

# Polymer recycling considering current and future legal regulations in selected EU countries – a review

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**Abstract:** An overview of the most important legal acts regulating polymer recycling at national and EU level is presented. Basic legal obligations, strategic goals and directions of development of the plastic waste management system are also discussed.

**Keywords:** polymer recycling, environmental protection, laws and regulations, industrial packaging.

## Recykling polimerów w świetle obecnych i przyszłych regulacji prawnych w wybranych krajach UE – przegląd

**Streszczenie:** Przedstawiono przegląd najważniejszych aktów prawnych regulujących recykling polimerów zarówno na szczeblu krajowym, jak i unijnym. Omówiono również podstawowe obowiązki prawne, cele strategiczne i kierunki rozwoju systemu gospodarowania odpadami z tworzyw sztucznych.

**Słowa kluczowe:** recykling polimerów, ochrona środowiska, prawo i regulacje, opakowania przemysłowe.

The recycling of polymers as a subject of interest in legal science has its origins in international law, where the right to a clean environment has developed over the years. Etymologically, this right belongs to the third generation of human rights [1] and is classified among solidarity (collective) rights [2].

In international law, the right to a clean environment [3] was expressed late [4]. Recognition of the right to a clean environment was first articulated in 1972 through the Stockholm Declaration (Declaration on the Human Environment). This development was a result – albeit indirectly – of the United Nations Conference on the Human Environment, whose primary focus was not on the right itself, but on governmental actions affecting the environment. Nevertheless, it was included in Principle 1 concerning the natural environment of human beings – as the right to enjoy the environment and the duty to care for it: “Everyone has the fundamental right to freedom, equality and adequate conditions of life in an environment that

allows for a decent life in prosperity. Everyone has a serious responsibility to protect and improve the natural environment for present and future generations” [5]. Another act recognizing this right is the Rio Declaration on Environment and Development, which was the result of the United Nations Conference on Environment and Development (in Rio de Janeiro in 1992), referred to as the “Earth Summit,” in which principal No. 1 states that people are “the goal of sustainable development. They have the right to a healthy and productive life in harmony with nature”. It is worth noting that the European Organization for Human Rights did not mention the right to the environment [6]. However, the Parliamentary Assembly of the Council of Europe has repeatedly acted in the field of environmental protection and so-called sustainable development, using recommendations. The first of these dates are from September 28, 1990. This recommendation was adopted at the 11<sup>th</sup> session of this body, stating that “every person has a fundamental right to the environment and to living conditions that are conducive to good health, well-being and the full development of human personality” (Reg. 6) and that “every European and every European state party has an equal responsibility to maintain and protect the environment in the interests of the health and well-being of all people, both within and outside Europe, for the benefit of present and future generations of human beings” [7]. In turn, Recommendation 1431(1999) of the Parliamentary Assembly of November 4, 1999, the initiative to prepare a substantive additional protocol to

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the ECHR on the individual right to a healthy and livable environment (Reg. 11. 2-point b) appeared for the first time [8]. Although this idea was not implemented, its evolution was taken up in another proposal. Especially, Recommendation 1614(2003) of the Parliamentary Assembly of June 27, 2003, which recommended that the Committee of Ministers of the Council of Europe prepare an additional protocol to the ECHR of a procedural nature, i.e. containing individual procedural rights for individuals seeking to improve the state of the environment, in accordance with the provisions of the Aarhus Convention of 1998 [9]. However, the fact that the right to a clean environment is not expressly mentioned in the text of the European Convention on Human Rights does not in any way mean that this right cannot be derived from that text, as its existence is confirmed by case law. This conclusion is based on two key rulings of the European Court of Human Rights: *Tyrer* of April 25, 1978, and *Marckx* of June 13, 1979. In these rulings, the Court recognized the need to apply a dynamic and functional interpretation of the Convention. This method assumes that the Convention must function as a "living instrument, the interpretation of which must be made in accordance with contemporary conditions" [10]. Therefore, in justifying the need for such an interpretation, the Court argued that if the provisions of the Convention were interpreted solely based on the objectives pursued by its authors at the time of its adoption, the protection of the rights and freedoms enshrined therein would lose its real meaning as social and political conditions changed. Meanwhile, the essence of the Convention lies in the fact that it was designed "to protect the individual in a practical and effective manner" and therefore "aims to guarantee rights that are not theoretical or illusory, but practical and effective," as emphasized by the Court in its judgment in the *Airey* case of October 9, 1979 [11]. It is on this basis that the Court, relying on Article 8 of the European Convention on Human Rights, which concerns respect for private and family life, recognized the existence of the right to the environment [12].

