

expensive, which can increase the price of the final product. Also, not all countries have the equipment to produce these materials yet. Another big challenge is teaching people how to use this packaging correctly — for example, how to recycle it or how to read “smart” indicators.

To wrap up, I want to say that innovative packaging is much more than just a wrapper; it is a vital tool in the fight against hunger and environmental crisis. As a student of the Food Technology department, I see my mission in creating and implementing such safe and effective solutions. The future of our food system depends on how we combine science, economy, and care for nature. Let’s make sure that our technology works for the benefit of every person and the entire planet.

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DETECTION OF PESTICIDES AND NON-DIOXIN-LIKE POLYCHLORINATED BIPHENYLS BY CHROMATOGRAPHIC METHODS

У статті розглядаються хроматографічні методи (газова та рідинна хроматографія) для виявлення та кількісного визначення пестицидів і поліхлорованих біфенілів у харчових продуктах і об’єктах довкілля. Особлива увага приділяється їх чутливості, ефективності та ролі у забезпеченні безпечності продукції.

Ключові слова: пестициди, поліхлоровані біфеніли (ПХБ), газова хроматографія, рідинна хроматографія, мас-спектрометрія, харчова безпечність, аналіз.

The article discusses chromatographic methods (gas and liquid chromatography) for the detection and quantification of pesticides and polychlorinated biphenyls in food products and environmental samples. Special attention is given to their sensitivity, efficiency, and role in ensuring food safety.

Keywords: pesticides, polychlorinated biphenyls (PCBs), gas chromatography, liquid chromatography, mass spectrometry, food safety, analysis.

The detection of pesticides and non-dioxin-like PCBs using chromatographic methods is an important process for ensuring food safety. In practice, gas chromatography (GC) and liquid chromatography (LC) are most commonly used, particularly in combination with mass spectrometric detectors (GC-MS, LC-MS) [1].

Modern chromatographic methods are diverse and lack a unified classification. One of the most common approaches is classification based on the type of phases. According to this, gas chromatography involves a gaseous mobile phase (gas-solid and gas-liquid chromatography), while liquid chromatography uses a liquid mobile phase (liquid-solid or liquid-liquid chromatography) [2].

Gas chromatography is characterized by high sensitivity and is widely used for detecting and quantifying trace amounts of pesticides in food products, biological samples, and environmental objects. However, its application may be limited due to the low volatility or thermal instability of certain compounds. The efficiency of the method depends on the detector type, properties of the analytes, and column characteristics [3].

Various detectors are used for pesticide determination, including the electron capture detector (ECD), which is highly sensitive to halogen-containing compounds and is often applied for organochlorine pesticides. For organophosphorus compounds, detectors sensitive to phosphorus and nitrogen are used. GC/MS systems enable identification based on spectral libraries and allow quantitative determination [4].

For quantitative analysis of pesticides, HPLC, TLC, and capillary electrophoresis are also applied. Determining pesticide concentrations in biological samples is important for diagnosing poisoning and selecting appropriate treatment methods [4].

Liquid chromatography is based on the distribution of substances between two phases, where the mobile phase is liquid. It is suitable for analyzing non-volatile and thermally unstable compounds, as well as large sample volumes. Its advantages include versatility, while disadvantages involve a limited range of detectors [5].

Polychlorinated biphenyls (PCBs) are persistent organic pollutants consisting of chlorinated compounds. The primary route of human exposure is through the consumption of animal-derived food products, particularly milk, meat, and fish.

Modern physicochemical methods, especially chromatographic techniques, are widely used for PCB monitoring. They provide effective separation, identification, and quantification of compounds, even with similar properties [6].

The most effective methods for PCB determination are gas chromatography with electron capture detection (GC/ECD) and gas chromatography with mass spectrometric detection (GC/MS). The choice of method depends on the research objective. Simpler methods are used for total determination, while more complex approaches with congener-specific identification are applied for accurate analysis of toxic PCB compounds.

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