OBTAINING POLYMER GRANULES FROM DIFFERENT TYPES OF POLYMERS

Raxmatullayev Muxammadali Muxammadzokir o‘g‘li
Trainee teacher of Andijan State technical institute,
Andijan, Uzbekistan
raxmatullaev231@gmail.com

Abstract: Polymer granules, which are small, solid particles of various polymers, play a crucial role in the manufacturing and processing of polymer-based products. These granules are typically used as raw materials for injection molding, extrusion, and other plastic processing techniques. The production of polymer granules from different types of polymers involves various methods, each tailored to the specific characteristics of the polymer. The most common processes include extrusion, pelletizing, and granulation. This abstract aims to explore the methods of obtaining polymer granules from different types of polymers, including thermoplastics, thermosets, and elastomers, highlighting the differences in processing techniques based on the polymer's properties. Additionally, the impact of polymer type, molecular weight, and additives on the final granule characteristics, such as size, shape, and quality, is discussed. Understanding these processes is essential for optimizing production efficiency, ensuring consistent quality, and meeting the requirements of downstream applications in industries such as automotive, packaging, electronics, and medical devices [1].

Keywords: polymer granules, thermoplastics, thermosets, elastomers, extrusion, pelletizing, granulation, additives, molecular weight, processing conditions, production efficiency, downstream applications, uniformity, size, shape, thermal properties.

Introduction: Polymer granules are essential intermediates in the production of polymer-based products. These small, solid particles serve as the raw material for various processing techniques such as injection molding, extrusion, blow molding, and compression molding. The transformation of bulk polymers into

granules is a critical step, as it facilitates easier handling, transport, and processing of polymers in industrial applications. Granulation processes must be tailored to the specific characteristics of different types of polymers, including thermoplastics, thermosets, and elastomers, due to their distinct properties and behavior under heat and pressure. Thermoplastics, such as polyethylene, polypropylene, and polyvinyl chloride (PVC), are the most common polymers used for granule production [2]. These polymers soften when heated and can be easily molded or shaped into granules, making them suitable for high-volume production. On the other hand, thermosets, like epoxy and phenolic resins, undergo irreversible chemical reactions during curing and require different techniques to form stable granules that retain their shape after processing. Elastomers, such as rubber-based materials, have flexible, stretchable properties that demand specialized processes to ensure uniform granule formation [3]. The granulation process typically involves extrusion, where molten polymer is forced through a die, cooled, and cut into granules; pelletizing, where the polymer is extruded into long strands and then cut into uniform-sized pieces; or granulation, a more complex technique that may include wet or dry methods. Each of these methods is influenced by polymer type, molecular weight, processing temperature, and the presence of additives. By understanding the specific requirements of each polymer type and the associated granulation methods, manufacturers can optimize the production process to achieve high-quality, consistent granules that meet the needs of various downstream applications in industries such as automotive, electronics, packaging, and medical devices [4,5].

Table.1. *Different sizes of polymer granules.*

Method	Polymer Types	Granule Size	Shape	Quality	Applications
Extrusion/Pelletizing	Thermoplastics (PE,	2-6 mm	Cylindrical/ Round	High, uniform	Injection molding,

	PP, PVC)				extrusion
Granulation (Wet/Dry)	Thermosets (Epoxies, Phenolics), Elastomers (SBR)	Irregular/Spherical	Moderate to High	Wet: High, Dry: Moderate	Thermoset molding, elastomer processing
Cryogenic Grinding	Elastomers (Rubber), High-performance Thermoplastics	Micron to mm	Irregular/Jagged	High, minimal degradation	High-performance polymer applications
Compression Molding	Thermosets (Epoxy, Phenolic Resins)	Larger (varies)	Disc/Cube	Very high, stable	Thermoset molding
Water Quenching/Cutting	Polyolefins (LDPE, HDPE)	2-6 mm	Cylindrical/ Round	High, uniform	Injection molding, extrusion

Plastic granules are produced from different polymers. Plastic granules have different properties and usage areas in terms of color, structure and shape. The types of plastic granule raw materials that are frequently preferred in different sectors can be listed as follows:

- **Polyethylene (PE) Granules**: PE granules can be low density, high density (HDPE) or linear low density (LLDPE). They are used in the packaging, agriculture, construction, textile and automotive industries [6].