Against this background, the European Court of Human Rights reconstructed this right, ruling on numerous occasions on interference with the right to respect for private life, including:

- systematic noise associated with the proximity of an airport (judgment in the case of *Powell and Rayner v. the United Kingdom* of February 21, 1990, application no. 9310/81),
- proximity to a nightclub (judgment in the case of *Gomez v. Spain* of November 16, 2004, application no. 4143/02),
- emission of foul-smelling substances (judgment in the case of *Lopez Ostra v. Spain* of December 9, 1994, application no. 16798/90),
- collection and disposal of waste (judgment in the case of *Di Sarno and Others v. Italy* of January 10, 2012, application no. 30765/08),

– spreading fertilizer near the doors and windows of an inhabited house (judgment in the case of *Surugiu v. Romania* of April 20, 2004, application no. 48995/99),

– use of toxic substances in a gold mine for mining purposes near the place of residence of a specific family (judgment in the case of *Tatar v. Romania* of January 27, 2009, complaint no. 67021/01) [13].

In Poland, the right to a clean environment can be traced back to the Constitution of the Polish People's Republic, although at that time this right was limited. Article 71 of the Constitution of the Polish People's Republic granted citizens the right to enjoy the environment, stating that "Citizens of the Polish People's Republic shall have the right to enjoy the values of the environment and the duty to protect it." [14]. Part of the doctrine interpreted this as the right to enjoy the natural environment in the form of the right to an environment of adequate natural quality and positively affecting human health, i.e., the right to an unpolluted environment [15]. However other scholars interpreted this constitutional provision as the right to enjoy an unspoiled landscape [16]. This provision was later borrowed by the Small Constitution of 1992 (including it in Article 77), which remained in force until the entry into force of the current Constitution of 1997 [17]. Interestingly, the authors of the current Constitution of the Republic of Poland did not decide to adopt Article 71 of the Constitution of the Polish People's Republic. As a result, the Constitution repeatedly refers to the environment and the obligation to protect it, dividing the regulations in this area into three groups of issues:

1. environmental protection as a task of the state (Articles 5, 74, 68(4) and 232),
2. environmental protection as a universal obligation (Article 86),
3. environmental protection treated as a basis for restricting rights and freedoms (Article 31(3)) [18].

The current constitution does not directly and explicitly provide for the right to a clean environment. However, this does not mean, that this right cannot be interpreted from the content of the Constitution, but none of its articles stipulates or guarantees a subjective right to a clean environment or to "live in a healthy environment," as repeatedly emphasized by the Constitutional Tribunal in its case law [19]. Nevertheless, the Constitutional Tribunal considers the appropriate state of the environment (according to the term "healthy environment") to be a constitutional value that must be considered in the process of interpreting the provisions of the Constitution [20]. Currently, the right to a clean environment in Polish constitutional law is decoded from Article 2 of the Constitution [21]. When interpreting this provision, it is assumed that the essence of a democratic state ruled by law requires that human rights, including third-generation human rights, which include the right to live in a clean environment, be considered in its content [22].

