codex alimentarius commission

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

WORLD HEALTH ORGANIZATION

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CODEX COMMITTEE ON FOOD ADDITIVES AND CONTAMINANTS

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POSITION PAPER ON CHLOROPROPANOLS

BACKGROUND

1. The 34th Session of the Codex Committee on Food Additives and Contaminants (CCFAC) requested the United Kingdom, with assistance provided by Canada and the United States of America, to revise the Position Paper on Chloropropanols presented at the 34th Session (CX/FAC 02/28) for circulation, comment and consideration at the 35th Session of the CCFAC. The Committee also agreed that the paper should include a proposal for maximum levels of chloropropanols in relevant foods. This paper has been revised in light of comments submitted on the earlier paper.

2. 3-Monochloropropane-1,2-diol (3-MCPD) and 1,3-dichloro-2-propanol (1,3-DCP) belong to a group of chemicals called chloropropanols. They can be formed in foods as a result of processing/storage conditions, though the mechanism for their formation is not fully understood. 3-MCPD has been shown to be a precursor for 1,3-DCP formation.[1]

3. 3-MCPD was originally identified as a contaminant of acid-hydrolysed vegetable protein (acid-HVP),[2, 3, 4] a frequently used ingredient of savoury foods such as soups, prepared meals, savoury snacks, gravy mixes and stock cubes. 3-MCPD has also been found to occur in a range of other foods and ingredients,[5, 6] most notably in soy sauce.[7, 8, 9,10,11] 1,3-DCP has also been detected in acid-HVP [2, 3] and soy sauce[8,11,12] but its presence in other foods and ingredients has not been investigated to the same extent. In addition to the presence of 3-MCPD in food, there is a theoretical source of very low levels of this substance in drinking water from upland areas in the UK. This is due to its presence as a contaminant of epichlorohydrin-linked cationic polymer resins in flocculants used for water purification in a small number of treatment plants. A summary of the possible sources of chloropropanols in the diet is given in Annex I.

4. A fully validated analytical method capable of measuring 3-MCPD in food and food ingredients at levels down to 0.01 mg/kg has been developed[13] by the UK's Central Science Laboratory. This method has been validated through an international collaborative trial and has been accepted as a first action status method by the Association of Official Analytical Chemists (AOAC).[14]

5. The UK's Central Science Laboratory have also developed a method for the determination of 1,3-DCP in soy sauces.[15] The method has been validated by collaborative trial.

6. Following toxicological assessment in the UK which concluded that 3-MCPD can be regarded as having no significant genotoxic potential *in vivo* and therefore acts as a non-genotoxic carcinogen[16, 17] the European Commission's Scientific Committee for Food (SCF) were able to derive a Tolerable Daily Intake (TDI) of 2 μg/kg bw in May 2001.[18]

7. The 57th Session of the Joint FAO/WHO Expert Committee on Food Additives (JECFA) considered chloropropanols, 3-MCPD and 1,3-DCP, in June 2001.[19] They recommended a provisional maximum tolerable daily intake (PMTDI) for 3-MCPD of 2 μg/kg bw. JECFA concluded that available studies clearly indicated that 1,3-DCP was genotoxic in vitro and the establishment of a tolerable intake was inappropriate because of the nature of toxicity.

8. The Committee observed that a regulatory limit on the concentration of 3-MCPD in soy sauce could markedly reduce 3-MCPD intake by soy sauce consumers and that the available evidence suggested that 1,3-DCP is associated with high concentrations of 3-MCPD. The Committee noted that regulatory control of 3-MCPD would therefore obviate the need for specific controls on 1,3-DCP.

