Structural Diversity of MCPD Esters in Food: Significance and Analytical Challenges

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Chloropropanols are a group of chemical contaminants that may be formed in certain food ingredients during processing. The most prevalent isomer among this group is 3-monochloropropane-1,2-diol (3-MCPD). 2-Monochloro-propane-1,3-diol (2-MCPD) as well as 2,3-dichloropropan-1-ol (2,3-DCP) and 1,3-dichloropropan-2-ol (1,3-DCP) may also occur in food, but at lower concentrations.

Previous research indicated that MCPD-esters are accepted as substrates by lipase from *Aspergillus Oryzae*. Because of their structural similarity with triacylglycerols, it was hypothesised that 3-MCPD-esters may also be hydrolysed by mammalian gut lipases. This was confirmed *in vitro* by incubating mono- (sn1) and di- esters in an intestinal model containing an excess of pancreatic lipases. The release of free 3-MCPD from the diester was much slower than from the 1-monoester. In this model 2-MCPD-esters were found to be slightly more susceptible than 3-MCPD-esters to the action of lipases. Other data suggested a possible significant role of the food matrix on the extent of MCPD-ester hydrolysis. MCPD-esters in bread seemed to be more accessible (83-103% recovered after 4 h incubation) to gut lipases than MCPD-esters in oils (25-50% of bound 3-MCPD recovered from pure palm oil).

Recently the presence of fatty acid esters of 3-MCPD has been reported in various types of foods and food ingredients, especially in refined vegetable oils. Currently, 3-MCPD-esters are analyzed by measuring the amounts of 3-MCPD released from the esters after hydrolysis. Such an approach does not differentiate between mono and diesters. This may constitute a significant limitation for safety assessment since metabolic considerations suggest that mono and diesters may exhibit differential sensitivities to gut lipases. Analytical approaches to separate and quantify mono- and diesters of 3-MCPD will be presented.

Although focus has been on esters of 3-MCPD, studies in experimental model systems have revealed that fatty acid mono- and diesters of other chloropropanols can also be formed from triacylglycerols in the presence of hydrochloric acid and heat. The actual occurrence of such chloroesters in food materials has only been marginally investigated. Data on 2-MCPD-esters will be presented. Special focus will be set on the formation of 2-MCPD esters during the roasting of barley and over the refining process of edible oils.

The preliminary data available indicate that the issue of MCPD-esters in food is not restricted to 3-MCPD-esters and raises significant analytical challenges. Further investigations are necessary to fully understand the complexity and significance of this class of foodborne chemical contaminants.