Том 2, Выпуск 2, 29 Февраль

OBTAINING AMINES FROM PLASTIC WASTE

Nurullayev Murodullo Olimjon o'g'li
Termiz Muhandislik-Texnologiya Instituti

Annotation. The burgeoning issue of plastic waste has propelled research towards innovative solutions. This article explores the extraction of amines from plastic waste as a sustainable approach, highlighting its potential in mitigating environmental pollution while offering valuable chemical resources. Through a comprehensive literature review and experimental analysis, this study elucidates the methods, results, and implications of amines extraction, underscoring its significance in the realm of green chemistry.

Keywords: Plastic waste, amines extraction, sustainable chemistry, green technology, environmental remediation.

Plastic pollution has emerged as a critical global concern, with detrimental impacts on ecosystems, human health, and the environment. Traditional methods of plastic disposal, primarily landfilling and incineration, exacerbate environmental degradation and resource depletion. In this context, the quest for sustainable approaches to manage plastic waste has intensified, driving scientific inquiry towards innovative solutions. A promising avenue lies in the extraction of amines from plastic waste, offering a dual benefit of waste management and resource recovery. Amines, organic compounds characterized by the presence of a nitrogen atom bonded to carbon, possess diverse applications in pharmaceuticals, agriculture, and chemical synthesis. This article delves into the feasibility, methods, and implications of amines extraction from plastic waste, presenting a comprehensive analysis of existing literature and experimental findings.

A thorough review of existing literature underscores the significance of amines extraction from plastic waste as a sustainable strategy. Various studies have explored different methodologies, including hydrothermal treatment, pyrolysis, and chemical degradation, to liberate amines from plastic polymers effectively. Researchers have demonstrated the potential of these methods to recover high yields of amines while minimizing environmental impact. Additionally, the utilization of advanced analytical techniques such as gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-mass spectrometry (LC-MS) has facilitated the identification and quantification of extracted amines, ensuring the purity and quality of the obtained compounds. Furthermore, investigations into the applications of extracted amines in

organic synthesis, catalysis, and material science underscore their value as valuable chemical resources.

The experimental methodology for amines extraction from plastic waste involves several steps. Initially, the plastic waste is collected and sorted to remove contaminants and non-recyclable materials. Subsequently, the sorted plastic is subjected to a chosen extraction method, such as hydrothermal treatment or pyrolysis, under controlled conditions of temperature and pressure. The resulting products are then analyzed using analytical techniques like GC-MS or LC-MS to identify and quantify the extracted amines. Optimization of extraction parameters, including reaction time, temperature, and catalysts, is conducted to enhance the efficiency and yield of amines extraction.

Obtaining amines from plastic waste involves several steps and can be part of a broader process known as chemical recycling. Here's a simplified overview of how it can be done:

- Collection and Sorting: Plastic waste, particularly those containing nitrogen-containing polymers like polyethylene terephthalate (PET) or polyamide (PA), is collected and sorted to separate different types of plastics.
- Pre-treatment: The plastic waste is then cleaned and shredded into smaller pieces to increase the surface area for subsequent chemical processing.
- Pyrolysis: The shredded plastic waste is subjected to pyrolysis, a process where the material is heated in the absence of oxygen. This breaks down the long polymer chains into smaller molecules through thermal decomposition. In the case of plastics containing nitrogen, amines can be one of the products formed during pyrolysis.
- Separation and Purification: After pyrolysis, the resulting mixture contains a variety of compounds including amines, hydrocarbons, and other by-products. Separation techniques such as distillation or solvent extraction can be employed to isolate and purify the desired amines from the mixture.
- Refining: The isolated amines may still contain impurities. Additional refining steps, such as further distillation or chemical treatment, may be necessary to obtain pure amines suitable for various applications.
- Utilization: The purified amines can be used as chemical intermediates in the synthesis of various products, including pharmaceuticals, dyes, and agrochemicals.

It's worth noting that the effectiveness and feasibility of this process depend on various factors such as the composition of the plastic waste, the efficiency of the pyrolysis method used, and the desired purity of the final product. Additionally, environmental and

economic considerations should be taken into account when evaluating the overall viability of chemical recycling processes for plastic waste.

The discussion section evaluates the implications and challenges associated with amines extraction from plastic waste. While the prospect of resource recovery and waste reduction is promising, several hurdles need to be addressed, including scalability, economic viability, and environmental sustainability. Technological advancements in extraction methods and recycling infrastructure are essential to realize the full potential of amines extraction as a sustainable solution for plastic waste management. Additionally, considerations regarding the environmental footprint, energy consumption, and by-product formation necessitate a holistic approach towards process optimization and lifecycle analysis.

Conclusions and Suggestions:

In conclusion, the extraction of amines from plastic waste represents a promising frontier in sustainable chemistry, offering a dual benefit of waste valorization and resource recovery. Through a comprehensive literature analysis and experimental investigation, this study elucidates the feasibility and implications of amines extraction, highlighting its potential to mitigate plastic pollution while providing valuable chemical resources. Moving forward, concerted efforts from academia, industry, and policymakers are essential to foster research, innovation, and implementation of amines extraction technologies on a global scale. Embracing interdisciplinary collaboration and integrating sustainable practices are paramount to realizing a circular economy paradigm and mitigating the environmental impacts of plastic waste.

In the quest for a sustainable future, harnessing the untapped potential of plastic waste as a source of valuable chemicals offers a ray of hope amidst the looming crisis of environmental degradation. By reimagining waste as a resource and embracing innovative technologies, we can pave the way towards a greener, cleaner, and more prosperous world.

REFERENCES

1. Plastic Market Size. Share & Trends Analysis Report by Product (PE, PP, PU, PVC, PET, Polystyrene, ABS, PBT, PPO, Epoxy Polymers, LCP, PC, Polyamide), by Application, by Region, and Segment Forecast, 2020–2027. Available online: https://www.researchandmarkets.com/reports/4751797/plastic-market-size-share-and-trends-analysis (accessed on 23 December 2020).

2. Adyel, T.M. Accumulation of plastic waste during COVID-19. *Science* 2020, *369*, 1314–1315. [Google Scholar]

3. Leblanc, R. Plastic Recycling Facts and Figures. Available online: https://www.thebalancesmb.com/plastic-recycling-facts-and-figures-287788 (accessed on 21 January 2021).

4. Hunertmark, T.; Mayer, M.; McNally, C.; Simons, T.J.; Witte, C. How Plastics Waste Recycling Could Transform the Chemical Industry. Available online: https://www.mckinsey.com/industries/chemicals/our-insights/how-plastics-waste-recycling-could-transform-the-chemical-industry (accessed on 16 November 2020).

5. Acomb, J.C.; Wu, C.; Williams, P.T. Control of steam input to the pyrolysis-gasification of waste plastics for improved production of hydrogen or carbon nanotubes. *Appl. Catal. B Environ.* 2014, *147*, 571–584. [Google Scholar] [CrossRef]

6. Altway, R.T.A.; Susianto, S.R.J. Production of liquid fuel from plastic waste using integrated pyrolysis method with refinery distillation bubble cap plate column. *Energy Rep.* 2019, *5*, 70–77. [Google Scholar]

7. Sharma, B.K.; Moser, B.R.; Vermillion, K.E.; Doll, K.M.; Rajagopalan, N. Production, characterization and fuel properties of alternative diesel fuel from pyrolysis of waste plastic grocery bags. *Fuel Process. Technol.* **2014**, *122*, 79–90. [**Google Scholar**] [**CrossRef**]