

WORKING PARTY ON CHEMICAL CONTAMINANTS IN FOOD

INTRODUCTION TO PROCESS CONTAMINANTS

Background

1. The Agency, previously MAFF/JFSSG, has carried out work on process contaminants for many years but it has been dispersed amongst many Branches and Divisions and not properly co-ordinated. Much of the research conducted on process contaminants occurred in the late 1980s and early 1990s and hence any data available are unlikely to be up to date and reliable. For this reason, responsibility has been brought together under Branch E to ensure that it receives the right level of priority. In addition, the work is also necessary to ensure that UK is prepared for any Commission actions in this area.

2. Process contaminants are formed when components in the food undergo a reaction during processing. The contaminants of concern are typically toxic chemicals, and of most concern are those considered to be carcinogens especially those with genotoxic potential. Processing methods include fermentation, acid hydrolysis, kilning, curing, smoking, drying as well as cooking (grilling, frying, boiling, barbecuing). The contaminants are formed in a number of ways

- as the product of a reaction between inherent food components
- by reactions between inherent food components and other chemicals
- by the application of heat on both inherent and other chemicals previously.

Process contaminants are inherent in food and therefore cannot be eliminated completely, but levels can be reduced significantly through changes to manufacturing practice or choice of ingredients.

Industrial Processing

3. Industrial methods such as the roasting of coffee, kilning of malts and production of distilled alcoholic drinks, have been used for many years. Elevated temperatures are known to increase the formation of contaminants, but, by adapting the processing methods in a suitable manner these contaminants can

be kept to minimum levels. For example, the levels of ethyl carbamate in whisky have been significantly reduced by careful choice of the grain used and by adjusting the distillation methods. Methods of manufacturing and the type of foods produced are constantly changing. Therefore, work is required to provide the Agency with up to date information and data. Such studies inform our discussions with industry as they attempt to meet regulatory and/or guideline advice on reducing the levels of a particular contaminant.

Domestic Cooking

4. 'Food Processing' also includes domestic cooking processes. For centuries people have been using the methods of smoking, pickling, drying and curing (e.g. by addition of salt, sugar, salts of nitrate and vinegar) as a method of food preservation as well improving colour and flavour characteristics. Certain cooking methods known to increase contamination, such as barbecuing, have become more popular in recent years. Frying, broiling and barbecuing lead to higher levels of mutagens than stewing, steaming and poaching. As in industrial processes, elevated temperatures promote the formation of certain contaminants, and previous studies have shown that levels of process contaminants rise during simple domestic cooking activities such as toasting. Advice may need to be given to consumers on the health risks associated with certain cooking methods and the ways of minimising the levels of the contaminants produced by such processes. This will enable the consumer to make an informed choice about the methods of domestic cooking which they use. However, in order to be able to provide this advice, further research on the levels of contaminants that arise during cooking processes, the mechanism of formation in certain foods and hence methods of reducing these levels, still needs to be conducted. Further toxicological studies as well as dietary exposure assessments also need to be performed.

Present Work

5. Previous surveys have included nitrosamines, ethyl carbamate and polycyclic aromatic hydrocarbons in foods and beverages. These studies have shown that relatively high levels of these contaminants can be formed in some foods. The method of processing is believed to result in the formation of these

contaminants. Recently, a considerable amount of work has been commissioned on 3-monochloropropane-1,2-diol (3-MCPD), the most common of a group of process contaminants known as chloropropanols. Early studies concentrated on 3-MCPD in acid-hydrolysed vegetable protein although, it has subsequently been found in other products as a result of processing, storage conditions or migration from certain food contact materials. Surveys of 3-MCPD levels in soy sauce and related products and also in a range of foods and food ingredients were carried out in 1999/2000 and results for the latter two surveys will be published February 2001. Work has also been carried out on validation of methods of analysis. A SCOOP (A European Community Scientific Co-operation) task has validated a method of analysis for 3-MCPD in acid-HVP and other foods. 8 member states were involved in the task. The task was used to standardize various test materials that can be used as quality control materials on an on-going basis.

Future Work

6. There is also a need for research into contaminants previously not investigated by the Agency. Heterocyclic amines are such a group, they have been detected in foods with high muscle content, such as meat and fish, as a result of cooking at high temperatures. Since these foods are likely to make up a large proportion of a Western diet, it is a necessary area for investigation. The table in Annex 1 displays what is known so far about various process contaminants. A paper is currently being prepared reviewing all available information from scientific research including toxicological studies, mechanism of formation and the factors that affect it etc. It will also consider food surveys published to date. It will highlight the areas that appear to pose the greatest health risk to consumers and that therefore require further investigation. Subsequently, it is envisaged that a workshop will be held to discuss this paper and formulate a full programme of research and survey work on process contaminants which will enable us to move forward in this area.

7. Comments on the issues raised in this paper are welcomed from members. Issues to consider include:

- Where should the priorities for the Agency's work on process contaminants lie?
- Should nitrate be considered as a process contaminant?

- Are there any other process contaminants that should be considered in addition to those in Annex 1?

Contaminants Division

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Annex 1

Contaminant	Food in which occur	Mechanism of formation
Ethyl Carbamate	Distilled spirits and other fermented products such as bread, cheese and yoghurt	Carbamyl phosphate, cyanic acid and ethanol. Heating and urea required in non distilled foods
Chloropropanols	Acid-hydrolysed vegetable protein, soy sauces Cooked foods, malted ingredients, soy products (3-MCPD)	Cl moiety of HCl interacts with residual lipids in vegetable protein. For other foods mechanism not clarified
N-nitrosamines	Cured meats, kilned malted drinks,	From nitrosation of nitrites/nitrates
Heterocyclic Amines	Smoked, broiled and fried meats and fish	Creatinine/creatine and amino acids (+ sugar) when heated at high temperatures. Occurs in muscle foods
Polycyclic aromatic hydrocarbons	Barbecued, smoked, fried and chargrilled products.	Incomplete combustion or high temp pyrolysis of components in the food.