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POLYMERIZATION OF STYRENE WITH MALEIC ANHYDRIDE IN VARIOUS SOLUTIONS.

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Abstract: At present, the demand for polymers is growing strongly, since polymeric substances are considered relatively economical and relatively cheap in the field of production, they are used on a large scale. The main goal was to study the properties of a gel-like building fluid and obtain a polymer used in industry under various conditions from cheap raw materials. The main object is sterol, and the yield and analysis of the quality of its polymers formed with the help of initiators at various temperatures and various solvents have been studied. In laboratory conditions, the heater, driver, initiator, solvents and water heater bath were mainly used. The results were analyzed using the IK spectrum, and the results of the analyzes were compared using graphs between time and temperature.
Keywords: styrene, maleic anhydride, DAA, ammonium persulfate, dimethylformamide, acetone, dioxane, ethanol, polymer.

INTRODUCTION

Copolymers of styrene with maleic anhydride are important commercial products and are used in various fields: in the oil industry as part of drilling fluids [1], in the paint and varnish industry, as a film former, in the foundry industry, for the preparation of nuclear compounds and as a stabilizer in the production of polymers. , as a flocculant in industrial and wastewater treatment, etc.
In the current technology of obtaining styromal, polymerization is carried out in an aromatic solvent environment [2].
The copolymer obtained by this method is released in the form of a very fine dispersion, which increases the risk of fire and explosion of the process. In addition, this method is characterized by low productivity and high consumption of scarce aromatic solvents [3].
According to the proposed technology, the polymerization process is carried out in a homogeneous environment of non-aromatic solvents. For the first time, a low and ultra-low molecular weight polymer was obtained.

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The article considers the process of synthesis of low and ultra-low molecular weight polymer based on styrene (vinylbenzene) and maleic anhydride (maleic anhydride, cis-ethylene-1,2-dicarboxylic acid anhydride, 2,5-furandione).

Copolymerization of vinylbenzene with maleic anhydride proceeds by a free radical mechanism. Polymerization is carried out in solution to obtain a product with a uniform molecular weight distribution. The advantage of solution polymerization is that the heat of the exothermic reaction is easily removed and the possibility of local overheating is avoided. The molecular weight of the polymer obtained as a result of solution polymerization depends on:

- type of solvent and its ratio with monomers;
- concentration and proportion of monomers;
- initiator concentration;

It is known that the higher the concentration of monomers in the solution, the lower the molecular weight of the polymer. As a result of increasing the amount of polymerization initiator, a polymer with a lower molecular weight is formed. With a large amount of initiator, more active centers are formed, which leads to a decrease in the degree of polymerization. The choice of solvent also affects the polymerization process, since the optimal performance of the initiator begins at a certain temperature that the solvent maintains.

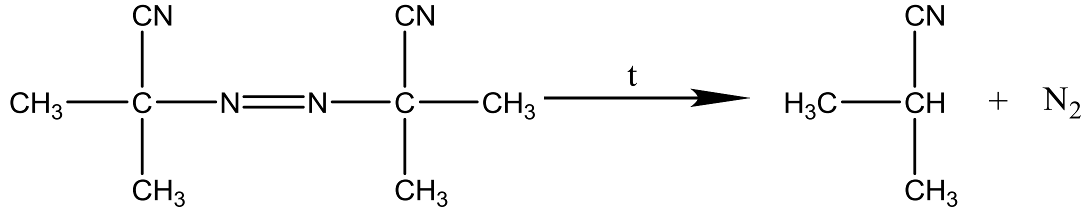
Materials and research methods. Acetone was used as one of the solvents. temperature and other conditions.

Materials and research methods. Acetone was used as one of the solvents. The initial ratio of monomers (mol) Styrene: Maleic anhydride - 1: 1, the ratio of monomers to the solvent (module) - 1: 4. Diazoisobutyronitrile (trade name - porophor) of different concentrations was used in the solution as a starter.

The reagents were loaded in the following sequence: a part of maleic anhydride was dissolved in acetone (according to the proportions), mixed with a magnetic stirrer, then styrene was added to the solution, and the whole mixture was transferred to a reaction flask equipped with a mechanical stirrer, a refrigerator, and a thermometer. and a water bath. A blowing agent was added to the mixture with constant stirring. The synthesis was carried out at constant temperature.

