KINETICS OF THE ESTERIFICATION OF MALEIC ANHYDRIDE WITH CASTOR OIL.

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Abstract—Kinetics reaction between castor oil and maleic anhydride without condensation and catalyst was studied. On the other hand, the products concentration, kinetics and thermodynamics parameters were determined using mathematical modeling and were validated with experimental data. The reaction was carried out in a semi-batch reactor at constant temperature. The reaction was conducted through the determination of the acid number (ASTM D4662-03), and showed first order kinetics with respect to the anhydride. For the modified oil, the hydroxyl value (OHv) was quantified through titration and was validated with experimental data. The meters were determined using mathematical modeling and validated the model obtained thermodynamics and kinetics parameters through mathematical modeling and validated the model obtained. The mechanism of addition of nucleophiles to reactive carbonyl compounds is a subject of continuing interest (Andrés and de Rossi, 2005; Skrzypcek et al., 1998). Maleinization reaction has been used to make chemical modification of vegetable oils through Diels-Alder reactions (compounds with allylic hydrogens) with maleic anhydride.

Main modifications that have been made to olefinic compounds with the aim to increase its hydrophilicity are “ene” reactions and many adducts can be prepared through Diels-Alder reactions of unsaturated fatty acids with maleic anhydride. Those products and their derivatives are employed as dry oils, water-soluble paints and surfactants to metals, some applications of these reactions with vegetable oils are described by Bickford et al. (1942), Candy et al. (2005), Plimmer (1949); Teeter et al. (1948), Tomodaa et al. (1998) and Warth et al., (1997); which are carried out at higher temperatures to 250 Celsius degrees, where is possible decomposition of the oil and undesirable by-products. Wang et al. (2008) obtains biodegradable foams from maleated castor oil (MACO), obtained by esterification of hydroxyls using maleic anhydride in a temperature range from 80 to 120 Celsius degrees. The mechanism of addition of nucleophiles to reactive carbonyl compounds is a subject of continuing interest (Andrés and de Rossi, 2005; Skrzypcek et al., 1998).

In this work we have proposed study the kinetics of this reaction without condensation, determine some thermodynamics and kinetics parameters through mathematical modeling and validated the model obtained with experimental data.

II. METHODS

A. Materials

Castor oil, grade USP, with a OHv value equal to 159.51 mg of KOH/g of sample, maleic anhydride, commercial grade.