

DETERMINATION OF 3-MCPD AND GLYCIDYL ESTERS IN VEGETABLE OILS

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Abstract

The article presents modern knowledge about the mechanisms of formation of esters of fatty acids 2-, 3-monochloropropanediol (MCPD) and glycidyl esters (GE). The only source of GE detection in food products is refined vegetable oil, in which they are formed when diacylglycerols (DAG) or monoacylglycerols (partially glycerols) are heated by removing water or fatty acids under conditions of high-temperature deodorization. The highest amount is found in high DAG oils, such as palm oil. The mechanism may include acloxonium ions or intermolecular DAG reaction. The aim of this study is to reduce the content of monochloropropanediol and glycidol esters in refined vegetable oils, which pose a danger to human health. This problem can be solved by understanding the mechanisms of formation of esters of monochloropropanediol and glycidol in oils, mastering the methodology of their analysis and developing the necessary action strategy based on the knowledge gained about the formation of MCPD or GE esters.

The research materials are sunflower oil, rapeseed oil, corn oil, corn oil, olive oil, palm oil, soybean oil, which were purchased in JSC "Eurasian Foods" in the city of Karaganda. All analyzed samples of vegetable oils were within the limits established for the acid value. Acid value of vegetable oils varies in the range of 0.2-4.6 mg KOH/g. Peroxide value of the studied vegetable oils varies in the range of 0.8-9.8 meq O₂/kg. Anisidine value of the studied vegetable oils varies in the range of 2.5-6.4.

Concentrations of 3- MCPD and GEs in the palm oil were significantly higher than other vegetable oils. The amount of GE detected in vegetable oils fell within the permissible limits, postulating that all vegetable oils, other than palm oil, are safe for human consumption.

Determination of glycidyl esters in terms of glycidol was carried out by gas chromatography with mass-selective determination in SIM mode (selective ion monitoring) in accordance with the procedure described in ISO 18363-1:2015 "Animal and vegetable fats and oils. Determination of the content of fatty acid esters of monochloropropanediols (MCPD) and glycidol using GC-MS". Concentrations of 3- MCPD and GEs in the palm oil were significantly higher than other vegetable oils. The amount of GE detected in vegetable oils fell within the permissible limits, postulating that all vegetable oils, other than palm oil, are safe for human consumption.

Thus, products with a high concentration of these pollutants, as well as their precursors, are still widely available to consumers. There are many recommendations for the use of strategies to reduce the formation of pollutants. Their efficiency at the industrial level requires the efforts of all participants in the production chain, which will solve future problems of increasing the database to reduce the content of glycidyl esters.

Key words: Monochloropropanediol (MCPD), Glycidyl esters (GE), Food products, Glycidol, Vegetable oils, Esters.