## CARE FOR THE ENVIRONMENT AS AN EU POLICY OBJECTIVE

The European Union places significant emphasis on environmental protection, a priority repeatedly reaffirmed through legislation adopted by the European Parliament. Articles 11 and 191–193 of the Treaty on the Functioning of the European Union (TFEU) designate the EU as the competent authority in shaping environmental policy. Key areas of EU action include air and water pollution, waste management, and climate change mitigation.

The foundation of EU environmental policy dates to 1972, when the European Council meeting in Paris emphasized the necessity of integrating environmental concerns into Community policy. This led to the call for a comprehensive program of action aimed at environmental protection, improvement, and the fight against pollution and nuisances.

A formal legal basis for environmental policy was established with the Single European Act of 1987, which introduced a new Title VII entitled “Environment.” This commitment was strengthened in the 1993 Maastricht Treaty, where environmental protection was recognized as an official policy area under Title XVI. Subsequently, Article 3c of the 1999 Treaty of Amsterdam mandated the integration of environmental protection into all EU sectoral policies to support sustainable development across Member States.

The Treaty of Lisbon, adopted in 2007, further elevated the EU’s environmental ambitions by making climate change mitigation and sustainable development enduring priorities. These principles laid the groundwork for landmark regulatory initiatives, notably the European Green Deal and the European Climate Law.

In 2021, the European Climate Law was adopted, legally binding the EU to achieve climate neutrality by 2050 and to reduce net greenhouse gas emissions by at least 55% by 2030 compared to 1990 levels. In April 2023, the European Parliament approved the “Fit for 55” legislative package to help meet these targets.

According to Article 191 of the TFEU, EU environmental policy pursues the following objectives:

- preservation, protection, and improvement of environmental quality,
- protection of human health,
- prudent and rational use of natural resources,
- promotion of international measures to address regional and global environmental challenges, with particular emphasis on combating climate change.

These overarching objectives have been further refined through the European Green Deal, which defines six priority areas in environmental and climate policy:

1. achieving the 2030 greenhouse gas emission targets and climate neutrality by 2050,
2. increasing adaptability, enhancing resilience, and reducing vulnerability to climate change,
3. transitioning to a regenerative growth model that decouples economic growth from resource use and envi-

ronmental degradation, while accelerating the shift to a circular economy,

4. attaining zero pollution for air, water, and soil, thereby protecting the health and well-being of EU citizens,

5. protecting, preserving, and restoring biodiversity and natural capital, including air, water, soil, and forest, freshwater, wetland, and marine ecosystems,

6. reducing environmental and climate pressures arising from production and consumption, particularly in sectors such as energy, industry, construction, mobility, and food systems.

In line with the sixth objective, since 2014 the European Parliament has adopted several legislative measures aimed at promoting the circular economy. These regulations address, among other topics, waste management, batteries, end-of-life vehicles, and landfill practices. Recycling has been assigned a pivotal role in achieving the EU’s environmental and climate objectives [23].

## RECYCLING AS AN EU FORM OF ENVIRONMENTAL PROTECTION

Recycling refers to activities aimed at returning part of the waste stream to the beginning of the production cycle. Proper recycling requires the appropriate separation of different types of waste materials and their subsequent purification. In the case of polymers covered by the project, recycling requires prior collection and segregation.

There are different forms of recycling. In relation to polymers, it takes the form of:

- material recycling – reprocessing,
- chemical recycling – pyrolysis and solvolization,
- organic recycling – composting,
- energy recycling.

Currently, one of the most popular methods of recovering raw materials from industrial waste is chemical recycling. This method involves breaking down materials into their basic chemical components, which can then be reused to manufacture new products. Chemical recycling is based on the depolymerization of part or all the material, resulting in low-molecular-weight compounds that form the basis to produce further materials [24].

Commission Regulation (EU) 2022/1616 of 15 September 2022 on recycled plastic materials and articles intended to meet food, which repeals Regulation (EC) No. 282/2008, plays a crucial role in this area.