CODEX MEMBER STATES' ACTIVITIES ON CHLOROPROPANOLS

Australia & New Zealand

9. During 2001, Australia and New Zealand introduced emergency measures to establish maximum levels for chloropropanols in soy and oyster sauces (0.2 mg/kg for 3-MCPD and 0.005 mg/kg for 1,3-DCP).[20]

10. While there is some evidence that controlling the level of 3-MCPD will control the level of 1,3-DCP, the evidence is not conclusive. Therefore Australia considered that regulatory control of 3-MCPD was not adequate from a regulatory point of view to obviate the need for specific controls on 1,3-DCP. Therefore given the toxicity profile of 1,3-DCP a maximum level for 1,3-DCP at the limit of detection (0.005 mg/kg) of the assay methodology was set.

11. Based on the JECFA PMTDI (0.002 mg/kg bw) for 3-MCPD, dietary exposure assessment using Australian food consumption data indicates that consumers of soy sauce products containing a 3-MCPD level above 3.5mg/kg will exceed the PMTDI. Of the 172 retail soy sauce products sampled and tested in Australian and New Zealand surveys, 16 products (9%) were found to contain greater than 3.5 mg/kg of 3-MCPD. These products were removed from the market in Australia.

Canada

12. An initial survey conducted by the Canadian Food Inspection Agency in 1999, found levels of 3-MCPD up to 178 ppm in sauces marketed in Canada. A preliminary risk assessment conducted by Health Canada at that time, focussed on 3-MCPD's carcinogenic and genotoxic potential. It was concluded that 3-MCPD is a non-genotoxic carcinogen and a provisional TDI of 1.1 ug/kg bw/day was established. Based on this provisional TDI and recognizing that these sauces are not the only potential source of 3- MCPD, a interim guideline for enforcement purposes was set at 1 ppm for soya sauces and related products. While it established this interim guideline, Health Canada's long term position with respect to 3-MCPD (and 1,3-DCP), is to ensure that the levels of these contaminants are as low as reasonably acheivable. The Canadian Food Inspection Agency is conducting on-going investigations to verify the effectiveness of compliance measures. The most recent results of 8 samples of soy sauces show a range of 3-MCPD levels of <0.001 mg/kg to 1.12 mg/kg. Five samples of the eight, that contained a range of 3-MCPD of <0.01 mg/kg to 0.15 mg/kg, all contained <0.5 ? g/kg 1,3-DCP.

Japan

13. Results of a 3-MCPD survey in Japan suggests that intake of 3-MCPD from most soy sauces is estimated to be quite low compared with JECFA's PMTDI of 2 μg/kg body weight per day. Analysis of 3-MCPD in 14 samples of Japanese acid-HVP by the Japan Food Research Laboratories found the highest level of 3-MCPD was 280 ppb. Per capita consumption of soy sauce in Japan has been calculated as 28g per person per day. Therefore the estimate of maximum possible intake of 3-MCPD from mixed soy sauce (assuming that it is composed of 100% acid-HVP) would be 8 μg per person per day. Equivalent to 0.13 μg/kg bw (for 60kg adult) and well below the JECFA PMTDI. Japan will continue to conduct comprehensive surveys on 3-MCPD content for a wide variety of foods and food ingredients including soy sauce and acid-HVP in order to collect data necessary for setting the limits.

Thailand

14. Thailand has established a limit of 3-MCPD in seasoning products from soy protein hydrolysis at the level of 1 mg/kg[23]. The limit is based on the evaluation of the 57th Session of JECFA that established a PMTDI of 2 µg/kg.

