

Investigation of the Mechanism of the Formation of 3-MCPD Esters during Oil Refining

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3-Chloropropane-1,2-diol (3-MCPD) was first identified in acid-hydrolysed vegetable proteins and soy-sauces a few decades ago and shown to be a product of the reaction of hydrochloric acid with residual lipids present in raw materials. It was shown later that 3-MCPD does not occur only in a free form, but also esterified by one or two fatty acids (bound form, 3-MCPD esters). The occurrence of 3-MCPD esters has been reported in a variety of raw ingredients (malt, coffee) and foodstuffs (bread and other cereal-based products, meat and dairy products). Recently, significant levels of 3-MCPD esters have been found in various processed vegetable oils assuming the reaction of chloride ions with (partially hydrolysed) glycerolesters during the refining process. Since refined oils are used in various food products (either as ingredients or as a medium during the processing), there is an enormous interest to elucidate the mechanism of 3-MCPD esters formation during refining and possibly apply relevant mitigation strategies. Although the mechanism of the heat-induced formation of 3-MCPD esters from (partially hydrolysed) triglycerides under acidic conditions (involving nucleophilic substitution and formation of cyclic acyloxonium cation) has been previously proposed, the detailed molecular mechanism and understanding of the critical factors are still unclear. This speech concentrates on the evaluation of individual steps of oil refining process with respect to the formation of 3-MCPD esters, taking into account several variables, both compositional variation of the material used (e.g. the content of mono- and diacylglycerols) and process conditions (e.g. the deodorisation temperature), that may bring more clarity into the subject.