

ANNOTATION

of dissertation work by Toishimanov Maxat on the topic " Improvement the quality and authenticity evaluation method of seed oils fatty acid composition by gas chromatography with mass spectrometric detection", submitted for the degree of Doctor of Philosophy (PhD) under the educational programm 8D07501-“Standardization and certification (by industry)”

Relevance of the research topic.

Authentication of food products has been constantly evolving in situations that have been largely determined by global market trends. Analytical methods have been developed or modified to provide plausible solutions to insidious falsifications at any time. Classical tests have largely been replaced by newer technical procedures, most of which are based on gas chromatography. However, with the use of modern technology, complex falsifications are solved, which are a new challenge these days, although promising proposals for detecting such falsifications using databases and statistical algorithms are emerging.

The oil and fat industry in the Republic of Kazakhstan is one of the dynamically developing and export-oriented industries. The value of domestic oilseeds is confirmed by their food, feed and agrotechnical role. Vegetable oils and fats obtained from oilseeds form the basis of rational nutrition of the country's population.

Identification of vegetable oil products is an important task in the field of food safety. The assessment of the fat phase of vegetable oil products is carried out according to the fatty acid composition. But the lack of specific substantiated indicators of various mixed oils can lead to controversial situations. The currently available methods of analysis according to standards, technical conditions, guidelines, technical regulations do not solve the entire problem of authentication, but only allow identifying a separate indicator. In controversial situations, the results obtained on the fatty acid composition of vegetable oils do not allow obtaining comprehensive answers to the question of the fatty phase of oils. In such cases, the lack of standard indicators for the quantitative determination of fatty acids leads to unreliable results. Therefore, due to the lack of proper quality control for the fatty acid composition of vegetable oils, it is necessary to develop an improved method for assessing the criteria, introduce additional indicators, systematize and establish quality control and implement new technologies for determining the quality.

The purpose of the dissertation research is to determine the export potential for fatty acid composition of finished domestic vegetable oils and plant materials (seeds) using an improved method of gas chromatograph with mass spectrometric detection. In accordance with the above, the following tasks were set.

Research objectives:

- Analysis of regulatory documentation for determining the fatty acid composition of finished domestic vegetable oils and plant materials (seeds) for export potential and domestic demand (production, export, import);
- Monitoring and determining the quantitative content of fatty acid composition of the main types of vegetable oils on the market (sunflower, rapeseed, soybean, corn, linseed, cottonseed, safflower) using gas chromatography;
- Conducting a comparative analysis of domestic vegetable oils according to international requirements;
- Improvement of the existing gas chromatography method using mass spectrometric detection;
- Validation and testing of an improved method for determining fatty acid composition using gas chromatography with mass spectrometric detection;
- Application of chemometric multivariate data analysis tools.

Substantiation of the novelty and practical significance of the results obtained.

Scientific novelty. Possibilities of using gas chromatography with mass spectrometric detection to identify the fatty acid profile of vegetable oils.

The scientific work has practical value, since it contributes to the methodology for identifying the fatty phase of vegetable oils using modern gas chromatography with mass spectrometric detection.

To improve the method of sample preparation for determining the fatty acid composition by GC-MS, a method for extracting methyl esters of fatty acids from plant materials (seeds) will be developed.

The tools of chemometric multivariate data analysis - principal component analysis (PCA), cluster analysis (CA), discriminant analysis (DA) - will be used to extract significant variables, visualize differences and classify between the analyzed samples of vegetable oils.

Significant differences in the fatty acid profile of domestic vegetable oils were established when compared with other markets, due to differences in climatic and genotypic differences in oilseeds. It has been proven that an improved GC-MS method for determining the fatty acid composition of vegetable oils using chemometric data analysis tools allows for identification to confirm the authenticity of a particular type of oil.

This work represents a new concept for the application of fatty acid analysis in developing authentication methods for industrial crops and their main food products.

Practical significance. A method for identifying the fatty phase of vegetable oils using modern gas chromatography with mass spectrometric detection has been developed and implemented in the laboratory. The developed method will allow for its subsequent standardization. The research results have been implemented in the practice of the testing center of the Kazakhstan-Japan Innovation Center of the Kazakh National Agrarian Research University (Accredited in the accreditation system of the Republic of Kazakhstan for compliance with the requirements of GOST ISO/IEC 17025. Accreditation certificate No. KZ.T.02.2314 dated March 18, 2020). During the implementation of the developed method of gas

chromatography with mass spectrometric detection for analyzing the composition of fatty acids, the sample preparation method was improved and optimal chromatography modes were established.

The author's personal contribution consists in setting the necessary tasks, planning and conducting experiments, statistical processing of the results obtained and their publication, conducting industrial testing of the developed model; development of regulatory documentation.

Compliance with the directions of science development or state programs:

The research was conducted within the framework of the Scientific and Technical Program of the Scientific and Technical Center of the Ministry of Agriculture of the Republic of Kazakhstan for 2021-2023: BR10764970 "Development of science-intensive technologies for deep processing of agricultural raw materials in order to expand the range and output of finished products per unit of raw materials, as well as reduce the share of waste in the production of products" subsection "Development of technologies for processing agricultural raw materials using Halal standards".

Scientific provisions submitted for protection:

- The regulatory and technical basis for quantitative determination of the fatty acid composition of vegetable oils is a set of regulatory and legal acts;

- The obtained array of statistical data on the results of quantitative determination of the fatty acid composition of vegetable oils made it possible to identify the ranges of the fatty acid content of domestic vegetable oils;

- An improved method for quantitative determination of the fatty acid composition of vegetable oils was validated and tested in accordance with the International Council for Harmonization.

- A recommendation was developed for enterprises to improve the method for assessing the quality of vegetable oils by fatty acid composition.

Approbation of the work.

- The research results were tested in laboratory conditions.

- Standard and modern methods of statistical data processing were used, which show the reliability of the results of the work.

- A recommendation was developed for the enterprise to improve the method.

- The research results were presented in scientific journals at international scientific and practical conferences.

Description of the doctoral student's contribution to the preparation of each publication:

All the results and conclusions given in the dissertation were obtained and formulated with the direct participation of the applicant in accordance with the results of the study. The doctoral student mastered the research methodology, took an active part in the discussion and publication of the results obtained, preparation and registration in domestic and foreign scientific journals.

Publications. The main results of the dissertation work have been published in 6 scientific papers, 4 of which are in journals included in the Scopus database with non-zero impact factors «Sustainability», 2024, 88% (Q1), «Applied

Sciences» 2024, 79% (Q1), «Natural product research» 2024, 78% (Q1) and «Scientific Horizons» 2024 49%. 2 works were published in international scientific and practical conferences of the CIS and the EU.

The structure and scope of the dissertation. The dissertation consists of an introduction, four sections, a conclusion, a list of used sources from 238 titles and appendices. The text of the dissertation is presented on 85 pages and contains 23 tables, 25 figures.