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**Development of High-Performance Non-Isocyanate Polyurethane  
Dispersions for Eco-Friendly Automotive Coatings**

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**ABSTRACT**

The development of high-performance non-isocyanate polyurethane (NIPU) dispersions represents an important advancement in the field of sustainable and environmentally friendly automotive coatings. Traditional polyurethane coatings commonly use isocyanates, which are associated with health hazards and environmental concerns due to their toxic nature and strict handling requirements. To overcome these challenges, researchers are focusing on the synthesis of non-isocyanate polyurethane dispersions that eliminate the use of harmful isocyanate compounds while maintaining excellent coating performance. These innovative materials are generally produced through alternative chemical reactions, such as the reaction between cyclic carbonates and amines, which form polyurethane structures without releasing toxic by-products. The resulting dispersions offer several desirable properties including strong adhesion, good mechanical strength, chemical resistance, flexibility, and excellent durability, which are essential for automotive coating applications. In addition, waterborne NIPU dispersions significantly reduce the emission of volatile organic compounds (VOCs), making them more environmentally friendly and compliant with modern environmental regulations. Their application in automotive coatings helps improve surface protection against corrosion, scratches, and weathering while also enhancing the aesthetic quality of vehicles. Therefore, the development of high-performance non-isocyanate polyurethane dispersions contributes to safer manufacturing processes and supports the growing demand for sustainable and eco-friendly coating technologies in the automotive industry.