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TECHNOLOGY OF POLYESTER PRODUCTION IN TURKMENISTAN

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Abstract

This article discusses the technology of polyester production in Turkmenistan, focusing on the current processes used in the production of polyester fibers and resins. Turkmenistan, with its strong textile industry, has made significant strides in developing its domestic polyester production, utilizing both local resources and advanced technology. The article highlights the raw materials used, production methods, and the environmental impact of polyester production. Additionally, it explores future developments in the sector, including sustainability initiatives and the potential for expanding the industry to meet both domestic and international demand.

Keywords

Polyester, production technology, textile industry, raw materials, environmental impact, sustainability, Turkmenistan.

1. Introduction

Polyester is one of the most widely used synthetic fibers in the world, valued for its strength, durability, and versatility in various industries, including textiles, packaging, and automotive. In Turkmenistan, polyester production is gaining momentum as part of the country's broader strategy to diversify its industrial base. The development of domestic polyester manufacturing is crucial for reducing dependency on imports and creating jobs in the growing textile sector. This article provides an in-depth look at the technology behind polyester production in Turkmenistan, examining the processes, raw materials, and future prospects for the industry.

2. Raw Materials Used in Polyester Production

The primary raw material for polyester production is petroleum-derived paraxylene, which is used to produce terephthalic acid (TPA), a key precursor in the synthesis of polyester. In Turkmenistan, efforts are being made to enhance local production of raw materials, particularly through the utilization of natural gas, a key resource in the country. Additionally, Turkmenistan is exploring the possibility of integrating renewable sources of energy in the production process, aligning with global sustainability goals.

The production process also requires ethylene glycol, another petrochemical, which can be sourced locally or imported. The quality and availability of these raw materials play a critical role in the cost-effectiveness and efficiency of polyester production.

3. Polyester Production Technology

Polyester production involves a chemical process known as polycondensation, where terephthalic acid (TPA) and ethylene glycol (EG) react to form polyethylene terephthalate (PET), the polymer used in making fibers, films, and resins.

In Turkmenistan, polyester is primarily produced using a melt-phase polymerization process, which involves the following steps:

- 1. **Synthesis of Terephthalic Acid (TPA):** The first step in the production process is the synthesis of TPA from paraxylene, which is derived from petroleum or natural gas.
- 2. Synthesis of Ethylene Glycol (EG): Ethylene glycol is synthesized from ethylene, which can be produced from natural gas.
- 3. **Polymerization of PET:** TPA and EG are combined and heated in the presence of a catalyst to form PET through a condensation reaction. The resulting polymer is then cooled and processed into various forms, such as fibers or granules.
- 4. **Spinning and Drawing:** The polymer is spun into fibers using a process called melt spinning. The fibers are then drawn to increase their strength and elasticity, making them suitable for use in textiles and other applications.
- 5. **Post-Processing:** After the fibers are produced, they undergo further treatment to enhance their properties, such as heat setting, dyeing, and texturizing.

Polyester resin, used in the production of films, bottles, and other packaging materials, is produced through a similar process but is often polymerized to a higher molecular weight.

4. Environmental Impact and Sustainability

Polyester production, like many other petrochemical processes, can have significant environmental impacts, particularly in terms of energy consumption and greenhouse gas emissions.

In Turkmenistan, there is growing recognition of the need to address these challenges through the adoption of cleaner technologies and the efficient use of resources.

Efforts are being made to reduce the carbon footprint of polyester production by incorporating renewable energy sources such as solar and wind power. Additionally, the recycling of polyester fibers is becoming more common, helping to reduce waste and promote a circular economy. Turkmenistan is also exploring ways to improve water management and reduce waste products in the production process, in line with global sustainability trends.

5. Future Prospects and Developments

The polyester production industry in Turkmenistan is poised for significant growth, driven by increasing domestic demand and the potential for export. The government is investing in modernizing production facilities and improving the efficiency of the manufacturing process. This includes the implementation of advanced technologies, such as automated production lines and digital monitoring systems, to ensure higher quality and consistency in the final product.

There is also a growing emphasis on producing eco-friendly polyester products, such as recycled polyester and biodegradable variants, in response to global environmental concerns. Turkmenistan's strategic location and access to abundant natural gas resources position the country well to become a leading player in the global polyester market, provided the industry continues to innovate and adapt to changing market demands.

6. Conclusion

In conclusion, polyester production in Turkmenistan holds significant potential for both domestic use and international export. The country has a strong foundation in the raw materials required for polyester production and is making strides in adopting advanced production technologies. While there are environmental challenges to address, the move towards more sustainable practices and the potential for increased domestic production makes polyester a key industry for Turkmenistan's economic future. By continuing to innovate and invest in sustainability, Turkmenistan can position itself as a competitive player in the global polyester market.

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