Questions and answers on furan in food

Updated BfR FAQ of 28 May 2020

Furan is a volatile compound that can form when food is heated. Particularly high concentrations of furan are found in roasted food such as coffee and convenience foods that are subjected to high temperatures in closed containers.

In studies with rats and mice, high doses of furan lead to cancer. How exactly furan causes cancer in animal studies has not yet been conclusively elucidated. In addition, studies in rats show that long-term intake of furan can cause damage to the liver.

Certain groups of consumers who regularly ingest high amounts of furan due to their eating habits could, therefore, be at risk. This applies in particular to infants, who may be exposed to comparatively high levels of furan due to regular consumption of ready-to-eat baby food.

Consumers can influence the intake of furan via food through their eating habits. Furthermore, the formation of furan during food preparation can be significantly minimised by using moderate preparation conditions (“Don’t char it; lightly brown it”). The evaporation of volatile furan from food is promoted by stirring.

What is furan?

Furan is a highly volatile substance that can form when food is heated. For this reason, furan is also referred to as a “heat-induced contaminant”.

How does furan form in food?

Several possibilities are being considered for how furan forms in food, which may vary depending on the composition of the food. A heating process is the basis of all relevant formation pathways.

Various studies indicate that in particular the thermal decomposition of carbohydrates (e.g. glucose, fructose and lactose), amino acids (e.g. serine and cysteine), ascorbic acid and its derivatives or of polyunsaturated fatty acids as well as the thermal oxidation of carotenoids during the heating process may lead to the formation of furan.

In which foods were particularly high concentrations of furan found?

Furan has been detected in various foods. Particularly high concentrations of furan were found in foods that were roasted (e.g. coffee, cocoa, nuts, toasted bread, popcorn) or heated in closed containers (e.g. canned food, ready meals and baby food).

Which foods notably contribute to furan intake?

Infants and toddlers are exposed to furan mainly through convenience food. Cereals and cereal products (e.g. breakfast cereals) make the greatest contribution to the intake of furan by children and adolescents. Coffee consumption is considered the main source of furan intake for adults.

Is the occurrence of furan in food a new phenomenon?

The occurrence of furan in food is not a new phenomenon. Furan is formed during the preparation of food, but also when thermal processes are used for preserving food, most of which have been in use for several decades.

Why is furan a cause for concern?
In long-term studies in rats and mice, high doses of furan lead to cancer. In addition, studies in rats show that long-term intake of furan can cause damage to the liver.

How exactly furan causes cancer in animal experiments and leads to liver damage has not yet been conclusively elucidated. Based on the available data, different mechanisms of action, such as oxidative stress, indirect carcinogenic mechanisms (epigenetic changes, oxidative DNA damage), but also a direct genotoxic carcinogenic mechanism (adduct formation of the reactive furan-metabolite cis-2-butene-1,4-dial (BDA) with DNA) are being discussed.

There is currently no reliable information on the effect of furan in humans. However, it is possible that the long-term intake of furan could also lead to the development of cancer in humans.

What is the health risk posed by furan?
The European Food Safety Authority (EFSA) published a comprehensive assessment of the health risk posed by furan in food in 2017. Based on the available data, EFSA could not exclude a genotoxic mechanism of action (adduct formation of the reactive furan-metabolite cis-2-butene-1,4-dial (BDA) with DNA) for carcinogenic effects of furan. According to the current state of knowledge, it is not possible to derive a threshold for substances that are genotoxic and carcinogenic below which it can be assumed with sufficient certainty that no increased health risk exists. Therefore, EFSA has not established a tolerable daily intake (TDI) for furan.

Ultimately, EFSA concluded that there may be a health risk for certain groups of consumers who are regularly exposed to high amounts of furan due to their eating habits.

Furan has also been detected in baby food. Are babies particularly at risk from furan?
Due to the comparatively high concentrations of furan in baby food, infants are on average exposed to higher levels per kilogram of body weight than other age groups. Whether the temporary intake of high levels of furan during infancy actually poses a particular health risk cannot be reliably assessed at present on the basis of the available information. However, infants are generally a particularly vulnerable population group, which is why the furan level in baby food should be reduced as a precaution.

How can furan intake be reduced?
Consumers can influence the intake of furan through their eating habits, but may also significantly minimise the formation of furan during the preparation of food:

- In general, the potential health risk associated with food can be reduced by following the general recommendation of a varied food selection. This can prevent one-sided exposure to a variety of potentially harmful substances, which are expected to occur occasionally in food. In this regard, special attention should be paid to food containing particularly high amounts of furan.
- Infants and toddlers are mainly exposed to furan through ready-to-eat baby food. Cereals and cereal products (e.g. breakfast cereals) make the greatest contribution to the intake of furan by children and adolescents. For adults, coffee consumption is the most significant source of exposure to furan.
- When roasting or browning food, the concentration of furan rises considerably with increasing degrees of browning. Therefore, the recommendation here is: “Don’t char it; lightly brown it.”

- As furan is a volatile substance, levels can be reduced by stirring the food during heating and also afterwards in an open container. The volatile furan can evaporate better under these conditions.
- Only small amounts of furan are present in foods prepared from fresh ingredients, provided that these foods are not overheated during preparation. This also applies to baby food.

This text version is a translation of the original German text which is the only legally binding version.