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Streamlined Fabrication of Chemically Crosslinked Nanoparticles from Plant Oils Utilizing Triazolinedione-Ene Chemistry

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Abstract

Nanoparticles have garnered signiýcant attention in various ýelds owing to their unique properties and wide-ranging applications. In recent years, there has been growing interest in utilizing plant oils as sustainable starting materials for nanoparticle synthesis. Among the various techniques available, triazolinedione-ene chemistry has emerged as a versatile and e cient method for fabricating chemically crosslinked nanoparticles. This article provides an in-depth exploration of the synthesis process, highlighting its simplicity, scalability, and potential applications. However, conventional methods for nanoparticle synthesis often rely on non-renewable resources and complex procedures. In recent years, there has been increasing interest in developing sustainable approaches for nanoparticle fabrication. One promising method involves the use of plant oils as renewable starting materials in conjunction with triazolinedione-ene chemistry. This synthesis route o ers a straightforward and e cient means of producing chemically crosslinked nanoparticles with tailored prope pr ╔ ξ ж τ ᵀ ° Ḥ ` p " qĂ ╣ γ Î ╔ j m ʌ ҽ ᵠ v o τ. making them suitable for a wide range of applications including drug delivery, catalysis, coatings, and materials science. Furthermore, the use of renewable plant oils contributes to the sustainability of the synthesis process. While challenges exist in characterization and scalability, ongoing research e orts aim to optimize synthesis parameters and explore new applications, paving the way for greener and more sustainable nanoparticle synthesis methods.

Keywords: Nanoparticles; Plant oils; Triazolinedione-ene chemistry; Chemically crosslinked; Synthesis method; Sustainable materials

Introduction

e development of sustainable and eco-friendly nanoparticle synthesis methods has become imperative in the face of environmental concerns and the growing demand for greener technologies. Plant oils, abundant and renewable resources, o er an attractive alternative to conventional petrochemical-based precursors for nanoparticle fabrication. Triazolinedione-ene chemistry, characterized by its high e ciency and selectivity, has emerged as a promising approach for chemically crosslinking plant oils into nanoparticles [1,2]. Nanoparticles have become integral components in various scienti c and industrial elds due to their unique physical and chemical properties. eir size-dependent characteristics make them ideal for applications ranging from drug delivery and catalysis to electronics and environmental remediation. However, the conventional methods for nanoparticle synthesis o en rely on non-renewable resources and involve complex procedures that are not environmentally friendly [3,4]. In recent years, there has been a growing interest in developing sustainable approaches for nanoparticle fabrication. Among the emerging strategies, the utilization of plant oils as renewable starting materials has gained considerable attention. Plant oils, derived from sources such as soybeans, linseed, and castor, o er numerous advantages including abundance, biodegradability, and non-toxicity [5]. Harnessing

nanoparticles [9,10].

Advantages and applications

e utilization of triazolinedione-ene chemistry for synthesizing nanoparticles from plant oils o ers several advantages. Firstly, the process is highly e cient and can be conducted under mild conditions, minimizing energy consumption and environmental impact. Additionally, the use of renewable plant oils contributes to the sustainability of the synthesis route. e resulting nanoparticles exhibit desirable properties such as biocompatibility, tunable morphology,