According to Article 3(1) of this Regulation, “*plastic*” is defined as a material consisting of a polymer to which additives or other substances may have been added, and which may function as a main structural component of final products, excluding natural polymers that have not undergone chemical modification.

The definition of *polymer* is provided in Article 3(5) of Regulation (EC) No. 1907/2006 of the European Parliament and of the Council of 18 December 2006 con-



cerning the Registration, Evaluation, Authorization, and Restriction of Chemicals (REACH), which also establishes the European Chemicals Agency and amends various previous directives and regulations. According to this provision, a polymer is a substance consisting of molecules formed by a sequence of one or more types of monomer units. These molecules exhibit a statistical distribution of molecular weights within a defined range, with molecular weight variations primarily resulting from differences in the number of monomer units per molecule. Specifically, a polymer contains: a) molecules forming a simple weight majority that contain at least three monomer units covalently bonded to at least one other monomer unit or reagent; b) molecules that do not constitute a simple weight majority among molecules of the same molecular weight.

In this context, the term “*monomer unit*” refers to the reacted form of a monomer within the polymer. A *monomer* itself is defined as a substance capable of forming covalent bonds with a series of other similar or dissimilar molecules through a polymerization reaction under the conditions specific to the process.

Within the scope of the applicable regulations, *further processing* is defined as all unit operations following the decontamination stage, during which the product undergoes additional polymerization, treatment, or transformation, resulting in recycled plastic materials and articles in their finished form.

The Regulation introduces extended producer responsibility, which practically translates into an obligation for producers to manage the collection, transportation, processing, awareness-raising, data collection, and reporting related to recyclates. Furthermore, the legislation establishes rules for the separate collection of single-use recyclable plastics, setting the following recycling targets for Member States:

- by 2025, the weight of collected single-use plastic products listed in Part F of the Annex must reach 77% of the weight of such products placed on the market in that year,
- by 2029, the collected amount of single-use plastic products listed in Part F of the Annex, which constitute waste, must equal 90% by weight of the corresponding products placed on the market in that year.

Additionally, Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste — which amends Regulation (EU) 2019/1020 and Directive (EU) 2019/904 and repeals Directive 94/62/EC — is also highly relevant. This Regulation introduces an obligation for all companies placing plastic packaging on the market to ensure a minimum content of recycled materials.

According to Article 7 of this Regulation, from 1 January 2030, or three years after the entry into force of the corresponding implementing act, all plastic packaging must contain between 10% and 30% post-consumer

recycled material. Furthermore, from 1 January 2040, the required content will increase to between 50% and 65%.

Directive 2008/98/EC on waste indicates, among other things, that EU Member States are required to take measures to promote selective dismantling to enable the removal and safe handling of hazardous substances and to facilitate reuse and high-quality recycling through the selective removal of materials, and to ensure the establishment of sorting systems for construction and demolition waste at least for wood, mineral fractions (concrete, bricks, tiles and ceramic materials, stones), metal, glass, plastics and gypsum. In order to ensure compliance with the objectives of this Directive and to move towards a European circular economy with a high level of resource efficiency, Member States shall adopt measures to achieve the following targets: by 2020, the preparation for reuse and recycling of waste materials, at least of paper, metal, plastic and glass from households and, where feasible, of other sources provided that these waste streams are similar to household waste, shall be increased to a minimum of 50 wt% by 2020 preparing for reuse, recycling and other forms of recovery, including backfilling with waste where the waste replaces other materials, of non-hazardous construction and demolition waste except for material in its natural state as defined in category 17 05 04 of the European Waste Catalogue, shall be increased to a minimum of 70% by weight; by 2025, the preparation for reuse and recycling of municipal waste shall be increased to a minimum of 55% by weight; by 2030 the preparation for reuse and recycling of municipal waste shall be increased to a minimum of 60% by weight; by 2035, the preparation for reuse and recycling of municipal waste shall be increased to a minimum of 65% by weight.

