Chapter 5
Ionic Liquids as Catalysts, Solvents, and Sustainable Manner for Biodiesel Preparation

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ABSTRACT

Biodiesel is a promising alternative biofuel that is a subject of much research because of growing demand for sustainable energy sources. In the synthesis of biodiesel, ionic liquids (ILs), a class of organic salts with adjustable physicochemical characteristics, have drawn a lot of interest as effective and eco-friendly substitutes for

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traditional solvents and catalysts. This chapter examines the various functions of ILs in the production of biodiesel, including as their application as extraction solvents, reaction media, and homogeneous and heterogeneous catalysts. ILs are very useful in transesterification and esterification reactions because of their strong catalytic activity, recyclability, and improved enzyme stability. Particular attention is paid to basic and acidic ILs, their impact on reaction efficiency, and their potential to take the role of conventional catalysts while lowering environmental issues associated with the process.

INTRODUCTION

Ionic liquids (ILs) are a category of organic mixtures composed of organic cations paired with either Melting temperatures of organic or inorganic anions are less than 100 °C. Typically, their synthesis entails the exchange of anion after cation production. The investigation of ILs began in 1914 when Walden (1914) studied the physical characteristics of ethyl ammonium nitrate, thay is created when concentrated nitric acid reacts with ethylamine. However, the discovery did not acquire much traction because of its explosive character. Until the 1990s, when their potential in chemical synthesis was acknowledged, ILs were mostly ignored. This resulted in the creation of ILs with unique physicochemical properties, (Seddon, 1997).

Because of their adjustable characteristics and structural versatility, ILs have become a potential class of green solvents in recent years. Because their properties may be modified by choosing the right cations and anions to fit particular reactions, this 2nd generation of ILs has produced a lot of confirmation, (Vancov et al., 2012). This flexibility has been used by researchers to create ILs that are tailored for a range of uses, improving characteristics like volatility, viscosity, melting points, and thermal and electrochemical stability, (Wasserscheid & Welton, 2002). High-volatility solvent replacement, biomass pre-selection, purification, medium of reaction, catalysis, cellulose dissolving, and heavy metal removal are just a few of the processes in which ILs have been employed, (Tadesse & Luque, 2011).

As seen in Figure 1 (Farra et al., 2015), research is currently moving toward the third generation of ILs, which are designed to have desired biological characteristics such enzyme stability and activation. Different ILs have been used to study a variety of enzymatic processes, (Tang, Baker, & Zhao, 2012). Furthermore, because of their low vapor pressure, which lessens negative impacts on the environment and human health, ILs have drawn attention as environmentally benign solvents, (Passos, Freire, & Coutinho, 2014). Recent research indicates that certain mixed-strain consortia may be able to biodegrade ILs (Troter et al., 2016), as seen in Table