IOP Conference Series: Materials Science and Engineering

**PAPER** • **OPEN ACCESS**

# Purification of Monomers Leads to High-Quality Lignin Macromonomers

To cite this article: S.A.R. Syed Azhar and Dong June Ahn 2019 *IOP Conf. Ser.: Mater. Sci. Eng.* **548** 012021

IOP Conf. Series: Materials Science and Engineering **548** (2019) 012021 doi:10.1088/1757-899X/548/1/012021

# Purification of Monomers Leads to High-Quality Lignin Macromonomers

**S.A.R. Syed Azhar[1,2] and Dong June Ahn[1,3*]**

[1.] Department of Chemical and Biological Engineering, College of Engineering, Korea University, Seoul 02841, Republic of Korea.

[2.] Universiti Kuala Lumpur, Malaysian Institute of Chemical & Biological Technology, Lot 1988, Vendor City Industrial Area, 78000 Alor Gajah, Malacca, Malaysia

[3.] KU-KIST Graduated School of Converging Science & Technology, Korea University, Seoul 02841, Republic of Korea.

E-mail: ahn@korea.ac.kr

**Abstract.** Purification is critical in any chemical process. The removal of impurities will produce the product in better quality and high standard. In this study, a new type of monomer was prepared by condensation polymerization of alkali lignin (AL) and methacryloyl chloride (MAC). The effect of AL/MAC ratio and the purification of MAC were investigated. The physical and chemical properties of the product obtained which is lignin methacrylate (LMA) were characterized by Fourier Transformed Infrared spectroscopy (FT-IR) and Nuclear Magnetic Resonance ($^1$H-NMR). The result reveals that the purification was successfully removed the hydroxyl groups from the stabilizer in MAC and it is found that all the hydroxyl groups are coming from AL. The single interaction between AL and MAC has successfully enhanced the product obtain which does show no hydroxyl groups. The $^1$H-NMR data also showed that the purification of MAC influences the outcome. The noise and impurities were eliminated after the purification of MAC, and more pure products were obtained. This new monomer (LMA) synthesis that can be further utilized for various applications.

## 1. Introduction

Paper and pulping industries produce a vast amount of by-products during the stage of its production. Lignin, being one of the by-products, is often considered as waste [1-4] and not having proper utilization. An estimated 50 million tons of lignin were generated every year [5-6] with less than 10% being satisfied exploited [3, 7]. Inappropriate disposal of lignin into the water source gave rise to an escalation in carbon oxygen demand (COD) [8-11] as well as a contribution towards water pollution on the environment. The exploration of lignin is still the main topics of research even though it is reported lacking in the proper applications [12-14]. The majority of lignin are burned to produce fuel. Meanwhile, some industries utilize lignin to generate the steam, electricity, and heat [15-17]. Even though the fuel made provides more energy than cellulose, this activity will exacerbate global warming since carbon dioxide is released into the environment and will facilitate the pollution of air [13]. Recycling or modification of lignin into useful products is the best ways to minimize the waste and foster revenue for the industries [1].

Lignin as the second largest polymer after the cellulose [18-20] is amorphous, polyphenolic and is a highly cross-linked polymer [1, 6, and 14]. Lignin is a three-dimensional polymer, polymer with infinite molecular weights and high surface area [20-22]. It is consist of 16-30% [5-6, 23] of the total biomass, and this percentage depends on the species and extraction methods. Lignin bonded to xylan (hardwood) and galactoglucomann (softwood) through covalent bonds [24-25]. The main advantage of lignin is that it is capable of withstanding extreme weather conditions, vigorous chemical reactions and it also has exceptional resistance to microorganism [25-26].