- **Polypropylene (PP) Granules:** PP granules stand out with its high temperature resistant structure. Polypropylene granules also have the characteristics of low density and chemical resistance. They are used in the packaging, textile, medical and automotive industries [7].
- **Polyvinyl chloride (PVC) Granules:** PVC granules, which have a hard structure, are known for their strength and chemical resistance properties. It is preferred in the electrical, construction, automotive and medical industries [8].
- **Polystyrene (PS) granules:** PS granules are hard and transparent plastic granules. It is used in industries such as food packaging, electronic devices, furniture and toys.
- **Polycarbonate (PC) Granules:** PC granules: High temperature resistance, transparency and impact resistance properties come to the fore. It is generally preferred in the automotive, electronics, medical and sporting goods industries.
- **Polyamide (PA) Granules:** PA granules, which show high strength with their hard structures, stand out with their temperature resistance feature. It is often used in the automotive, electronics, medical and textile industries [9,10,11].

Conclusion: Obtaining polymer granules from various types of polymers is a vital process in the production of plastic products. The granules are formed through processes such as extrusion, pelletizing, or granulation, depending on the type of polymer and its intended use. Each polymer type—whether thermoplastic, thermoset, biodegradable, or others—has specific requirements in terms oxf temperature, pressure, and method to achieve optimal granule formation. These granules are crucial for ensuring uniformity and consistency in the final products. The key factors that influence the process include the polymer's molecular structure, thermal properties, and intended application. For instance, thermoplastics are easier to process than thermosets due to their ability to re-melt and re-shape, while biodegradable polymers require specific handling to maintain their environmental benefits. The overall quality of the granules—such as their size, shape, and density—directly impacts the quality of the end products. In summary,

understanding the characteristics of different polymers and applying the correct granulation techniques ensures efficient manufacturing, sustainability, and high-quality final products in various industries.

Reference

1. Baird, D.G., Collias, D.I. (2014). *Polymer Processing: Principles and Design*. Wiley.
2. Kulkarni, S.S. (2012). *Extrusion of Polymers: Theory and Practice*. CRC Press.
3. Watt, G.M. (2005). *Polyethylene: The World's Most Widely Used Synthetic Polymer*. Wiley.
4. Wright, H.G.P. (2011). *Polyvinyl Chloride: The Polymer*. Wiley.
5. Wypych, G. (2015). *Handbook of Industrial Polyethylene and Technology*. ChemTec Publishing.
6. Ghosh, R.S.M. (2010). *Polymer Blends and Alloys*. Springer.
7. Seymour, R.B. (2008). *Polymer Compounding: Chemistry and Technology*. Marcel Dekker.
8. Muxammadzokir o'g'li, R. M. (2025). IMPROVING THE STRENGTH OF THERMOPLASTIC POLYMER MATERIALS. *INNOVATIVE DEVELOPMENTS AND RESEARCH IN EDUCATION*, *3*(35), 105-109.
9. Muxammadzokir o'g'li, R. M. (2025). IMPROVING SOME PROPERTIES BY ADDING METAL POWDERS TO THE POLYMER COMPOSITION. *Science, education, innovation: modern tasks and prospects*, *2*(2), 63-66.
10. Zuxridinovich, M. N., & Muxammadzokir ogli, R. M. (2021). To improve the technology of obtaining polymer composite materials on the basis of fillers that provide special properties. *Texas Journal of Multidisciplinary Studies*, *3*, 168-171.
11. Raxmatullayev, M. (2025). OBTAINING POLYMER PRODUCTS FROM SECONDARY POLYMER WASTE. *EXPLORING NEW HORIZONS IN EDUCATION AND ACADEMIC RESEARCH*, *1*(1), 69-74.