United Kingdom

15. The results of surveys of 3-MCPD levels in food[6] and food ingredients[5] conducted in the UK have shown that 3-MCPD is present in a wide range of foods including baked goods, bread, cooked/cured meat/fish and malt ingredients. Surveys of 3-MCPD[9] and 1,3-DCP[12] levels in soy sauces and related products published in February 2001 showed that 31 % of the 100 retail products sampled contained quantifiable levels of 3-MCPD (ie equal to or above 0.01 mg/kg), with the highest level being 93.1 mg/kg. 17% of the same 100 samples contained quantifiable levels of 1,3-DCP, the highest level being 0.345 mg/kg. No direct correlation between the levels of 3-MCPD and 1,3-DCP was observed other than that all samples with quantifiable levels of 1,3-DCP contained levels of 3-MCPD greater than 0.02 mg/kg and that the 3-MCPD level was always greater than the 1,3-DCP level. Two further surveys were conducted in 2002. The first, a survey of 3-MCPD in 273 samples of soy sauce taken from catering establishments,[10] found 4 % of samples had levels of 3-MCPD above 0.01 mg/kg, the highest level being 23.7 mg/kg (normalised to 40 % dry matter content). The second, a survey of 3-MCPD and 1,3-DCP in soy sauce and related products[11] from retail establishments found 9 of the 99 samples contained levels of 3-MCPD above 0.01 mg/kg. With the highest being 35.9 mg/kg (normalised to 40 % dry matter content). Only one sample was found to contain 1,3-DCP, this was at a level of 0.017 mg/kg and was the same sample that contained the highest level of 3-MCPD.

16. A survey of 3-MCPD in the diet has been conducted to provide information on exposure to 3-MCPD from foods other than soy sauce. The survey has recently been completed and the resulting exposure assessment will be published shortly.

17. An ongoing project to investigate the factors affecting the formation of 3-MCPD in food is due to be completed in 2004. As part of the project a review paper considering the occurrence of 3-MCPD and related compounds has been published.[24]

United States of America

18. Based on technological feasibility and a preliminary quantitative cancer risk assessment by the Food and Drug Administration (FDA), specifications of 1 ppm 3-MCPD and 50 ppb 1,3-DCP in acid-hydrolyzed vegetable proteins (on a dry basis) were established by the Food Chemicals Codex (FCC) in December of 1997. Following discussions with FDA, the US industry has voluntarily complied with these FCC specifications which appear to provide a significant margin of safety to protect the public from the diverse array of products that use acid-HVP. By limiting the amount of 3-MCPD permitted in acid-HVP, manufacturers can reasonably control the formation of 1,3-DCP.

19. In 2000, the US FDA began a survey of soy sauces and related products. Fifty-five samples have been analyzed for 3-MCPD. Sixty percent of the samples were found to contain greater than the laboratory quantification limit (LQL) of 0.025 mg/kg 3-MCPD in soy sauce; the highest level found was 876 mg/kg. Thirty-nine of the samples analyzed for 3-MCPD were also analyzed for 1,3-DCP. Of these samples, 36 percent were found to contain greater than the LQL of 0.025 mg/kg 1,3-DCP in soy sauce ; the highest level found was 9.8 mg/kg. Survey samples that were found to contain 1,3-DCP also contained 3-MCPD. The survey data suggests that soy sauce and related products with greater than 10 mg/kg 3-MCPD could be suspected to contain higher amounts of 1,3-DCP ranging from approximately 0.250 to 10 mg/kg. In 2002, a limited survey of chloropropanols in canned tuna was conducted. Of the thirteen samples analyzed, none were found to contain 3-MCPD greater than the LQL of 0.014 mg/kg for canned tuna; only one sample was found to contain 1,3-DCP at slightly greater than the LQL of 0.019 mg/kg. The FDA continues to monitor chloropropanol levels and evaluate its risk management options to lower chloropropanols in soy sauces in order to eliminate any significant health risk from these products.

20. The FDA, in its formal quantitative risk assessment of 3-MCPD completed in 2000, concluded that 3-MCPD was genotoxic and carcinogenic, this assessment was provided to the 57th JECFA. The FDA arrived at its findings prior to the UK's release of the results of its genotoxicity studies, it's assessment of the mutagenicity of 3-MCPD and the conclusion reached by the 57th JECFA in June 2001 that 3-MCPD was not genotoxic *in vivo*.

