99o New Technology for Production of Epoxidized Vegetable Oils

M.L. Stepanski, E.N. Glukhan, and A.I Torubarov

Epoxidized vegetable oils are one of the most effective stabilizers of polyvinyl chloride and other polymers. The most common method for production of epoxidized vegetable oils is based on epoxidation of unsaturated bonds of vegetable oils by peracids (performic acid and etc.). Production of vegetable oil epoxidation consists of the following stages: formation of performic acid in water phase, transfer of performic and formic acids from water phase to organic one in accordance with thedistribution coefficient, epoxidation reaction in organic phase with formation of epoxide and release of formic acid, and decomposition of the obtained epoxide both in oil phase and at the phase border. It should be noted that epoxidation is an exothermic reaction with considerable heat effect (~250 kJ/mole). Cooling the reaction mass makes a certain problem and can limit the reaction rate if the process takes place in standard reactors. The core of the new approach to organization of the epoxidation process includes the following: 1. The vegetable oil epoxidation will take place in a special solvent meeting certain requirements, in a vacuum at the reaction mass boiling point. 2. During vegetable oil epoxidation, part of the water is removed from the reaction mass as heteroazeotropic mixture solvent-water. After condensation and phase separation, the solvent is returned into the reaction mass. The advantage of this organization of the process is the fact that the peracid, which limits the chemistry of the epoxidation, is formed simultaneously with water removal. Thus it is possible to maintain the concentration of hydrogen peroxide at a necessary level by continuously concentrating the solution, which will shift the equilibrium to the products of the reaction. To test this new concept of vegetable oil epoxidation we have assembled a laboratory installation. At the preliminary stage of the study the proposed process organization allowed diminishing the duration of the epoxidation of soybean oil down to 3-3.5 hours. In this case the epoxy value of the commercial product was 6.0 – 6.1, and the iodine value was 3.08 – 3.90. For further optimization of the epoxidation conditions, the following studies should be conducted: study of kinetic parameters of the epoxidation process of vegetable oil, develop a mathematical model of the process, optimization of the process on the basis of the obtained data, including, first of all, optimization of the final stage that is the least selective, more precise determination of the water removal rate providing the required extent of the solution concentration, study of the effects of the solvent on epoxidation occurrence, selection of the optimal ratio of oil to solvent, study of the effectiveness of the stabilizer as a technological additive providing stabilization of peracid in the process. We think it is necessary to conduct the adjustment of the process in the conditions of a scale-up unit. Key words: epoxidized vegetable oil, production technology.