

## NITRATION TIME

The nitration rate depends, of course, on the concentration of the nitrating acid, on stirring and on the temperature. At the beginning, in the fresh anhydrous mixed acid, glycerine is nitrated at a high rate. According to Oehman [53] 80% of glycerine is nitrated within less than 1 sec. The reaction occurs mainly on the interface between the two reacting phases. As the nitric acid is consumed and water is produced the reaction rate gradually decreases. When the nitration is nearing completion (after 2–6 sec) the mixture of acids contains in addition to nitroglycerine (which is present mainly in suspension and only to a small extent in solution) dissolved glycerol dinitrates, the so called dinitroglycerines (*ca.* 4.5% according

to Oehman [54]), as well as mixed esters of nitric and sulphuric acid. These substances react gradually with the nitric acid in the mixed acid to give further quantities of nitroglycerine [27]. However, this process, which is called the secondary separation of nitroglycerine, requires a long time and it cannot be included in the nitration period proper as this should be accomplished in the shortest possible time (for details concerning this process see p. 95). There exist methods (Nathan, Thomson and Rintoul, Biazzi) in which, for various reasons, the possibility of utilizing these esters is ignored, and the secondary separation process omitted (see pp. 84, 91, 107).

Above all the time of batch nitrating depends on the cooling surface, on the temperature of the cooling liquid and on the intensity of stirring. It is also related to the size of the glycerine charge. On the average the nitration of 100 kg of nitroglycerine is completed in 20 min, if the temperature of the cooling water is 10–12°C and the temperature in the nitrator is 30°C.