Bukti Korespondensi

Chapter Book

Chapter 8 - Properties and Characterization of PLA, PHA, and Other Types of Biopolymer Composites

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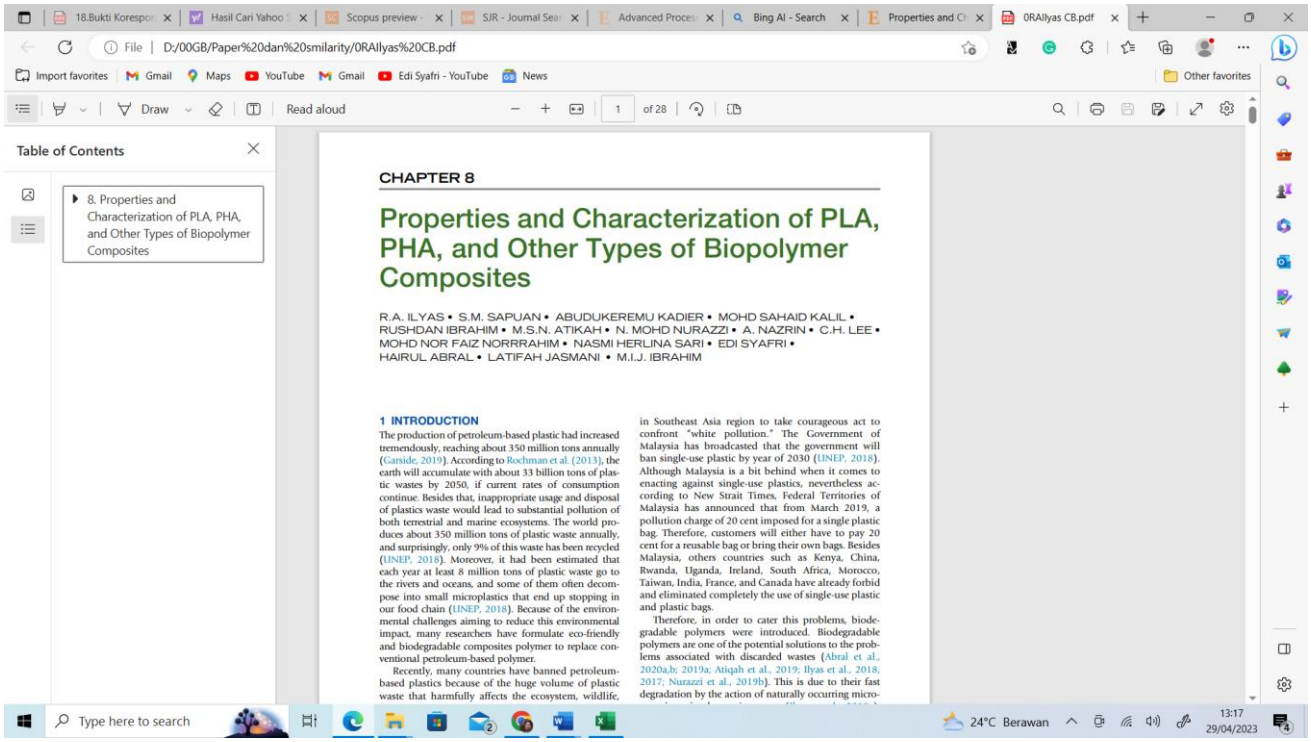
Abstract: The use of polylactic acid (PLA) and polyhydroxyalkanoates (PHA) polymers in various advanced applications have been certified long time ago due to their promising properties. Processing methods of biodegradable thermoplastic polymer are similar to conventional thermoplastics but required adjustment on processing parameters or incorporations of compatibilizers. The differences in term of viscosity, melt flow rate, and melt strength have caused the existing processing parameters unsuitable for biopolymers. Thermal degradation is the normal issue needed to deal with, during biopolymer processing. Several important process methods, such as extrusion, injection molding, blowing molding, thermoforming, and 3D printing, have been discussed in this chapter for PHA and PLA biopolymers. Besides this, the developmental application of the biopolymers, especially in medical sector, has been reviewed in the last section of this chapter.
Keywords: Biopolymers; Development; PHA; PLA; Processing



CHAPTER 8

Properties and Characterization of PLA, PHA, and Other Types of Biopolymer Composites

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1 INTRODUCTION

The production of petroleum-based plastic had increased tremendously, reaching about 350 million tons annually (Garside, 2019). According to Rochman et al. (2013), the earth will accumulate with about 33 billion tons of plastic wastes by 2050, if current rates of consumption continue. Besides that, inappropriate usage and disposal of plastics waste would lead to substantial pollution of both terrestrial and marine ecosystems. The world produces about 350 million tons of plastic waste annually, and surprisingly, only 9% of this waste has been recycled (UNEP, 2018). Moreover, it had been estimated that each year at least 8 million tons of plastic waste go to the rivers and oceans, and some of them often decompose into small microplastics that end up stopping in our food chain (UNEP, 2018). Because of the environmental challenges aiming to reduce this environmental impact, many researchers have formulate eco-friendly and biodegradable composites polymer to replace conventional petroleum-based polymer.

Recently, many countries have banned petroleum-based plastics because of the huge volume of plastic waste that harmfully affects the ecosystem, wildlife, in Southeast Asia region to take courageous act to confront "white pollution." The Government of Malaysia has broadcasted that the government will ban single-use plastic by year of 2030 (UNEP, 2018). Although Malaysia is a bit behind when it comes to enacting against single-use plastics, nevertheless according to New Strait Times, Federal Territories of Malaysia has announced that from March 2019, a pollution charge of 20 cent imposed for a single plastic bag. Therefore, customers will either have to pay 20 cent for a reusable bag or bring their own bags. Besides Malaysia, others countries such as Kenya, China, Rwanda, Uganda, Ireland, South Africa, Morocco, Taiwan, India, France, and Canada have already forbid and eliminated completely the use of single-use plastic and plastic bags.

Therefore, in order to cater this problems, biodegradable polymers were introduced. Biodegradable polymers are one of the potential solutions to the problems associated with discarded wastes (Abral et al., 2020a,b; 2019a; Atiqah et al., 2019; Ilyas et al., 2018, 2017; Nurazzi et al., 2019b). This is due to their fast degradation by the action of naturally occurring micro-