To implement the above solutions, Poland has introduced, among other things, Article 17 of the Act of June 13, 2013, on packaging and packaging waste management, which entered into force on January 1, 2025, and will remain in force until December 31, 2025.

Another legal act of fundamental importance is the Act of December 14, 2012, on waste. It lays down the rules for waste management, storage, recovery, treatment, and reuse. These provisions establish the principles of waste management, including those related to industrial recycling.

## INDUSTRIAL POLYMERS

According to research and estimates cited in many places, while it seems realistic to increase the mass of food recyclates in line with the targets set out in EU legislation, industrial recyclates are a key area where deficits may arise. It will be difficult to meet the legal requirements in this area to achieve the desired level of recovery of industrial waste raw materials.

One example of such a problematic activity is the use of various types of roofing film. Technologically, roofing films can be recycled, especially chemically, and the granulate from film recycling can be further used for var-

ious types of production, including for subsequent materials of this type. However, the problem on the market is the lack of this type of material for recycling. Therefore, other substances that could be used for this purpose are being sought.

Assuming that films have been used for the last 20 years, it will be physically impossible to collect enough recycled material for new production in the next decade. This situation raises concerns that the EU may impose additional charges for, for example, a lower recycled content in products.

In view of this phenomenon, it is reasonable to seek diversification of recycled material that can be used to produce the final product, if only to meet the assumed standards for the use of recycled materials.

### GERMAN POLYMER RECYCLING LAW

In the context of meeting recycling targets, it is instructive to examine the situation in other countries. For example, Germany boasts a recycling rate of approximately 67%. Notably, this performance exceeds the EU-mandated targets for Member States, which are set at 55% by 2025, 60% by 2030, and 65% by 2035. Germany has achieved this high recycling rate over several decades, thanks to a series of effective measures.

One of the most impactful initiatives was the introduction of the deposit return system (DRS), which has yielded a recycling rate of 98.4% since its implementation. Germany further enhanced its recycling framework through several legal regulations, including:

1. The Packaging Act of 2019, which replaced earlier regulations in place from 1991 to 2019. This Act introduced a requirement for German companies to register with the Central Packaging Register, managed by the relevant agency, and to regularly report the weight and material composition of their products.

2. The Green Dot System, which mandates manufacturers to display a green label on packaging, signifying their responsibility to accept the raw materials for recycling.

3. The Closed Substance Cycle and Waste Management Act (1996), which expanded upon the policies of the earlier Packaging Ordinance by obliging all stakeholders involved in the production, sale, and consumption of goods to take responsibility for waste avoidance, reuse, recycling, and environmentally sound disposal.

4. At the end of 2019, Germany implemented a ban on plastic bags by amending Article 5 of the Packaging Act and integrated provisions addressing single-use plastics into its regulatory framework.

Currently, Germany exports part of its plastic waste for processing, with significant quantities shipped to Malaysia and approximately 15% directed to the neighboring The Netherlands [25].

It is worth noting that this is primarily industrial polymers, and Germany is still in the early stages of develop-

