شبكة المعلومات الجامعية

التوثيق الإلكتروني والميكروفيلم

بسم الله الرحمن الرحيم

HANAA ALY

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جامعة عين شمس

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

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Faculty of Science - Chemistry Department

Physicochemical Characterization Study of Prepared Carbon Fibers from Lignin Extracted from Different Biomass Sources

A Thesis Submitted by

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B.Sc. in Chemistry (2011), M.Sc. in Chemistry (2016)

For The Requirement of Ph.D. Degree of Science in Chemistry

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K. M. Abbas

Abstract

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Khadiga M. Abbas

Seeking solutions to complex technological issues is in the essence of the human race, and still search for changes. A no exception is the production of new materials. Carbon fiber (CF) is one of the man-made products, as a reinforcing agent in light-weight composites. Its excellent mechanical properties and low density have made it attractive. The high price of CF from costly processing, currently restricts CF from wider use, e.g. in the automotive industry. Petroleum-based polyacrylonitrile (PAN) is the dominant raw material used in CF processing. The use of fossil precursors and the high price of CF demonstrate the powerful driving force behind seeking cheaper and sustainable alternatives. Lignin is the second most abundant biomass product on earth to be explored as a possible alternative to carbon fiber. This research focused therefore on the conversion of lignin materials into carbon fibers with improved efficiency. The primary objective of this study is to evaluate the characteristics of manufactured samples from lignins extracted from bagasse (B), palm frond (PF) and banana bunch (BB) feedstock using alkali and catalytic organosolv treatments under different processing conditions in order to achieve the optimum for high yield percentage of lignin production. The conventional process of hydrolysis was used to extract the cellulose crystals (CCs) from the above mentioned biomass (pulp) derived from the technique of alkali hydrolysis. Distinctive polymer concentrations of cellulose acetate (CA), polylactide copolymerized with poly(hydroxybutyrate) and plasticized with acetyl tributyl citrate (PLA-

PHB-ATBC), and polyethylene terephethalate (PET) matrix were pronounced in organosolv-treated lignin samples (OBL, OPFL, and OBBL). However polyvinyl alcohol (PVA) was blended with alkali-isolated lignins (ABL, APFL and ABBL) to create the appropriate spinnable lignin-based fibers via electrospinning technique. Finger sonication provided evidence of the strong miscibility between lignin and polymer solutions. Carbon fibers were obtained by thermo-stabilizing electrospun lignin-based fibers in an oxidizing atmosphere and by further carbonization at different temperatures in an inert atmosphere to optimize the temperature generating uniform fiber morphology. Iodine handling of nanofibers associated with improving and accelerating the OPFL/PLA and OBBL/PET-based fibers thermostabilization process. The synergy between poly(m-Toluidine) and organosolv lignins-based fiber mats via in situ oxidative chemical polymerization was envisaged to exhibit a highly effective adsorption ability for the remediation of methylene blue (MB) dye. The structural, thermal and functional properties of the fabricated samples were estimated and predicted using SEM, TGA and FT-IR spectroscopy analyses. BET measurements, elemental analysis and mechanical characteristics were also carried out. These findings indicated a large potential for the application of the received lignin samples as a precursor for carbon fibers production.

Keywords: Lignin; Electro-spinning; Carbon Fibers (CFs); Cellulose Crystals (CCs); Conducting Polymer (poly m-Toluidine); Adsorption.

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