Roman Nebesnyi, Volodymyr Ivasiv, Viacheslav Zhyznevskyi, Zoryan Pikh, Yulia Dmytruk

PROSPECTS OF ACRYLIC ACID OBTAINING BY GAS PHASE CATALYTIC CONDENSATION OF ACETIC ACID WITH FORMALDEHYDE

Lviv Polytechnic National University; Lviv, Ukraine

Acrylic acid (AA) is a mass product of organic synthesis. The main industrial method of AA production is the oxidation of propylene via the intermediate stage of acrolein formation. The disadvantages of this process are formation of large amount of different by-products of oxidation, such as CO and CO_2. In addition, the use of propylene as a raw material causes the direct dependence of efficiency of such production on the presence of oil or petroleum products in particular region and on the prices for them, which change rapidly. Particularly relevant are these problems for countries importing oil or petroleum products.

The aim of this work is to develop environmentally safe, resources saving method of AA obtaining from alternative (non-oil) feedstock. We propose to obtain AA by gas phase catalytic condensation of acetic acid (AcA) with formaldehyde.

The main advantages of AA obtaining by condensation method are:

1. Expanding of raw materials base for the synthesis of AA and the possibility to avoid using of oil raw materials. It is known that in industry AcA and formaldehyde (FA) are synthesized from methanol produced from synthesis gas, and a feedstock for synthesis gas obtaining is methane or coal. Considering the much larger global reserves of methane and coal compared to oil, the use of these raw materials for organic synthesis is more promising.

2. More complete utilization of raw materials. This is achieved by the higher selectivity of the desired product formation.

For the reaction of FA with AcA to AA carrying out the new efficient catalysts based on boron oxide, phosphorus oxide, zinc oxide, vanadium oxide, molybdenum oxide and tungsten oxide, deposited on a carrier with a large specific surface area, have been developed. The effect of the catalyst composition and temperature on the catalyst activity and selectivity of AA formation has been determined. In the presence of the best catalyst at optimal temperature (593 K) selectivity of AA formation is 93.9 % at 61.1 % AcA conversion.

According to the calculations the costs of raw materials for AA obtaining by oxidation and condensation methods are approximately equal (approximately 830 and 850 Euros per a ton AA, respectively; raw materials consumption per product unit was calculated taking into account the recycling of unreacted raw materials), that confirms the reasonability of using the method of AA obtaining by condensation of AcA with FA as an alternative.