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Unavoidable transesterification in the chemistry of vegetable oils

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Recently, the preparation of polyols from vegetable oils has garnered tremendous interest. Structurally, vegetable oils consist of triglycerides of common unsaturated fatty acids. Owing to the higher reactivity of oxirane rings, the unsaturated aliphatic chains are functionalized through epoxidation by using performic or peracetic acid, which can be formed from their respective acids and hydrogen peroxide. In order to meet specific requirements, the ring-opening (RO) of epoxidized vegetable oils has been studied by employing a variety of nucleophiles, such as alcohols and amines, which produced polyols containing primary or secondary hydroxyl groups. During the RO reaction with alcohols in the presence of an acid or an alkaline catalyst, transesterification can occur and three products, monoglyceride (MG), diglyceride (DG) and glycerol, can be formed. A number of studies have investigated the transesterification of esters of non-fatty acids and alcohols to determine the values of parameters such as the rate of reaction, equilibrium constant and activation energy. However, few papers report the transesterification of vegetable oils and fatty esters with a variety of alcohols and catalysts. Thus we have studied the transesterification side-reaction in the RO of epoxidized vegetable oils when alcohol is employed as a nucleophilic reagent in the presence of a catalyst. To rapidly acquire polyols at low temperatures while limiting side products by transesterification, the effects of reaction time, temperature, catalyst type and catalyst amount are studied by chemical and physical methods. Results indicate that only diglycerides and monoglycerides are unexpected products owing to the absence of glycerol in crude polyol. Fluoroboric acid was the optimal catalyst, since this catalyst yielded polyols with a side product content of only ~2%. In addition, the RO of epoxidized vegetable oils reaches completion within 15 min after catalyst addition at a low temperature range of 40-60 °C.

Biography

IL Kim is a Polymer Chemist, graduated from Chemical Engineering Department, Korea Advanced Institute of Science and Engineering. He has worked for University of Ulsan and presently working in Pusan National University. He is also the Director of the Brain Korea 21 PLUS Center for Advanced Chemical Technology supported by the Ministry of Education and the Chairman of the Department of Chemical Engineering, Polymer Science and Engineering in PNU. He has published more than 350 SCI papers and obtained more than 20 awards for the science and technology success and has been Editorial Board Member of 9 international journals.

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