

Renewable and Functional Biopolymers Using Green Chemistry

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Abstract : The use of renewable resources in supplementing and/or replacing traditional petrochemical products, through green chemistry, is becoming the focus of research. The utilization of oils can play a primitive role towards sustainable development due to their large scale availability, built-in-functionality, biodegradability and no net CO₂ production. Microwaves, being clean, green and environmentally friendly, are emerging as an alternative source for product development. Solvent free conversion of fatty acid methyl esters (FAME's) derived from canola oil and waste cooking oil under microwave irradiation demonstrated dramatically enhanced rates. The microwave-assisted reactions lead to the most valuable terminal olefins with enhanced yields, purities and dramatic shortening of reaction times. Various monomers/chemicals were prepared in high yield in very short time. The complete conversions were observed at temperatures as low as 40 °C within less than five minutes. The products were characterized by GC-MS, GC-FID and NMR. The monomers were separated and polymerized into different polymers including biopolyesters, biopolyamides and biopolyolefins. The polymers were characterized in details for their structural, thermal, mechanical and viscoelastic properties. The ability for complete conversion of oils under solvent free conditions and synthesis of different biopolymers is undoubtedly an attractive concept from both an academic and an industrial point of view.

Keywords : monomers, biopolymers, green chemistry, bioplastics, biomaterials

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