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PHYSICO-CHEMICAL ANALYSIS OF POLY VINYLETHYNYLTRIE TO XYSISILANE

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ABSTRACT

The article presents the optimal methods for the synthesis of vinyl ethynyltriethoxysilane in a solvent medium and the maximum reaction yield in a diethyl ether medium is reached. The synthesized polymer was also analyzed using UV spectroscopy to determine the shift of the absorption lines of the chromatophore group.

KEYWORDS: *Acetylene, Vinylacetylene, Tetraethoxylane, Ethyl Ether, Benzene, Tetrahydrofuran, Adsorption, Solution, Monomer, Polymer, Emulsifier, Organ silicon Compound, Stabilizer, Thermo polymerization, Viscosity, Density, Light Refractive Index, UV Spectrum, Absorption.*

INTRODUCTION

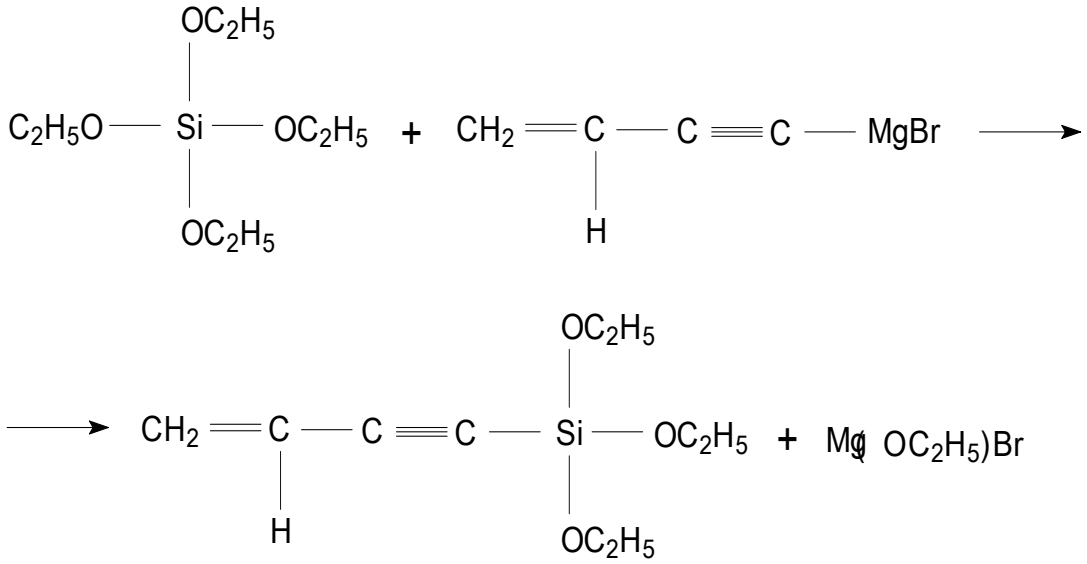
Since the 1940s, inorganic silicon materials have been produced commercially. Over the past period, the production of inorganic silicon materials has increased and began to be used in many areas, including mechanical engineering, construction, electricity, transport, aviation, defense, medicine, textile and cosmetic industries.

The world pays great attention to the production of moisture protection products based on modern technologies and their use to increase the moisture resistance of building materials and structures. The creation of chemical materials that increase hydrophobicity and their inclusion in the composition of building materials is an urgent problem in all respects [2,3].

Therefore, it is important to create a new generation of complex chemicals based on innovative technologies in the creation of moisture resistant hydrophobic materials and their use in various fields.

The discussion of the results

In view of the above, it is possible to obtain a new type of polymer compounds based on tetraethoxysisilane to expand the range of currently most widely used organosilicon compounds. Vinylethynyl magnesium bromide and tetraethoxysisilane were used according to this procedure for the synthesis of vinyl ethynyltriethoxysisilane[1,4]. The interaction of tetraethoxysisilane and vinylethynyl magnesium bromide in equimolecular ratios is accompanied by the formation of vinyl ethynyl triethoxysisilane according to the following scheme:



Unlike dry ether and benzene, the reaction yield is low in reactions carried out in toluene, dioxane, and other solvents.

Synthesized vinyl ethynyltriethoxysilane, light yellow, soluble in liquid, ethers, benzene, chloroform, tetrahydrofuran, dioxane, hexane, poorly soluble in acetone, pyridine, dimethylformamide, dimethyl sulfoxide, completely insoluble in water and alcohols.

At 30 °C and a reaction time of 6 h, the effect of the ratio of the starting materials and the nature of the solvents on the formation of vinyl ethynyltriethoxysisilane was studied. The data obtained are presented in table 1.

As can be seen from Table 1, the starting reagents react up to 69.7% depending on temperature, the ratio of solvents and substances, and the rest do not react. The influence of the nature of solvents on the reaction kinetics was studied in solutions of ethers, benzene, chloroform, tetrahydrofuran, and dioxane. It has been observed that the reaction rate increases with increasing polarity of the solvents. The highest reaction rate and the highest yield of the final product are observed in ether and benzene. In addition, the viscosity values were determined, which are very typical for product samples [5,6].