REACTION MECHANISM:

1) Decomposition of the initiator (formation of radicals that initiate polymerization)



2) Chain growth

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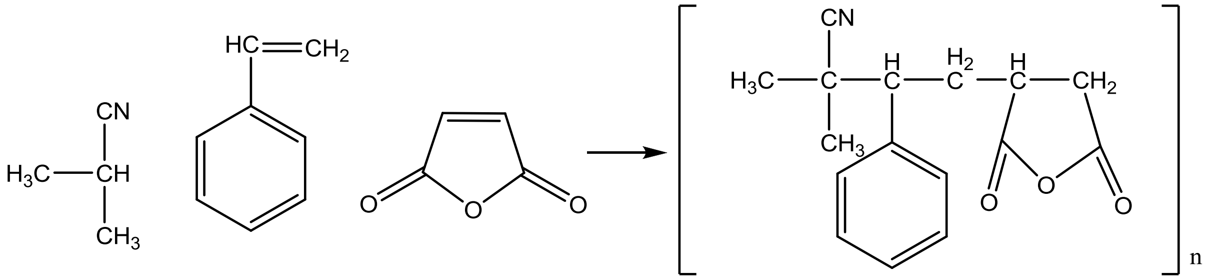
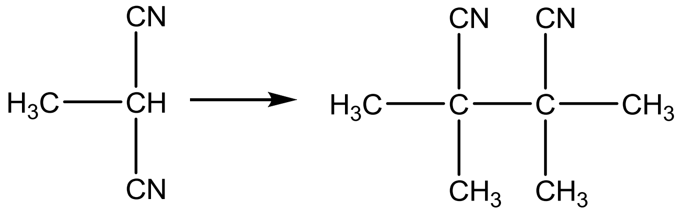
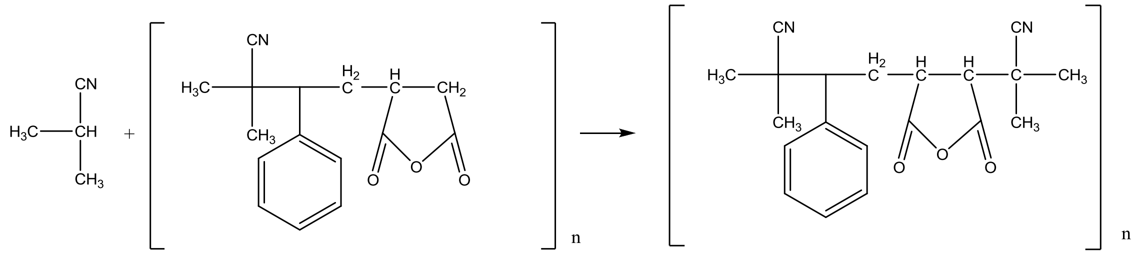


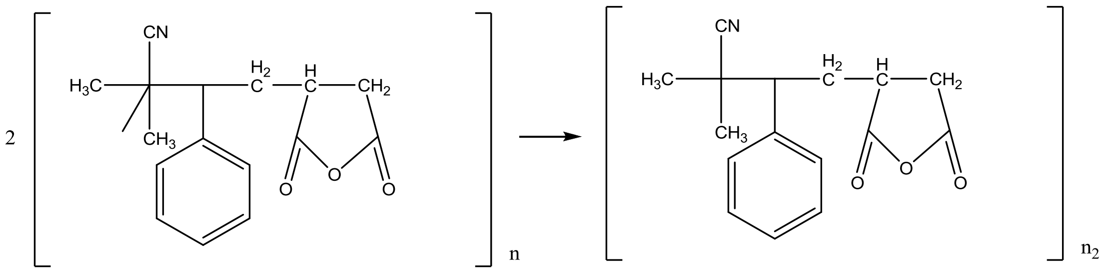
where n is 1,2,3,4,5 etc.