ing recycling in this area. It can therefore be said with complete confidence that such a high recycling rate in Germany was a long-term measure. Producers/first distributors of packaging filled with goods that are relevant to the system are required to register with the LUCID packaging register of the Central Agency ZSVR (Stiftung Zentrale Stelle Verpackungsregister), to participate in the collection system and to report various data. Failure to comply with the obligations set out in the German Packaging Act may result not only in a distribution ban but also in administrative fees of up to EUR 200,000. From July 1, 2022, operators of electronic trading platforms may not allow packaging relevant to the packaging system to be offered filled with goods if the manufacturer of this packaging has not participated in at least one dual system (collection system). As a result, operators of electronic trading platforms must actively monitor and verify that retailers selling through them have fulfilled their obligations under the Packaging Act (e.g., through mandatory audits prior to placing products on the market). Similar requirements apply to registration with LUCID. Service providers have a similar obligation from July 1, 2022. Failure to comply with our intentional violation of these obligations by a fulfillment service provider or electronic marketplace operator may be punished with a fine of up to EUR 100,000. In addition, following an amendment to the Packaging Act, from January 1, 2022, it will be prohibited in Germany to place lightweight plastic shopping bags with a wall thickness of between 15 and 50 micrometers on the market. As part of the implementation of EU requirements, from January 1, 2023, restaurants, bistros, and cafes selling takeaway food or drinks will be required to offer their products only in reusable packaging. Reusable cups must be available for all sizes of takeaway drinks. Companies with a total of five or fewer employees and a store area of no more than eighty square meters (e.g., small snack bars, night shops, and kiosks) are exempt from this obligation. From July 1, 2022, a mandatory deposit has been introduced for all single-use plastic beverage bottles and all beverage cans. Only milk or milk products were subject to a transition period until 2024. From 2025, the recycling rate for PET beverage bottles has been set at a minimum of 25% from recycled plastic. From 2030, this amount will increase to at least 30 percent and will apply to all single-use plastic bottles, except for single-use plastic beverage bottles where the body of the bottle is made of glass or metal and only the caps, lids, labels, stickers, or packaging are made of plastic. Manufacturers may decide for themselves whether they want to achieve the amount per bottle or spread it over the whole year in relation to their total bottle production [26].

### SPANISH POLYMER RECYCLING LAW

Spain, as an EU member state, has also adapted its recycling regulations to EU regulations. The national

regulations on plastic packaging and waste in Spain are as follows:

1. Law 7/2022 of April 8 on waste and contaminated soil for a circular economy ("**Law 7/2022**") ("*Ley 7/2022, de 8 de abril, de residuos y suelos contaminados para una economía circular*"). This law aims to regulate waste management by promoting measures to prevent waste generation and mitigate the negative impact on human health and the environment associated with its generation and management, improving resource efficiency. To this end, the law also establishes a compendium of extended producer responsibility obligations.

2. Royal Decree 1055/2022 of December 27 on packaging and packaging waste ("**RD 1055/2022**") ("*Real Decreto 1055/2022, de 27 de diciembre, de envases y residuos de envases*"). This royal decree aims to prevent and reduce the impact of packaging and packaging waste management throughout its life cycle on the environment. In addition, new obligations have been established regarding labeling, registration, single-use plastics, and the recyclability of packaging. To achieve these objectives, measures have been established to ensure, first, the prevention of packaging waste and, second, the reuse, recycling, and other forms of recovery of packaging waste, to avoid or reduce its disposal. One such measure is Royal Decree 293/2018 of May 18 on reducing the consumption of plastic bags ("**RD 293/2018**") ("*Real Decreto 293/2018, de 18 de mayo, sobre reducción del consumo de bolsas de plástico*"). The purpose of this royal decree is to adopt measures to reduce the consumption of plastic shopping bags to prevent and reduce the negative impact that the waste generated by these plastic bags has on the environment, with particular emphasis on the damage caused to aquatic ecosystems and certain economic activities, such as fishing or tourism, among others. The decree also aims to avoid the loss of material and economic resources caused by the abandonment of plastic bags and their dispersion in the environment [27].

However, in accordance with EU regulations, additional obligations have been introduced, primarily for manufacturers. On December 27, 2022, a royal decree on packaging and packaging waste came into force. It introduced a registration requirement, whereby manufacturers must now register themselves and the packaging they place on the market. Importantly, the registration requirement applies not only to household packaging but also to commercial and industrial packaging. The registration requirement works in the same way as the registration of electrical and electronic equipment, which is mandatory under the Spanish RAEE decree (WEEE Directive in Spain). Registration is difficult for foreign entities due to the requirement to have a Spanish tax number for non-resident companies, known as NIF. Companies distributing packaging for households are required to join ECOEMBES, the organization responsible for recycling packaging waste in Spain. The same organization oversees the recycling of products placed on the market. "For example, the

threshold for cardboard packaging above which a packaging license is mandatory is 14 tons." In accordance with the provisions of the Spanish Waste Act, service providers and e-commerce companies are subject to even higher requirements. "When selling products from foreign manufacturers who do not have a representative in Spain, order fulfillment service providers and e-commerce platforms assume the financial, informational, and organizational obligations of the manufacturers" [28].