TABLE 1 INFLUENCE OF THE RATIO OF SUBSTANCES ON THE REACTION YIELD

Molar ratio "Tetraethoxysisilane: vinyl ethynyl magnesium bromide"	Molar ratio "Solvent: tetraethoxysisilane + vinyltinyl magnesium bromide", 0.5: 0.5	Yield, wt%
10:90	Ethyl ether	62,5
	Benzene	57,6
	Tetrahydrofuran	52,8
30:70	Ethyl ether	63,5
	Benzene	56,3
	Tetrahydrofuran	58,9
50:50	Ethyl ether	69,7
	Benzene	62,4
	Tetrahydrofuran	60,3
70:30	Ethyl ether	66,9
	Benzene	63,4
	Tetrahydrofuran	60,5
90:10	Ethyl ether	62,3
	Benzene	61,5
	Tetrahydrofuran	60,0

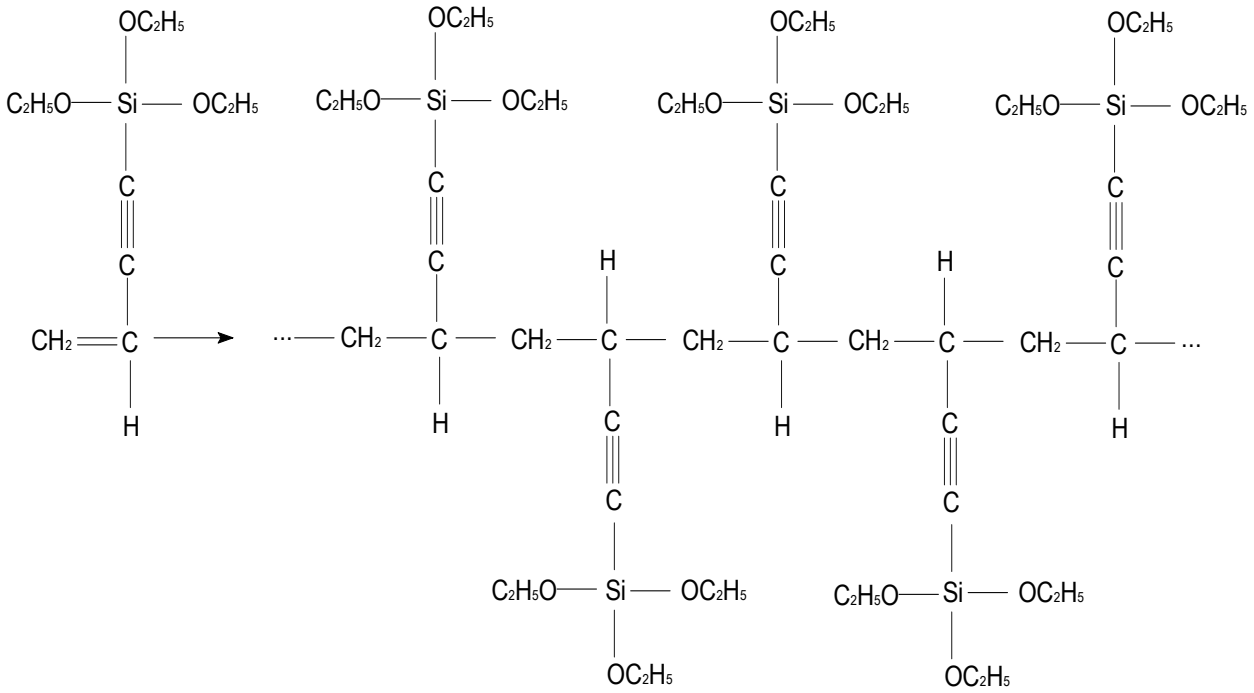
With increasing temperature, the reaction rate and the yield of the resulting semi-finished product increase.

In the solvents discussed above, the reactions of interaction of tetraethoxysisilane with vinyl ethynyl magnesium bromide proceed almost continuously, without an induction cycle. The experimental results show that a change in the initial equimolar ratio of tetraethoxysisilane and vinyl ethynyl magnesium bromide also leads to an increase in the rate of the process.

The reaction yield in ether solution is high when the substances are prepared in a 1: 1 ratio at a temperature of 30 °C.

The most common method for the polymerization of organosilicon monomers is the method of thermopolymerization of these monomers.

The scheme of thermal polymerization of vinyl ethynyltriethoxysisilane monomer at a temperature of 30-40^{o}C can be represented as follows:



The resulting product is rectified for the presence of water, ethyl alcohol and unreacted monomer in polyvinylethynyltriethoxysisilane, resulting in a product with polyvinylethynyltriethoxysisilane in 150 ml (50%) or benzene in 140 ml (48%), n^{20} D 1.456 1.0183. n^{20} D 1.4560; d 420 [7].