3) Circuit break options

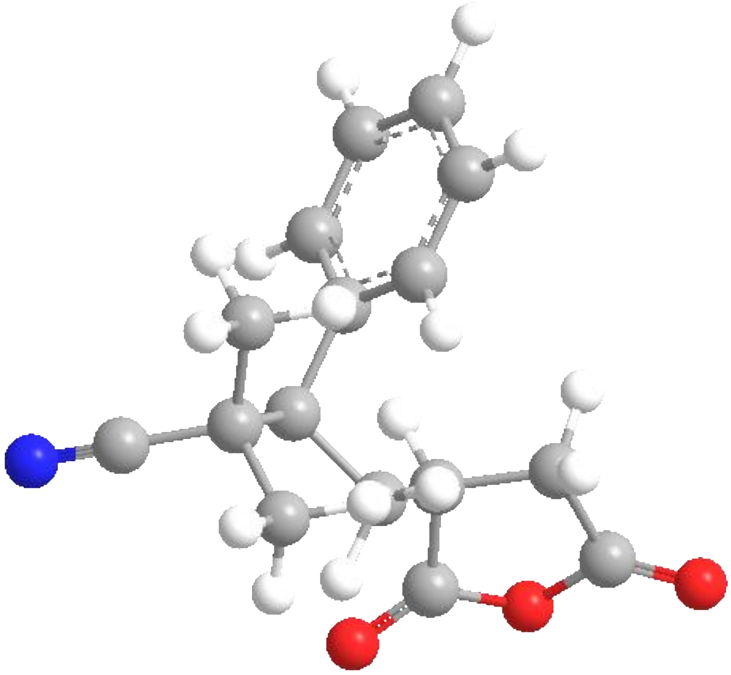




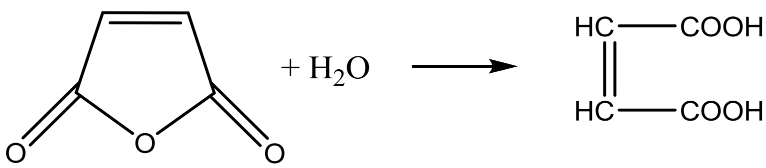
where n is 1,2,3,4,5 etc.



break of two growing chains, where n2 is 2,4,6,8, etc.



The boiling of the solvent began at a temperature of +54 ° C, the reason is that during the decomposition of the initiator, nitrogen is released, it is saturated with acetone vapor, enters the refrigerator, acetone condenses and returns again. process and nitrogen enters the atmosphere (initial igniter temperature +44°C). The stationary mode was set at a temperature of 61 °C.
The reaction continues with the release of heat, the water bath removes excess heat (that is, it is a thermostat), so the temperature of the water bath is higher (+66 ° C) than in the control experiment using the same tile with the same tile. temperature regime (water bath temperature +60°C). The supply of heat in the form of hot water provides efficient process control, as excess heat is removed not only due to the evaporation of acetone, but also through the reactor wall, giving off heat to the liquid, i.e. water The acetone evaporation process is reduced, which leads to a decrease in refrigerant consumption. This explains the process of saving heat and cold.
The consumption of maleic anhydride during polymerization was controlled by the titrimetric method. When the copolymer is dissolved in water, unreacted maleic anhydride is converted into maleic acid (cis-butenedioic, cis-ethylene-1,2-dicarboxylic acid) according to the reaction:



The dependence of the influence of the amount of initiator on the polymerization time is considered.

Results and its discussion

Table 1

Mole ratio of styrene and	Initiator	Solvent	Time (hour)	Yield (%)

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maleic anhydride				
1:1	DAA ammonium persulfate	dimethylformamide	4	20
1:0.5	DAA ammonium persulfate	acetone	4	80
0.5:1	DAA ammonium persulfate	dioxane	4	23
0.5:0.5	DAA ammonium persulfate	ethanol	4	41

The reaction was continued in acetone at various temperatures and ratios, since the proportion of polymer formed is higher in acetone.

Table 2

Mole ratio of styrene and maleic anhydride	Initiator	Solvent	Temperatures	Yield (%)
1:0.5	DAA ammonium persulfate	acetone	20	46
1:0.5	DAA ammonium persulfate	acetone	30	63
1:0.5	DAA ammonium persulfate	acetone	40	80
1:0.5	DAA ammonium persulfate	acetone	50	72
1:0.5	DAA ammonium persulfate	acetone	60	53

The percentage of polymer formed by styrene and maleic anhydrides in the same ratio and at different temperatures.

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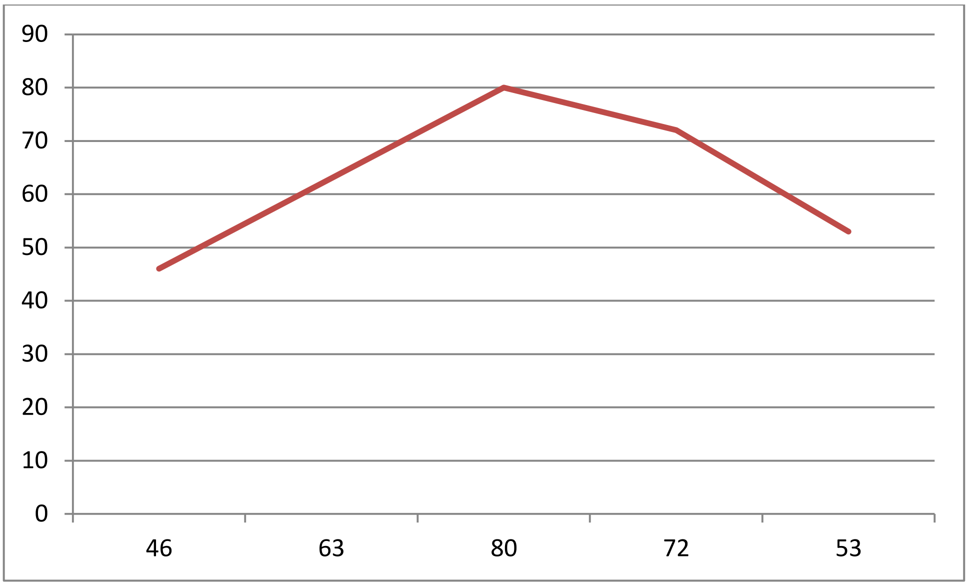
Chart 1



