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# Process Generated Contaminants

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## Introduction.

During the technological process of PP production, chemical reactions occur, resulting in the formation of desirable and undesirable products. Some of these undesirable compounds may exhibit toxic effects. The number of compounds formed is still unknown, but a large number of them have already been identified as polynuclear aromatic hydrocarbons, heterocyclic amines, nitrosoamines, oxidized styrenes, lysinesolamines, etc. acrylamide has recently been identified as a still unknown contaminant. Thanks to this discovery, it became clear that other toxicological substances, like still unknown compounds, are likely to be formed during food production [1,2,3]. In this article, we intend to consider in most detail only three compounds or classes of compounds.

1. Polyaromatic hydrocarbons.
2. Heterocyclic amines
3. Acrylamides

## Results and discussion.

Polyaromatic hydrocarbons (PAHs) make up a large and complex group of substances whose structure consists of two or more fused benzene rings. Classification can be carried out according to the number of benzene rings in the molecule. If the number of benzene rings exceeds 4, then the compound is classified as a heavy fraction and the rest as a light fraction. These compounds are formed as a result of the pyrolysis of organic material. Consequently, it will be possible to identify many sources of contamination, including industrial or geochemical activities. Therefore, PAHs are also considered as typical environmental contaminants. In this regard, it should be noted that PAHs also tend to bioaccumulate, especially those compounds included in the heavy fraction. In addition to contamination from the environment, they can also form on the PCB itself. For example by heating (grilling), fumigation or drying process.

PAHs are associated with carcinogenesis. However, not all compounds exhibit the same degree of toxicity. Therefore, the same systems for assessing PAN risks have been introduced. Exposure as applied for dioxin and dioxin-like compounds. Using the most toxigenic potential of the PAH as a reference, for example, benzpyrene, TEF values are assigned to the various PAHs. Again, it should be emphasized that for some things there is no designated meaning TER.

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There are still no definite TFI boundaries, but despite this fact, some MRL values are used by special enterprises. These values range from 25 to 50 mg/kg for the total amount of PAHs, and from 5 to 10 mg/kg for the heavy fraction of PAHs only.

In addition to grilling and smoked PPs, a large contribution to human exposure comes from oils, vegetables and fruits. In vegetable oils, the deodorization process can remove a light fraction. If heavy francium is also to be removed, active carbon treatment should be used.

Heterocyclic amines.

Soon after the development of a rapid assay for determining mutagenic activity, it became clear that under normal heat treatment conditions, mutagenic compounds are formed in most PPs rich in animal proteins. Mutagenic properties could not be attributed to PAHs, but were identified as heterocyclic amines.

Subsequently, about 20 different mutagenic heterocyclic amines have been identified in a number of model and real food systems. Some of these compounds have been shown to be carcinogenic in long-term animal studies and also genotoxic in DNA replication tests. Two compounds showed the highest activity: 2-amino-3,8-dimethylimidazo [4,5,8]. Xinoxaline (abbreviated as MeIQx) which is an imidazoquinoxine (IQ compound) and 2-amino-1-methyl-6-imidazole [4,5,7] pyridine (abbreviated PhIP) which is an imidazoquinoxaline[4,5,6]pyridine (abbreviated as PhIP), which is imidazoquinoxaline [2]. In general, PhIP is produced in greater amounts than MeIQx, typically peaking at 480 ng/g and 50 ng/g, respectively.

A complex combination of different chemical reactions can induce the formation of such heterocyclic amines in cooked PP. The Maillard reaction, which is a condensation reaction between a reducing sugar and an amine compound and which results in the formation of a golden ruddy color and aroma, is considered to be of paramount importance in relation to the formation of imidosoquinomines or IQ compounds. In addition, however, typical products of Maillard side reactions known as Strecker degassing, such as pyrazines and pyridines, are suggested to react with carbonyl and amino compounds to also promote the formation of pyridines and heterocyclic amines. It is commonly assumed that creatine and creatinine play a central role in the formation of IQ compounds. Phenylalanine and creatinine are thought to be important precursors for PhIP. In addition to phenylalanine, however, other amino acids may also be involved in this process. Reducing sugars such as glucose also appear to have a significant effect on the formation of such compounds, although they are not thought to be important for the formation of PhIP. In the absence of carbosyl compounds, the heterocyclic compounds appear to result from the pyrolysis of amino acids.