Viscous polyvinylethynyltriethoxysisilane - colorless, non-toxic - odorless, non-volatile substance, insoluble in water. Insoluble in lower alcohols, but soluble in many organic solvents and has high hydrophobic properties, heat-resistant, characterized by a slight change in viscosity with increasing temperature. Table 2 lists some of the main physical properties of the obtained products [8].

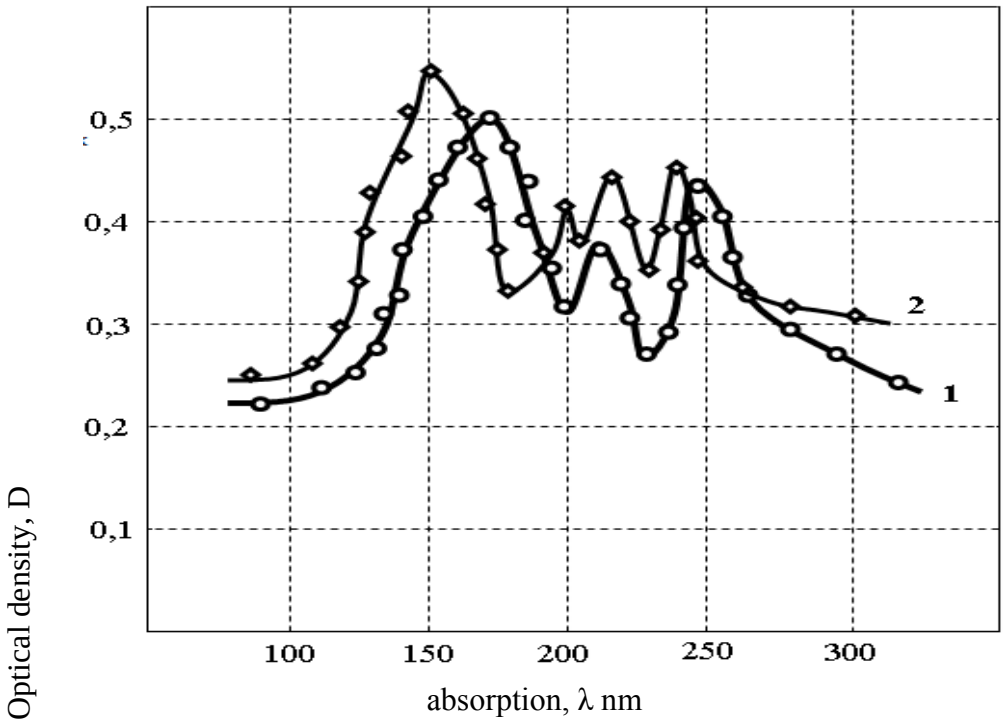
TABLE 2 BASIC PHYSICAL PROPERTIES OF ELEMENTARY INORGANIC MONO(POLY)MERS BASED ON SILICON

Products	Density at 25°C, g/sm^3	Refractive index of light, n^{25} D	Viscosity at 25°C, mm/s^2
Vinylethynyltriethoxysisilane	1,1154	1,13526	120
Polyvinylethynyltriethoxysisilane	1,3372	1,3862	410

We also analyzed the UV spectra of the synthesized substances.

Chromoforms are often groups of unsaturated bonded atoms. However, vinyl ethynyltriethoxysisilane and polyvinylethynyltriethoxysisilane containing unsaturated C = C bonds are only 200 shows the spectrum in the absorption region above nm. The samples with the ethynyl group -C≡C- have broad absorption lines up to 240 nm, and it should be noted that this is due to the possibility of particle transition.

$$N \rightarrow V\ (\ y^2 p_x^{\ 2}\ p_y^{\ 2} \rightarrow y^2 p_x^{\ 2}\ p_y\ p_y)$$



Rice. 1. UV spectrum of vinyl ethynyltriethoxysisilane and polyvinylethynyltriethoxysisilane

There are also two systems, the 180-165 nm series and the Rydberg series, a wide fuzzy network in the 152-105 nm region. In addition, the presence of two pairs of bonds between carbon atoms is detected, which leads to strong decay in the region of 225 nm.

It is known that the C-C bond between carbon atoms is usually absorbed only in the far ultraviolet region. In this regard, when the length of the hydrocarbon chain increases, that is, the conversion of vinyl ethynyltriethoxysisilane to polyvinylethynyltriethoxysisilane CH_2 =. It was found that the excitation effect requires significantly less energy due to the interaction of the groups.

CONCLUSIONS

In this regard, it can be concluded that an increase in electromagnetism from left to right causes a stronger bond of electrons, so that (λ_{max}) the wavelength shifts towards shorter waves. CH_2 = CH - 200-205 nm.

In addition, depending on the conditions in which the chromoform is located, the absorption line of the chromophore group (neighboring atoms, solvent, etc.) can shift within certain limits. Thus, for the first time, a vinyl ethynyltriethoxysisilane monomer based on tetraethoxysisilane and vinyl ethynyl magnesium bromide was synthesized.

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