ACTIVITIES BY NON-CODEX MEMBER ORGANIZATIONS ON CHLOROPROPANOLS

European Community

21. The European Commission's Scientific Committee on Food (SCF) assessed new toxicological data in May 2001 and reassessed their opinion to set a Tolerable Daily Intake (TDI) of 3-MCPD at 2 μg/kg bw.[18]

22. On 8 March 2001 the European Commission adopted Commission Regulation (EC) 466/2001 setting maximum levels for certain contaminants in foodstuffs, including amongst other things maximum levels for 3-MCPD in soy sauce and in hydrolysed vegetable protein[25]. The maximum levels of 0.02 mg/kg (for the liquid product containing 40% dry matter, corresponding to a maximum level of 0.05 mg/kg in the dry matter) took effect on 5 April 2002. A separate Commission Directive has been prepared on sampling and analysis methods[26].

23. It is recognised that 3-MCPD can be found in other foods and food ingredients not currently covered by this regulation. However, the European Community considers that further data are required before it discusses limits for these other products. can take place. A European Community Scientific Co-operation (SCOOP) task to collect and collate data on the levels of 3-MCPD and related substances in foodstuffs is due to be completed in 2003. This is being jointly co-ordinated by Sweden and the UK. A review of information on 3-MCPD and related chloropropanols in foodstuffs shall be completed in the light of the report from this task. The maximum levels for 3-MCPD in soy sauce and HVP will then be reassessed and the possible need for maximum levels in other foodstuffs will be considered.

24. High levels of 3-MCPD are continuing to be found in samples of soy sauce and related products sold within the European Community, with some Member States ordering the removal of some highly contaminated products from the market.

Food Chemicals Codex (FCC)

25. Discussions began in the early 1990s between the International Hydrolyzed Protein Council (IHPC) and the United States Food and Drug Administration regarding the need to control levels of 3-MCPD and DCP in acid-HVP. IHPC conducted annual surveys of 3-MCPD levels in acid-HVP and shared these data with FDA, which also had conducted its own analysis of 3-MCPD levels in acid-HVP. As a result the FCC published suggested limits,[27] which were "not more than 1 mg/kg, calculated on a dry basis" for 3-MCPD and "not more than 0.05 mg/kg, calculated on a dry basis" for 1,3-DCP. On a liquid basis these limits are 0.4 mg/kg and 0.02 mg/kg respectively.

SETTING LIMITS IN FOOD

26. The 57th Session of the JECFA discussed the impact of regulatory limits for 3-MCPD in foods. The JECFA further noted that 'the available evidence suggests that 1,3-dichloro-2-propanol is associated with high concentrations of 3-chloro-1,2-propandiol in food. Regulatory control of the latter would therefore obviate the need for specific controls on 1,3-dichloro-2-propanol' A limited amount of data was available and so the impact of setting limits in foods other than soy sauce could not be reliably ascertained.

27. A number of countries have introduced maximum levels for chloropropanols, including Malaysia (0.02 mg/kg for 3-MCPD in foods containing HVP and 1 mg/kg for 3-MCPD in acid-HVP)[28], Australia and New Zealand (0.2 mg/kg for 3-MCPD and 0.005 mg/kg for 1,3-DCP in soy and oyster sauces)[20], Thailand (1 mg/kg in seasoning products from soy protein hydrolysis)[23] and the European Community (0.02 mg/kg in soy sauce and in hydrolysed vegetable protein, for the liquid product containing 40% dry matter, corresponding to a maximum level of 0.05 mg/kg in the dry matter)[25]. Canada introduced an interim guideline of 1ppm for 3-MCPD in sauces.[21] and the United States, via the Food Chemicals Codex, has established limits of 1 ppm 3-MCPD and 50 ppb 1,3-DCP in acid-hydrolyzed vegetable proteins (on a dry basis).[27]

28. The position paper (CX/FAC 02/28) presented at the 34th session asked members to consider the setting of limits at the 35th session and to assist in this process information was requested on:

- levels of chloropropanols in foods and food ingredients;
- dietary exposure to chloropropanols;
- the origin and formation of chloropropanols;
- production methods which can be utilised to avoid chloropropanol contamination.

