

**POLYETHYLENE AS A CRUCIAL ELEMENT OF PLASTIC
INDUSTRY**

Maksym Korolov

Faculty of Chemical Technology,

National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute”

Polyethylene, a cornerstone of the modern plastic industry, is a synthetic polymer with the chemical formula $(-\text{CH}_2-\text{CH}_2-)_n$. This seemingly simple structure

belies its extraordinary versatility, making it one of the most widely used plastics globally.

The journey of polyethylene began in the early 20th century. German chemists Hans von Pechmann and Johann Friedrich Wilhelm Adolf von Baeyer first synthesized polyethylene in 1898. However, it wasn't until the 1930s that researchers at Imperial Chemical Industries (ICI) in the UK developed a practical method for its large-scale production. This breakthrough involved heating ethylene gas (C_2H_4) to high temperatures and pressures in the presence of a catalyst, typically a transition metal compound like titanium (III) chloride.

Polyethylene is not a monolithic material; it exists in various forms, each with distinct properties tailored to specific applications. The most common types are:

- **Low-Density Polyethylene (LDPE):** Characterized by its flexibility, toughness, and resistance to moisture, LDPE is commonly used in plastic bags, food packaging films, and wire insulation.
- **Medium-Density Polyethylene (MDPE):** Offering a balance of strength and flexibility, MDPE is ideal for applications like plastic pipes, geomembranes, and agricultural films.
- **High-Density Polyethylene (HDPE):** Renowned for its high strength, rigidity, and resistance to chemicals, HDPE finds applications in a wide range of products, including bottles, containers, toys, and pipes.

Polyethylene's versatility is evident in its diverse applications: **Packaging:** From grocery bags to food containers, polyethylene is ubiquitous in the packaging industry. Its excellent barrier properties, flexibility, and durability make it a preferred choice for protecting products. **Construction:** Polyethylene pipes are widely used in plumbing and drainage systems due to their resistance to corrosion and ease of installation. Additionally, geomembranes made of polyethylene are employed in civil engineering projects for waterproofing and erosion control. **Electronics:** Polyethylene's excellent dielectric properties make it a valuable material in the electronics industry. It is used as an insulator in cables and as a component in various electronic devices. **Medical Applications:** Polyethylene's biocompatibility and non-

toxicity make it suitable for medical devices like catheters, syringes, and surgical implants. Automotive Industry: Polyethylene is used in various automotive components, including fuel tanks, bumpers, and interior trim, due to its lightweight, durability, and recyclability.

One of the most significant advantages of polyethylene is its recyclability. HDPE, in particular, is easily recyclable, making it a sustainable choice for various applications. In fact, you can recycle HDPE at home by heating it in an oven to create plastic sheets that can be used to make boxes or extruded into rods for 3D printing.

As technology continues to advance, we can expect to see even more innovative applications of polyethylene. By understanding its properties, production processes, and environmental impact, we can make informed choices and contribute to a more sustainable future.

Reference:

Chemistry. Standard level. Retrieved from <https://uahistory.co/pidruchniki/yaroshenko-chemistry-10-class-2018-standard-level/30.php>