addictive potential of nicotine. Aldehydes are very reactive and produce other compounds such as the substance harman, which can also make cigarettes more addictive due to its mood-enhancing effect on the brain. This can ultimately lead to more cigarettes being smoked and thus greater exposure to the toxic substances in cigarette smoke.

In some products, flavours such as vanilla are added to cellulose during the paper-making process. This ensures that the smell of the smoke coming from the lit end of the cigarette (i.e. sidestream smoke) has a more pleasant aroma. This is a concern because not only could it allay any potential worries smokers may have about their habit but it could also increase non-smokers tolerance to sidestream smoke, and thereby increase their exposure to second-hand smoke.

Additives in tobacco products
e.g. cellulose fibre

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Additives in tobacco products

Guar Gum

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Guar gum is an extract of the guar bean plant. It is taken from the seeds of the plant and due to its gelling properties is used commercially (in powdered form).

General uses

Guar gum has many uses particularly in the food, cosmetic and pharmaceutical industries where it is used as a thickener, binder, emulsifier and stabilizer. It is added to various foods such as breakfast cereals, dairy products, gravy, processed vegetables, and baked goods.

Reported tobacco industry uses

The tobacco part of most cigarettes (i.e. the shredded brown interior) is a mixture of the tobacco leaf and a paper-like product called 'reconstituted tobacco'. Reconstituted tobacco is made up of mashed tobacco stems and other parts of the tobacco leaf that would otherwise be discarded. Tobacco manufacturers reportedly add guar gum (and its derivatives) to help bind this reconstituted tobacco in cigarettes. Tobacco manufacturers also use guar gum to prepare the cigarette paper that wraps the tobacco.

The amount of guar gum added to bind the tobacco can make up between 0.6-1.8 % of the total weight of the tobacco used in one cigarette.

Harmful health effects

Guargum is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. When a cigarette is burnt, the guar gum present produces several toxic compounds that are either well-known to cause cancer in humans (e.g. formaldehyde, benzo[a]pyrene and benzene) or thought to possibly cause cancer in humans (e.g. acetaldehyde and styrene) as defined by the International Agency for Research on Cancer (a leading expert cancer organisation).

Furthermore, the use of guar gum may be indirectly harmful due to the formation of compounds called aldehydes (e.g. acetaldehyde), which can make cigarettes more addictive by enhancing the addictive potential of nicotine. Aldehydes are very reactive and produce other compounds such as the substance harman, which can also make cigarettes more addictive due to its mood-enhancing effect on the brain.

Some of the compounds formed when guar gum is burnt have a distinctive flavour. For example, diacetyl is one of the substances produced and has a butterscotch flavour, which can make a cigarette more appealing due to the improved flavour of the smoke. 2-Furfural is also formed and has an odour and taste that is described as sweet, woody, bready, and caramel-like. Therefore, these compounds help make a cigarette more attractive by imparting a pleasant flavour to the cigarette smoke. This can ultimately lead to more cigarettes being smoked and thus greater exposure harm due to the toxic substances in cigarette smoke.

Additives in tobacco products
e.g. guar gum

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Additives in tobacco products

Liquorice Extract

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Liquorice (or licorice) is the root of the liquorice plant from which the characteristically sweet liquorice flavour is extracted. The extract contains the very sweet substance glycyrhizzin, as well as sugars.

General uses

The root or the extract is used as a source of liquorice flavour. The liquor from the extract is often processed into a powder or a more concentrated solid block.

The liquorice root/extract is widely used in the food industry as a sweetening agent, or flavouring ingredient in drinks, candy and gum. Due to its medicinal properties it is also used in both traditional and herbal medicines e.g. in the pharmaceutical industry liquorice is used in over-the-counter drugs and cough syrups.

Reported tobacco industry uses

Tobacco manufacturers reportedly use liquorice at different stages of manufacturing to add flavour to the tobacco and to sweeten the smoke. Liquorice gives a mellow, sweet and woody note to the smoke.

The amount of liquorice added to the cigarette can make up to 4 % of the total weight of the tobacco used in one cigarette. Liquorice is also used as a flavour for other tobacco products such as cigars, and chewing tobacco.

Harmful health effects

Liquorice is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. When liquorice extracts are burnt they produce several toxic compounds including some that are well known to cause cancer in humans (e.g. benzene), or those that could possibly cause cancer (e.g. acetaldehyde). Other toxic substances produced include the chemicals toluene and phenol that could cause other damaging health effects.

