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METHODS FOR DETERMINING MOISTURE CONTENT IN LIGHT INDUSTRY PRODUCTS AND THEIR RELEVANCE

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Abstract
Moisture content is one of the most critical parameters affecting the quality, durability, and technological performance of light industry products such as textiles, leather goods, and food-related materials. Accurate determination of moisture content is essential for ensuring product compliance with quality standards, optimizing manufacturing processes, and preventing deterioration during storage and transportation. This article provides an overview of the main methods used to determine moisture content in light industry products, with particular emphasis on their applicability, advantages, and limitations. Special attention is given to the gravimetric (drying) method, which is considered a reference technique due to its high accuracy and reliability. The relevance of moisture measurement methods is analyzed in terms of production efficiency, quality control, and long-term product preservation. The study highlights the importance of selecting appropriate moisture determination techniques depending on the type of material and industrial requirements.

Keywords: Moisture content; light industry products; quality control; gravimetric method; drying method; storage stability; production optimization.

Introduction

Light industry enterprises produce a wide range of products, including textiles, leather goods, food products, and others. In ensuring the quality of these products and preparing them for long-term use, moisture content is

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considered a crucial factor. Accurate and reliable measurement of moisture content is essential for maintaining the quality of light industry products, improving storage conditions, and optimizing production processes.

Methods for Determining Moisture Content

Several methods are used to determine moisture content in light industry products, each having its own advantages and disadvantages.

1. Gravimetric (Drying) Method

This is the most traditional and widely used method. The moisture content of a product is determined by drying it to a constant weight and calculating the difference between the initial and final weights. This method provides high accuracy but requires a considerable amount of time.

The method is considered highly reliable and standard. First, the product's weight in its moist state is measured. Then, it is dried at a specified temperature (usually 100–105 °C), after which the weight is measured again.

Advantages:

- Very accurate and reliable
- Recognized as a standard method (ISO, GOST, etc.)

Disadvantages:

- Time-consuming (from 30 minutes to 3 hours)
- Requires laboratory conditions and manual labor
- Strict temperature control is necessary

2. Electrical Conductivity Method

This method determines moisture content by measuring the electrical properties of the product. It is fast and simple, but the accuracy may depend on the type of moisture and the composition of the material.

The method is based on the principle that as moisture content increases, the electrical conductivity or dielectric constant of the product also increases. Instruments measure these properties to determine moisture content.

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Main types:

- Conductometric method – based on electrical current flow
- Capacitance method – based on changes in electrical capacitance
- Microwave method – based on high-frequency electromagnetic waves

Advantages:

- Very fast (results within 1–2 seconds)
- Portable and modern devices are available
- Can be integrated into production lines

Disadvantages:

- Results depend on material composition and density
- Requires calibration
- May not detect moisture in deeper layers

3. Infrared Spectroscopy

In this method, infrared (IR) radiation is directed at the product, and the degree of absorption is measured. Moisture content is determined based on the absorption of infrared radiation by water molecules. This method is fast and highly accurate.

Infrared rays are absorbed by water molecules at specific wavelengths. The intensity of reflected or transmitted IR radiation is measured to determine moisture content.

Advantages:

- Extremely fast (up to 1 second)
- High accuracy
- Suitable for laboratory and real-time (online) measurements
- Non-destructive method

Disadvantages:

- Product surface must be smooth
- High cost of infrared spectrometers
- Product color and composition may affect results

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4. Ultrasonic Method

This modern and non-invasive method uses ultrasonic waves to determine moisture content within a product. However, it requires specialized equipment.

Ultrasonic waves pass through the product, and changes in wave velocity and attenuation caused by moisture content are analyzed.

Advantages:

- Allows detection of internal moisture
- Non-invasive and fast
- Does not damage the material

Disadvantages:

- Expensive equipment
- Applied when full-volume moisture measurement is required
- Requires special preparation

5. Chemical Methods

In certain cases, moisture content can be determined using chemical reagents. These methods are complex and mainly used in laboratory conditions.

Chemical reagents react with water molecules in the product to determine moisture content. The most widely used method is Karl Fischer titration, which involves a reagent (iodine-based) that reacts specifically with water molecules.

Advantages:

- Extremely high accuracy (up to 0.001%)
- Suitable for precise laboratory measurements
- Applicable to substances other than water

Disadvantages:

- Requires specialized laboratory facilities and expertise
- Reagents are expensive
- Handling active chemicals may be hazardous

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Relevance of Moisture Determination

Product quality and service life: Moisture content directly affects product quality. For example, excessive moisture in textile products can cause rotting and mold formation.

Storage and transportation conditions: Incorrect determination or lack of moisture control can lead to product spoilage and economic losses.

Production process control: Regular moisture measurement ensures production stability and helps optimize energy and raw material consumption.

Competitiveness: Offering high-quality products in the market enhances a company's reputation and strengthens customer trust.

Conclusion

The correct selection and application of moisture determination methods in light industry products play a vital role in ensuring product quality. By using modern, fast, and accurate methods, industrial enterprises can improve product quality, efficiently manage production processes, and achieve economic benefits. Therefore, moisture determination and control remain a relevant and essential issue in the development of the light industry.

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