In addition, there are several extended producer responsibility systems for packaging in Spain:

- packaging for phytosanitary products and fertilizers: AEVAE,
- lightweight packaging and cardboard: ECOEMBES,
- glass packaging: ECOVIDRIO,
- packaging for medicinal products and expired medicines: SIGRE.

Recycling in Spain is supported by a deposit, return, and collection system applicable to plastic bottles with a capacity of up to three liters, as specified in Articles 10 and 47 of Royal Decree 1055/2022. Additionally, a tax on non-reusable plastic packaging has been introduced. The taxable base is defined as the amount of plastic (in kilograms), and the applicable tax rate is EUR 0.45 per kilogram.

Strategic goals for waste reduction and recycling have also been established. These include:

- 13% reduction in the weight of waste generated by 2025 compared to 2010 levels,
- 15% reduction by 2030,
- by 2035, the proportion of selectively collected municipal waste is expected to reach at least 50% of the total weight of municipal waste generated.

Further targets concern preparation for reuse and recycling of municipal waste. By 2025, this rate must reach at least 55% by weight, of which a minimum of 5% should come from preparation for reuse, primarily of textiles, waste electrical and electronic equipment, furniture, and other suitable waste streams. This rate is to increase by 5 percentage points every five years to reach 65% by 2035 [29].

Regarding single-use plastic products listed in Annex IV to Law 7/2022, the following reduction targets for placing these products on the market have been established:

- 50% reduction by weight compared to 2022 levels by 2026,
- 70% reduction by 2030.

For the plastic products listed in Annex IV, Part E of the same Act, the targets for separate collection for recycling are as follows: 70% by weight of products placed on the market by 2023 at the latest, 77% by 2025, 85% by 2027, and 90% by 2029.

Extended producer responsibility (EPR) schemes aim to ensure separate collection (by weight) of all household packaging waste placed on the market by participating producers, with the following minimum thresholds to be achieved: 65% by 2025, 75% by 2030, and 85% by 2035.



Moreover, Article 6 of Royal Decree 293/2018 imposes an obligation on the competent authorities to conduct awareness campaigns addressing the environmental impacts of excessive plastic consumption [30].

## CONCLUSIONS

In the future, Poland will need to adapt to the indicated standards. In some areas of industry, this will be extremely difficult, if only for the reasons outlined above, i.e., the lack of materials for recycling. For this reason, it seems reasonable to seek alternatives, diversify sources, and process waste from other industrial sectors to comply with the planned environmental protection standard.

Current Polish regulations do not provide any complex solutions than the legal regulations of foreign countries. The main sources of law in this area are related to the impact of EU regulations on national law. The European Union's policy objective is the sustainable development of the economies of individual Member States, while respecting the environment. One of the tools for achieving this goal is recycling, whose tasks and scope of application, and therefore its importance, will continue to grow in the future.

The recycling method proposed in the project is in line with European standards on the right to a clean environment. If the technical research is successful, it will be possible to market secondary materials produced from waste processing in the manner proposed in the project. This will be important for the implementation of EU standards on the use of waste in production.

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## Authors contribution

M.P. – conceptualization; M.P. – conceptualization; K.S. – conceptualization, writing-review and editing; B.S.-Z. – conceptualization, writing-original draft, visualization, writing-review and editing; K.B. – writing-original draft, visualization, writing-review and editing; R.O. – writing-original draft, visualization; M.O. – conceptualization, writing-original draft, visualization.

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## Conflict of interest

The authors declare no conflict of interest.

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