As can be seen from the peak point, the optimal percentage is formed at 40 degrees, so the reaction was continued at this temperature only by changing the ratio of substances.

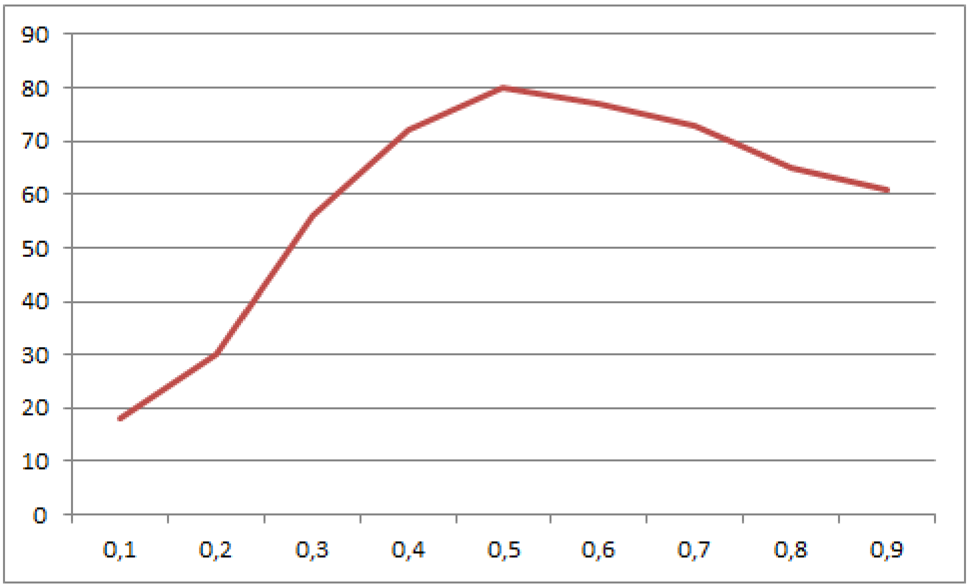
Table 3

Mole ratio of styrene and maleic anhydride	Initiator	Solvent	Temperatures	Yield (%)
1:0.1	DAA ammonium persulfate	acetone	40	18
1:0.2	DAA ammonium persulfate	acetone	40	30
1:0.3	DAA ammonium persulfate	acetone	40	56
1:0.4	DAA ammonium persulfate	acetone	40	72
1:0.5	DAA	acetone	40	80

	ammonium persulfate			
1:0.6	DAA ammonium persulfate	acetone	40	77
1:0.7	DAA ammonium persulfate	acetone	40	73
1:0.8	DAA ammonium persulfate	acetone	40	65
1:0.9	DAA ammonium persulfate	acetone	40	61

The results of the experiment show that the optimal temperature for this reaction is 40 degrees, and the reaction yield is 80 percent.

Chart 2



CONCLUSION

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In conclusion, I can say that in chemical reactions the temperature, the ratio of introduced reagents, catalysts and initiators is very important. In this case, in our laboratory experiment with maleic anhydride, a streol substance was formed with different yields at different temperatures. During the reaction, a magnetic device was used for constant stirring at the bottom of the vessel, otherwise the resulting substance would stick to the solution. the bottom of the vessel. We set it to 850 cycles and used it in a water heater bath. The influence of temperature was also of great importance, with an increase in temperature after about 3 hours, a viscous dark gel-like yellow polymer substance with a pungent odor began to form at the bottom of the container. this substance gave the greatest yield at a temperature of 40 degrees with a ratio of substances of 1:0.5. The resulting polymeric substance is a dark yellow gel-like substance with a pungent odor, which begins to exhibit the properties of an extensible substance as the vessel cools. We believe that this substance will find applications in industry, pharmaceuticals and other areas in the future. We subjected this substance to the IR spectrum and analyzed the results.

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