Conclusion. The programme for kinematic analysis of a lever mechanism based on the "assur" module allows for detailed calculation of positions, velocities and reactions in the links. It is based on mathematical models implemented in a programming language and provides:

1. versatility by supporting various assur groups;
2. accuracy, through the use of trigonometry and differential calculus;
3. the possibility of optimising designs through dynamics analysis.

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OVERVIEW OF METHODS FOR THE DETERMINATION OF CRUDE FAT CONTENT

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The determination of crude fat content is an important task in the food industry, agriculture and laboratory research. Crude fat is a mixture of fatty acid triglycerides and associated fat-like substances such as free fatty acids, alcohols, aldehydes, provitamins and pigments. Accurate determination of fat content is essential for product quality control, regulatory compliance and consumer safety.

The aim of the research is to study and comparative analysis of methods for determination of crude fat content in fodder, mixed fodder and feed raw materials in order to select the most effective approaches providing accuracy, speed and cost-effectiveness of analysis.

Material and methods. The work is based on the results of analyses of scientific and technical information, normative documents (GOST 32905-2014) and studies devoted to methods of fat extraction, their physicochemical properties, as well as the application of modern technologies such as infrared spectroscopy and machine learning methods.

Results and their discussion. The study includes:

1. Analysing the theoretical basis of different methods for fat determination, including classical (e.g. Soxhlet method, Gerber method) and modern (NIR spectroscopy, machine learning).
2. study of regulatory requirements for accuracy, repeatability and reproducibility of the results established in GOST 32905-2014.
3. assess the influence of factors such as sample type, analysis conditions and equipment on measurement uncertainties.
4. Comparison of the advantages and disadvantages of each method in terms of accuracy, speed, cost and applicability to different product types.

The **Soxhlet method (solvent extraction)** is the classical method of extracting fats from products using organic solvents such as ether or chloroform. This method is based on dissolving fats in organic solvents, which then evaporate, leaving pure fat. Calculation formula:

$$w = \frac{m_2 - m_1}{m_0} \cdot 100, \quad (1)$$

where: w – fat content in per cent; m_0 – mass of initial sample (g); m_1 – mass of empty extraction flask before extraction (g); m_2 – mass of extraction flask after extraction (g).

The Gerber method is used for the rapid determination of fat content in milk and milk products. It is based on the interaction of fats with sulfosinilic acid, which destroys the protein shell of fat globules. Calculation formula:

$$w = \frac{V \cdot F}{m_0} \cdot 100, \quad (2)$$

where: w – fat content in per cent; V – volume of fat phase (ml); F – correction factor; m_0 – mass of initial sample (g).

Near-infrared **(NIR) infrared spectroscopy** (NIR) is an advanced method based on the analysis of the absorption of infrared light by fat molecules. This method allows the determination of fat content quickly and without destroying the sample. Regression formula:

$$w = a_0 + a_1 \cdot I_1 + a_2 \cdot I_2 + \ldots + a_n \cdot I_n, \quad (3)$$

where: w – fat content; $I_1, I_2, \ldots, I_n$ – absorption intensities at different wavelengths; – $a_0, a_1, \ldots, a_n$ – regression coefficients.

Machine learning techniques are used to predict fat content based on various product parameters such as density, colour and texture. This is particularly useful for complex products where traditional methods are less effective. Example algorithm:

$$w = f(x_1, x_2, \ldots, x_n), \quad (4)$$

where: w – fat content; $x_1, x_2, \ldots, x_n$ – input parameters (e.g. spectral data, physical properties); f – machine learning model.

Conclusion. The methods are based on different physico-chemical properties of fats (solubility, density, spectral characteristics, etc.). The choice of method depends on various factors. Each method for the determination of crude fat content has its own characteristics that make it more or less suitable for specific conditions of use. The choice of method depends on the type of product, accuracy required, availability of equipment and cost of analysis. Modern methods such as NIR spectroscopy and machine learning offer new opportunities for automation and improved accuracy of analysis.

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