29. Information on levels of chloropropanols was received from Australia and Japan (paras 15-18). A number of exposure assessments for 3-MCPD where also made, however these assumed that only soy sauce contributed to exposure whereas there is evidence to suggest that other foods may contribute (para 28). The estimates also failed to consider the exposure of vulnerable groups who may for one reason or another (such as brand loyalty) regularly consume soy sauces containing high levels of chloropropanols.

30. As part of the European SCOOP task the UK has compiled a database of all available information on the levels of 3-MCPD and related substances in foodstuffs in the European Union. Both Member States and industry have provided data for this task. Additionally each country that supplied data has conducted their own exposure assessment. The final report for the SCOOP task is to be issued in 2003. Preliminary assessment of the results shows that there are foods other than soy sauce that may contribute significantly to the overall exposure to chloropropanols. Additionally the task collected data on the levels of other chloropropanols including 1,3-DCP and will provide further information on the ratio of 3-MCPD to 1,3-DCP. This will inform the discussion on whether or not the establishment of limits for 3-MCPD will obviate the need for limits for 1,3-DCP.

31. It was proposed at the 34th Session of the Codex Committee on Food Additives and Contaminants (CX/FAC 02/28) that the Global Environment Monitoring System – Food Contamination and Assessment Programme (GEMS/Food) regional diets[29] could be used to conduct an exposure assessment using the SCOOP occurrence data. The GEMS diets provides information on per capita consumption of raw and semi-processed foods and are derived from food balance sheet which are based on a country's annual production, imports and exports. The diets are currently used to predict dietary intakes of pesticides according to internationally accepted methodologies. The GEMS diets are therefore most useful in predicting intakes from pesticides and other chemicals present mainly in raw agricultural products. In contrast the data collated from the SCOOP task are mainly from processed foods and therefore it is difficult to relate these data to the raw agricultural products in the GEMS diets database without making assumptions as to how much of a particular agricultural product is used to produce a specific processed food. (e.g. how much maize is used in the production of breakfast cereal). It is therefore felt that this approach is not valid.

SUMMARY

32. The 57th Session of the JECFA considered 3-MCPD and 1,3-DCP in June 2001. It recommended a provisional maximum tolerable daily intake (PMTDI) for 3-MCPD of 2 μg/kg bw/day and concluded that the establishment of a tolerable intake for 1,3-DCP was inappropriate because of the nature of toxicity.

33. Chloropropanol contamination is a food safety issue that has international implications and a number of countries have introduced maximum levels for chloropropanols. Therefore a harmonised approach to control chloropropanol levels in foods is required to protect consumers. Comments received on the position paper on chloropropanols (CX/FAC 02/28 – Add 1) presented to the 34th Session indicated that a number of Codex members and Non-Governmental Organisations supported the setting of limits in foods, particularly soy sauce and acid hydrolysed vegetable protein.

34. The 57th Session of the JECFA identified soy sauce and acid hydrolysed vegetable protein as the major dietary sources of chloropropanols. However the occurrence of chloropropanols in other foods and their dietary contribution to chloropropanol intake needs additional information.

35. The data collated as part of the SCOOP task has been used to conduct intake assessments for those European countries that participated. Data from the United States, Australia and Japan are also available. These assessments could therefore be compared to the JECFA PMTDI to assist in the estimation of proposed maximum levels for chloropropanols. However data on intakes from other countries would be required in order to propose internationally applicable maximum levels. .

36. Therefore in order for a proposal to be made for setting maximum levels for chloropropanols in foodstuffs at the 36th Session, members of CCFAC are asked once again to provide information on levels of chloropropanols in foods and food ingredients and also dietary exposure to chloropropanols.