The sugars in the extract can also produce acidic compounds, which make it harder for the nicotine in the cigarette smoke to reach the brain. This forces smokers to inhale deeper and to also consume more cigarettes to get their nicotine fix. Furthermore, the use of liquorice may be indirectly harmful due to the formation of compounds called aldehydes (e.g. acetaldehyde), which can make cigarettes more addictive by enhancing the addictive potential of nicotine. Aldehydes are very reactive and produce other compounds such as the substance harman, which can also make cigarettes more addictive due to its mood-enhancing effect on the brain.

The addition of liquorice extract makes the smoking experience more pleasurable in several ways, i.e. it helps the tobacco to stay moist, balances the overall flavour of the cigarette, and reduces dryness in the mouth and throat.

Furthermore, the caramel flavours produced when the sugars in the liquorice extract are burnt help enhance the flavour and attractiveness of smoking. Also, the glycyrhizzin that is present could potentially to open up the airways, and in combination with other ingredients could allow smokers to inhale deeper, making it easier for them to get their nicotine fix.

Therefore, by adding more desirable flavours such as liquorice to cigarettes, tobacco manufacturers succeed in making smoking more pleasurable. This not only encourages the smoking habit, but also makes it easier for smokers to become addicted, which ultimately causes them to be exposed to higher levels of the toxic substances in cigarette smoke.

Additives in tobacco products
e.g. liquorice extract

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Additives in tobacco products

Menthol

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Menthol is a natural compound found in several plants of the mint family e.g. the peppermint, cornmint, and spearmint herbs. When consumed it imparts a minty taste and smell, and has a characteristic cooling effect.

General uses

Menthol is also produced synthetically for commercial use, and is widely used in the food, flavour, oral hygiene, cosmetic, and pharmaceutical industries. The tobacco industry is one of the main users of menthol.

Reported tobacco industry uses

Menthol is one of the most commonly used additives in the tobacco industry. It has been used in tobacco products since the 1920s to suppress the harshness of smoke and as a soothing alternative for smokers suffering from colds. Menthol is the only type of tobacco additive that is sold as a particular type of cigarette i.e. 'Menthol cigarettes'. Menthol is added to cigarettes to provide a distinctive (brand-specific) mint flavour to the inhaled smoke. The menthol is added to several parts of the cigarette: either directly to the tobacco, the inner foil of the cigarette packet, the filter paper, or more recently as a crushable capsule inside the filter for a stronger effect.

The amount of menthol added to the cigarette depends on whether it is being produced as a "menthol" cigarette. Mentholated cigarettes contain menthol at levels that are up to 0.45 % of the total weight of the tobacco used in one cigarette (although levels up to 2 % are also reported). Non-mentholated cigarettes can contain menthol at much lower levels that make up between 0.01 to 0.03 % of the total weight of tobacco.

Harmful health effects

Menthol is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. Although studies show that when a mentholated cigarette is burnt, almost all of the menthol is released into the smoke unchanged, a small amount (0.5 %) does burn and can form compounds such as benzo[a]pyrene and benzene. These chemicals have been classed as human cancer-causing agents by the International Agency for Research on Cancer (a leading expert cancer organisation).

Menthol numbs the throat and increases the smoothness of the smoke, which masks the harsh effects of cigarette smoke and thereby makes it easier to smoke. Menthol cigarette smokers also tend to inhale more deeply for the cooling effect. These effects (together with the minty taste) particularly appeals to young people as studies have shown that menthol cigarettes are commonly used in adolescents and is often their first cigarette brand of choice.

Tobacco manufacturers recognise that the cooling effect of menthol makes for a pleasurable smoking experience and, therefore, also add menthol to the tobacco used in non-menthol (i.e. regular) cigarettes. This provides a smoother and less harsh smoke without the mint taste. Other tobacco additives used for this purpose include peppermint, spearmint, thyme and eucalyptus oils, and the chemical methyl salicylate. Consequently, by adding menthol, tobacco manufacturers increase the attractiveness and appeal of cigarettes.

The sensory experience from smoking menthol cigarettes can make it difficult to stop as the pleasurable taste, odour, and cooling effects may reinforce the smoking habit. Indeed, menthol's numbing effects on the lungs may allow many smokers to inhale more deeply to get their nicotine fix.

Menthol's use in medicinal products can also give smokers a false sense of safety. Studies have shown that menthol cigarette smokers often have the wrong impression that the compound offers them some sort of health protection compared to non-menthol cigarettes. This can encourage continued consumption and helps sustain the smoking habit and thus greater exposure to the toxic substances in cigarette smoke.

Additives in tobacco products
e.g. menthol

can **increase**
- attractiveness,
- addictiveness and
- toxic emissions

therefore **increase** smokers' exposure to toxic smoke emissions

Increase
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Additives in tobacco products

Prune Juice Concentrate

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Prunes are ripe plums that are dried. Concentrated prune juice is extracted from softened prunes. As a fruit extract, prune juice concentrate is very rich in sugars and is therefore naturally sweet.