Cooked meat and fish are important sources of heterocyclic amines, because they are very popular in countries where they are used in the production of gravy. They were first found in the shell (crust) of these products. Meat is usually more sensitive than fish. Cooked meat products usually contain less than fresh meat, probably due to the presence of various additives such as sulfates, nitrates or citric acid, which inhibit the formation of these products. Commercially produced meat products usually contain very small or undetectable amounts of heterocyclic amines, with a few exceptions. This means that home cooking or restaurant cooking is usually important in order to reduce the absorption of these mutagenic compounds. Already daily individual absorption decomposes depending on the country and ranges from 0÷2 to 13.8 mg.

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**Acrylamides.**

A very large group of compounds belonging to heterocyclic amines, although their formation in PP was discovered only recently, are acrylamides. Previously it was assumed that the exposure of acrylamides to the human body is very small, because. acrylamide is often used as a monomer to make polyacrylamide. This polymer finds technical applications and is also sometimes used as a packaging material. Migration of unreacted acrylamide from this PP packaging material. Mogla occurs in PP and this is discussed below. Apart from this source, exposure to acrylamide is thought to be primarily occupational (eg, fumigation). However, Swedish scientists have discovered. That, besides this oxidative exposure, each individual is subjected to a particular contamination (waskground), which soon proved to be ascribed to the dietary absorption of acrylamide.

There is particular interest in the absorption of acrylamide from the daily diet due to its carcinogenicity, neurotoxicity, and reproductive toxicity.

Like heterocyclic amines, acrylamide appears to form in PP as a result of the Maillard reaction. In contrast to heterocyclic amines, however, the amide is formed to carbohydrate-rich PP, such as in potatoes or cereal products. As shown in the literature, it follows that the way in which PP is prepared has a huge impact on the content of acrylamide (eg fried and french fries). Therefore, the mechanism of acrylamide formation should be explained.

Like heterocyclic amines, the Maillard reaction seems to play an important role in the formation of acrylamide in PN, however, creatine is not involved, although asparagine and especially free asparagine appear to be a determining factor in their formation. Reaction mechanisms, the formation of acrylamide should be considered as a side reaction of the classical Maillard reactions, because other compounds that do not participate in the Maillard reaction also react with asparagine to form acrylamide, another route can also act: In addition to reducing sugars, other carbonyl compounds can form acrylamide when reacted with asparagine.

It is burned that the amount of free asparagine is important in relation to the formation of acrylamide. This is reflected in the look and their asparagine content. Unfortunately, important foods appear to be available for acrylamide formation. In some other products, such as potatoes, the content of free asparagine and reducing sugars, respectively, may vary during storage and from species to species. In addition to endogenous factors, it is clear in the field that process parameters also influence the formation of acrylamide; there are no reports that acrylamide is formed during boiling. When cooking, the temperature is much lower compared to the frying temperature, and excess water actually inhibits the formation of acrylamide. A heating process that induces loss of water from the surface of the PP, such as roasting or sterilization, on the other hand causes a noticeable formation of acrylamide. Temperature is also important, but in practice it remains a difficult parameter to change, because low temperatures also slow down desirable processes such as drying, the formation of dyes and flavors. Despite this fact. That acrylamide decomposes is evident at high temperatures (>200°C). High temperature processes are often undesirable because other adverse reactions may predominate.

**Conclusion.**

During the heat treatment of food raw materials, especially during frying, baking and fumigation, it is necessary to control the course of Maillard reactions in order to make sure that contaminants such as heterocyclic amines or acrylamides are formed or not, in addition, the

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formation of polynuclear aromatic hydrocarbons should be taken into account. All this is important from the point of view of food safety.

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