RECOMMENDATIONS

37. The 35th CCFAC should propose as new work the elaboration of maximum levels for 3-MCPD in acid hydrolysed vegetable protein and soy sauce and other foods as appropriate, consistent with principles described in the Preamble to the Codex General Standard for Contaminants.

38. The 35th CCFAC should request additional information on the occurrence of chloropropanols (3-MCPD and 1,3-DCP) in food and dietary exposure to chloropropanols (3-MCPD and 1,3-DCP) for presentation to the 36th CCFAC.

ANNEX I: POSSIBLE SOURCES OF CHLOROPROPANOLS IN THE DIET

(a) Acid-HVP

39. The procedure used to manufacture the savoury food ingredient acid-HVP can result in the formation of 3-MCPD and 1,3-DCP. Most acid-HVP is produced using hydrochloric acid. 3-MCPD is formed as a result of the high temperature chlorination of lipids present in the protein starting materials, 1,3-DCP can then be formed from the 3-MCPD precursor.[1] Surveys carried out by the UK Government in 1990 and 1992 showed that 3-MCPD levels of up to 100 mg/kg were quite common in acid-HVP at that time.[2, 3] Since 1992, levels of 3-MCPD in acid-HVP used in the UK have declined markedly, as was shown by the results of a 1999 survey of acid-HVP in which 3-MCPD was undetectable (less than 0.01 mg/kg) or was found at low levels in over 75% of the 50 samples analysed.[4] 1,3-DCP was found in only one sample in the 1990 survey, with none being detected in any of the 34 samples analysed in the 1992 survey.[2, 3] No further analysis of 1,3-DCP in acid-HVP has been published.

(b) Food Ingredients other than Acid-HVP

40. A survey of 3-MCPD in 63 samples of food ingredients available in the UK was reported in 2001.[5] 3-MCPD was quantified in 22 % of the samples using a validated method of analysis with a limit of quantification of 0.01 mg/kg. 3-MCPD was not found in any of the samples of yeast extracts, caramels or gelatines. 3-MCPD was quantified in 1 of 6 samples of breadcrumbs, 1 of 3 samples of enzyme HVPs, 1 of 5 samples of meat extracts, 2 of 7 samples of modified starches and in 9 of 24 samples of malts and malt-based ingredients. The highest level was 0.49 mg/kg for a modified starch (maize yellow dextrin). These controls have already been put in place successfully by European and US acid-HVP manufacturers.

(c) Soy sauces

41. Following the continued detection of high levels of 3-MCPD in samples of soy sauces sold in member states, authorities in European Community member states are continuing to report[a] elevated levels in some products. In the UK, a survey of 100 samples of soy sauce and related products showed that around one-third of the samples contained quantifiable levels of 3-MCPD (ie at or above 0.01 mg/kg)[5], the highest being 93.1 mg/kg. These products were imported from Thailand, China, Hong Kong and Taiwan, indicating that higher levels are not restricted to any one country of origin. A follow-up survey of 3-MCPD and 1,3-DCP levels in soy sauce and related products conducted in the UK in 2002[11] found 9 of the 99 samples contained levels of 3-MCPD above 0.01 mg/kg, with the highest being 35.9 mg/kg (normalised to 40 % dry matter content). Only one sample was found to contain 1,3-DCP, this was at a level of 0.017 mg/kg and was the same sample that contained the highest level of 3-MCPD.

42. In the US, a survey of 55 soy sauces and related products was conducted. 3-MCPD determination were made according to the UK validated method. Sixty percent of samples were found to contain 3-MCPD greater than the laboratory quantification limit of 0.025 mg/kg. Thirty-three percent of the samples were found to contain greater than 1 mg/kg; the highest level was 876 mg/kg 3-MCPD. In addition to products imported from Thailand, China, Hong Kong, and Taiwan, as noted by the UK, products imported from the Philippines also were among those containing the highest levels.