General uses

Prune juice concentrate has many uses in the food industry, e.g. as a sweetener, colour and flavour enhancer, a binding agent in cereal bars, and also as a 'humectant' to help keep cakes and cookies moist.

Reported tobacco industry uses

Prune juice concentrate (along with other extracts from either the plum or prune) is reportedly used by tobacco manufacturers to add flavour to the tobacco at different stages of manufacturing. Prune juice concentrate can make up to about 0.5 % of the total weight of the tobacco used in one cigarette.

Harmful health effects

Prune juice concentrate, a fruit extract, is safe for use in food products. However, this does not suggest it is safe when inhaled from smoking cigarettes. Studies have yet to identify the compounds produced from burning prune juice concentrate. However, the high sugar content of the concentrate suggests it is likely to behave in a similar way to sugar additives. This could lead to the formation of chemicals that are well known to cause cancer in humans such as polycyclic aromatic hydrocarbons, and those thought to possibly cause cancer such as acetaldehyde. These compounds have been classified by the International Agency for Research on Cancer (a leading expert cancer organisation). Other toxic compounds that irritate the airways are also formed (e.g. acrolein or 2-furfural).

The sugars also produce acidic compounds, which make it harder for the nicotine in the cigarette smoke to reach the brain. This forces smokers to inhale deeper and to also consume more cigarettes to get their nicotine fix. Furthermore, the use of prune juice concentrate may be indirectly harmful due to the formation of compounds called aldehydes (e.g. acetaldehyde), which can make cigarettes more addictive by enhancing the addictive potential of nicotine. Aldehydes are very reactive and produce compounds such as the substance harman, which can also enhance addictiveness due to its mood-enhancing effect on the brain.

Prune juice concentrate is used to smoothen and mildly sweeten the smoke. It imparts a sweet taste making the smoke more palatable. The high sugar content of the concentrate provides caramel flavours when burnt that enhance the flavour and attractiveness of smoking. By adding prune juice concentrate to improve the taste of the tobacco, the bitter taste of the smoke is sufficiently masked. Also, the sweet caramel flavours appeals to young people, which can make it easier for them to start smoking.

Prune juice concentrate may also be indirectly harmful by making smoking more pleasurable. This encourages the smoking habit, which could ultimately cause smokers to be exposed to higher levels of the toxic substances in cigarette smoke.

Overall, by adding more desirable flavours such as prune juice concentrate to cigarettes, tobacco manufacturers make it easier for smokers to become addicted.

Additives in tobacco products
e.g. prune juice concentrate

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Additives in tobacco products

Vanillin

Additives are substances intentionally added to tobacco products by tobacco industry in order to render toxic tobacco products palatable and acceptable to consumers.

Vanilla is one of the most popular flavours worldwide. It comes from the fruit of the vanilla plant that contains beans or seeds from where the vanilla extracts are obtained. Vanillin is the main substance of the vanilla bean extract responsible for the characteristic sweet smelling flavour of vanilla.

Although vanillin can be extracted from vanilla plants, this is quite expensive. Therefore, artificial vanilla flavouring made up of synthetic vanillin or chemically modified ethylvanillin is produced for commercial use and has a stronger flavour.

General uses

As a vanilla flavour ingredient, vanillin has a wide range of uses within the food, drink, cosmetic, pharmaceutical, and fragrance industries.

Reported tobacco industry uses

Tobacco manufacturers use vanillin as a flavouring material in cigarettes. Vanillin (or other compounds that release vanillin) can be added to the tobacco, cigarette paper or filter.

Vanillin can make up to 0.05 % of the total weight of the tobacco used in one cigarette. Lower levels of ethylvanillin are added due to its stronger flavour.

Harmful health effects

Vanillin is generally regarded as safe for use in food and cosmetics. However, this does not suggest it is safe when inhaled from smoking cigarettes. Vanillin is known to release several substances when burnt. These include polycyclic aromatic hydrocarbons, which have been classed as human cancer causing agents by the International Agency for Research on Cancer (a leading expert cancer organisation).

Vanillin is also indirectly harmful as it masks the harshness of tobacco smoke, making smoking easier, which thereby encourages the smoking habit. This ultimately causes smokers to be exposed to higher levels of the toxic substances in cigarette smoke.

Vanilla is a popular flavour in many products and tobacco manufacturers use this fact to make the cigarette more desirable, especially to young or first time smokers. Non-smokers or bystanders may be more tolerant towards smokers who smoke cigarettes with a vanilla aroma because of its less offensive and familiar smell.

Overall, by adding more desirable flavours such as vanillin to cigarettes tobacco manufacturers make it easier for smokers to become addicted.

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e.g. vanillin

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