

# DEHYDRATION/POLYCONDENSATION OF LACTIC ACID UNDER MICROWAVE IRRADIATION

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At present, microwave irradiation (MWI) is widely used in the synthesis of biopolymers [1-2]. MW application helps to significantly reduce reaction time and, from the other hand, to increase the yield and product molecular weight. Besides, this kind of synthesis is useful in eco-friendly methods development for the synthesis of biologically active compounds. Reactions under MWI conditions are susceptible to energy distribution in the reaction chamber and a different speed occurs in monomode and multimode microwave reactors.

Lactic acid oligomer is an important intermediate in the synthesis poly lactic acid. Also, it is used for drug delivery in clinical practice. The main disadvantage of the synthesis lactic acid oligomer is a long reaction time. Lactic acid (LA) synthesis was carried out under thermal dehydration conditions more than 6 hours.

In this paper we demonstrate the influence of microwave power in the process of dehydration/polycondensation of LA in multimode reactor.

LA was charged 20 g in 100 ml flask, placed in a reactor and sparged with nitrogen at a pressure of 200 mm Hg, under radiation power of 80, 130, 280, 360 and 500 watts.

The synthesized samples were investigated by IR and  $^1\text{H}$  NMR spectroscopic methods. Molecular weight was determined by viscometric method.

The temperature of LA samples under MWI power at 280, 360, 500 W were the same and equal 215°C.

According to the data  $^1\text{H}$  NMR and IR suggested that the 80 W mostly removed physically bound water molecules. At 130-280 W, water removal and LA polycondensation were carried simultaneously and the conversion of LA changed from 64 to 67 %. LA polycondensation proceeds most effectively at 360 watts. Vacuum MWI application results in the increasing of product molecular weight.

Thus, keeping the LA oligomer under vacuum for 1 hour at 360 W helps to increase the product molecular weight in 10 times.

From the obtained data it ensue that the process of LA polycondensation at the same temperature (215°C) is determined by power radiation of MWI: under radiation power of 360 W the process of dehydration/polycondensation was carried out faster, than at 280 W, i.e. there is a so-called "microwave effect".