43. Soy sauce can be manufactured by a range of processes, including traditional fermentation as well as processes which involve the use of an acid treatment or include acid-HVP as an ingredient. It is known that such acid treatments can generate very large amounts of 3-MCPD unless the processing conditions are well controlled. These controls have already been put in place successfully by many European acid-HVP manufacturers. Thus, it should be possible to bring in similar controls during soy sauce manufacture.

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[a] Notifications have been made within the European Community via the Rapid Alert System for Foodstuffs. This is a communications network administered by the European Commission, which allows action of food safety taken by one Member State to be followed up across the Community.

44. A further consequence of relatively high levels of 3-MCPD in soy sauces is that a considerable amount of 1,3-DCP can also be detected in such products.[8, 10] In a UK survey of 100 samples of soy sauces and related products 17 % of samples contained quantifiable levels of 1,3-DCP (ie at or above 0.005 mg/kg).[10] All samples with quantifiable levels of 1,3-DCP were found to contain levels of 3-MCPD above the EU limit of 0.02 mg/kg for 3-MCPD in soy sauce and HVP based on a 40% dry matter content. Of the 55 samples surveyed by the US FDA for 3-MCPD, 39 of these samples also were analyzed for 1,3-DCP by using a modification of the UK method that was validated at the FDA. Thirty-six percent of the samples analyzed for 1,3-DCP were found to contain greater than the laboratory quantification limit of 0.025 mg/kg; the highest level found was 9.8 mg/kg 1,3-DCP. Survey samples that contained 1,3-DCP also contained 3-MCPD.

(d) Foods other than Soy Sauces

45. A survey conducted in the UK has shown that 3-MCPD is present in a wide range of foods. The foods analysed were from five main food groups thought most likely to contain 3-MCPD, including cereal products, soups, meat products and dairy produce. 30% of the 300 retail food samples analysed in this survey contained quantifiable levels of 3-MCPD, these included baked goods, bread and cooked/cured meat/fish.[6]

(e) Domestic cooking

46. A limited amount of work has been conducted to investigate the effect of cooking on the formation of 3-MCPD in food[30]. The results of this work showed that elevated levels of 3-MCPD can occur in toasted bread, some grilled cheeses and fried batters. In contrast, 3-MCPD was undetectable or present only at very low levels in cooked meat, gravy, sauces and stocks. In the UK survey of 3-MCPD[6] in food in all the cases where 3-MCPD was detected in cooked foods it was also present in the uncooked food. However, the data were insufficient to say whether cooking contributed towards the formation of 3-MCPD in food. Further research is being conducted in the UK to investigate the effect of domestic cooking on 3-MCPD formation.

(f) Formation of 3-MCPD in food

47. Despite its widespread occurrence, research into the mechanisms for 3-MCPD formation has not been published for foods other than acid-HVP. The UK Government have commissioned a research project to investigate the factors effecting the formation of 3-MCPD in foods which is due to be completed in 2004.

(g) Packaging materials

48. Information from the packaging industry and others indicates that very low levels of 3-MCPD may migrate into food and beverages from packaging materials. 3-MCPD is present in certain types of epichlorohydrin-based wet strength resins used in paper (e.g. tea bag paper, coffee filters, absorbent meat padding) and cellulose casings. Work has been carried out by the industry to develop 'third generation' resins that have significantly lower levels of 3-MCPD, and these are increasingly being used in the above applications. With the increase in the availability and use of these resins, 3-MCPD exposure from this source will continue to decrease.

(h) Water

49. There is a theoretical risk that very low levels of chloropropanols may be found in drinking water from upland areas in the UK. This is due to its presence as a contaminant of epichlorohydrin-linked cationic polymer resins in flocculants used for water purification in a small number of treatment plants. Current controls allow no more than 40 ppm of 3-MCPD in polyamine flocculants, coupled with a maximum dosing rate of 2.5 mg of flocculant per litre of water. This ensures a theoretical maximum possible concentration of 3-MCPD in drinking water of 0.1 µg/l.[31]

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