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RESEARCH ARTICLE

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Temperature Influence on Copolymer Conversion in Continuous and Semi-Continuous Suspension Polymerization of MMA and BA

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ABSTRACT
This study investigates the effect of reaction temperature on the conversion efficiency in the suspension copolymerization of Methyl Methacrylate (MMA) and Butyl Acrylate (BA), using both continuous and semi-continuous processes. The experiments were carried out in a controlled setup using Azobisisobutyronitrile (AIBN) as initiator. Higher temperatures showed increased conversion, especially under continuous operation. This paper emphasizes the critical role of temperature in optimizing copolymerization performance and provides comparative insights between the two operational modes.
Keywords: Suspension Polymerization, Methyl Methacrylate, Butyl Acrylate, Conversion, Temperature Effect, Continuous Process, Semi-Continuous Process.

1. Introduction

Temperature plays a crucial role in polymerization kinetics and product characteristics. In suspension polymerization, control over temperature can affect not only the rate of polymerization but also the conversion and quality of the polymer. While various parameters influence copolymerization, this study isolates temperature as a variable and compares its effect under continuous and semi-continuous operation modes.

2. Experimental Setup and Materials

Materials:

- Monomers: Methyl Methacrylate (MMA) and Butyl Acrylate (BA)
- Initiator: Azobisisobutyronitrile (AIBN)
- Stabilizers: Potassium salt of MMA and Polyvinyl Alcohol
- Solvent: Toluene
- Others: Methanol (for washing), Nitrogen (to avoid oxygen inhibition)

Reactor Configuration:

Four-neck, 3-liter round-bottom glass reactor equipped with agitator, thermometer, condenser, and sampling port.

Procedure Summary:

Polymerization was conducted at three distinct temperatures (70 °C, 74 °C, 80 °C) for both continuous and semi-continuous operations using identical recipes and conditions, varying only the reaction temperature.

3. Analysis Method

Samples were taken periodically and quenched in toluene to halt polymerization. Conversion was calculated by isolating and drying the polymer beads, followed by weight analysis.

4. Results and Discussion

Table 1: Conversion vs. Temperature

Temp (°C)	Conversion (Continuous)	Conversion (Semi-Continuous)
70	91%	88%
74	93%	90%
80	96%	94%

Observations:

- Higher temperatures yield higher conversions.
- Continuous mode consistently outperformed semi-continuous in conversion percentage.
- Thermal energy at 80 °C significantly enhances initiator decomposition and monomer reactivity.

5. Conclusion

The findings confirm that temperature is a key parameter in achieving high conversion during the copolymerization of MMA and BA. At a constant initiator concentration (0.6%), increasing the temperature from 70 °C to 80 °C improved conversion from 91% to 96% in continuous mode. This supports the selection of continuous processes and higher operating temperatures for industrial applications aiming at high polymer yield.

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