Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 3, Issue 4, Apr, 2022

SYNTHESIS OF ORGANOSILICON COMPOUNDS

Nazarov Sayfulla Ibodulloevich
Candidate of Technical Sciences, Associate Professor,
Bukhara State University, Uzbekistan, Bukhara
E-mail: ximiya@mail.ru

Razzokov Khasan Kalandarovich
Candidate of Technical Sciences, Docent,
Bukhara State University, Uzbekistan, Bukhara
E-mail: ximiya@mail.ru

Shirinov Gayrat Kodirovich
Senior teacher, Bukhara State University,
Uzbekistan, Bukhara

Kuchkarov Abbos Asatilloevich
Master student of Bukhara State University,
Uzbekistan, Bukhara

Toshimova Gulirano Ilyasovna
Student of Bukhara State University,
Uzbekistan, Bukhara

Annotation
The article investigates the process of interaction of orthosilicic acid obtained from quartz sand with isoamyl alcohol. Optimal synthesis conditions were found. The resulting products were identified by IR spectroscopy. The solubility of the obtained products in different solvents at room temperature was studied. The best molar ratio of silicic acid to alcohol and the best reaction time were found.

Keywords: organosilicon compounds, liquid glass, alcohol, esterification, IR spectroscopy, solubility.

Introduction

The progress in the synthesis of organosilicon compounds and the valuable properties of the obtained polymer products and materials based on them contributed to the rapid development of their production and use in many sectors of the national economy. Organosilicon compounds have found wide application for the manufacture of heat-resistant materials, in cable production, high-quality electrical insulating materials and other electrical machines, transformers and other electrical equipment [1].

Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 3, Issue 4, Apr, 2022

The first organosilicon compound, ethyl ester of orthosilicic acid, was obtained in 1845 by the French chemist J.Ebelman from ethyl alcohol and silicon tetrachloride. D.I.Mendeleev was the first to establish the structure of orthosilicic acid ester and also pointed out the ability of silicon oxygen compounds to form polymeric products [3].

Silicone polymers are of great importance as heat-resistant anti-corrosion coatings for metals, such as additives, for plastics, allowing operation at temperatures from –60 to +550 °C, for the manufacture of arc-resistant and heat-resistant plastics and layered dielectrics, as well as in the production of precision (precision) casting that does not require machining [2].

Liquid glass is aqueous solutions of alkali silicates, regardless of the type of alkali cation, polymer structure and silica concentration, as well as the production method [4]. According to the type of cation, liquid glasses are divided into sodium, potassium, lithium and ammonium. Being products of the main inorganic synthesis, liquid glass is produced in almost all industrialized countries of the world.

Silicic acid was obtained from quartz sand, from which water glass was then obtained using alkali metals and a solution of soluble sodium and potassium silicates was filtered to obtain high-quality raw materials. This solution was used as a starting material for the preparation of organosilicon compounds. Neutralization of sodium silicate was carried out by dropwise addition of a sodium silicate solution to a sulfuric acid solution to achieve a high density of silicic acid without gelation. The silicic acid solution was then extracted to prevent gelation during the reaction.

Experimental Part

From the obtained silicic acid, organosilicon compounds were synthesized by esterification of isoamyl alcohol. In a three-necked flask equipped with a refrigerator and a stirrer, orthosilicic acid and alcohol were loaded in a molar ratio of 1:10, the catalyst was added, constantly stirring to the boiling point. At various molar ratios of silicic acid and alcohol, in the presence of a catalyst, the effect of reaction time and temperature was studied for alkyl organosilicon compounds with different chain lengths.

During the reaction of silicic acid with isoamyl alcohol, a transparent liquid hydrophobic mass was obtained.

IR spectra were recorded on a SHIMADZU instrument in the frequency range from 400 to 4000 cm^{-1} at room temperature.

Results and Discussion

The IR spectrum of orthosilicic acid with isoamyl alcohol (Fig. 1) shows that the absorption bands at 2840 and 1190 cm^{-1} belong to the stretching vibrations of the $SiOC_5H_{11}$ groups. The absorption bands in the region of 3340 cm^{-1} are characteristic of the –OH groups of the obtained product.

Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 3, Issue 4, Apr, 2022

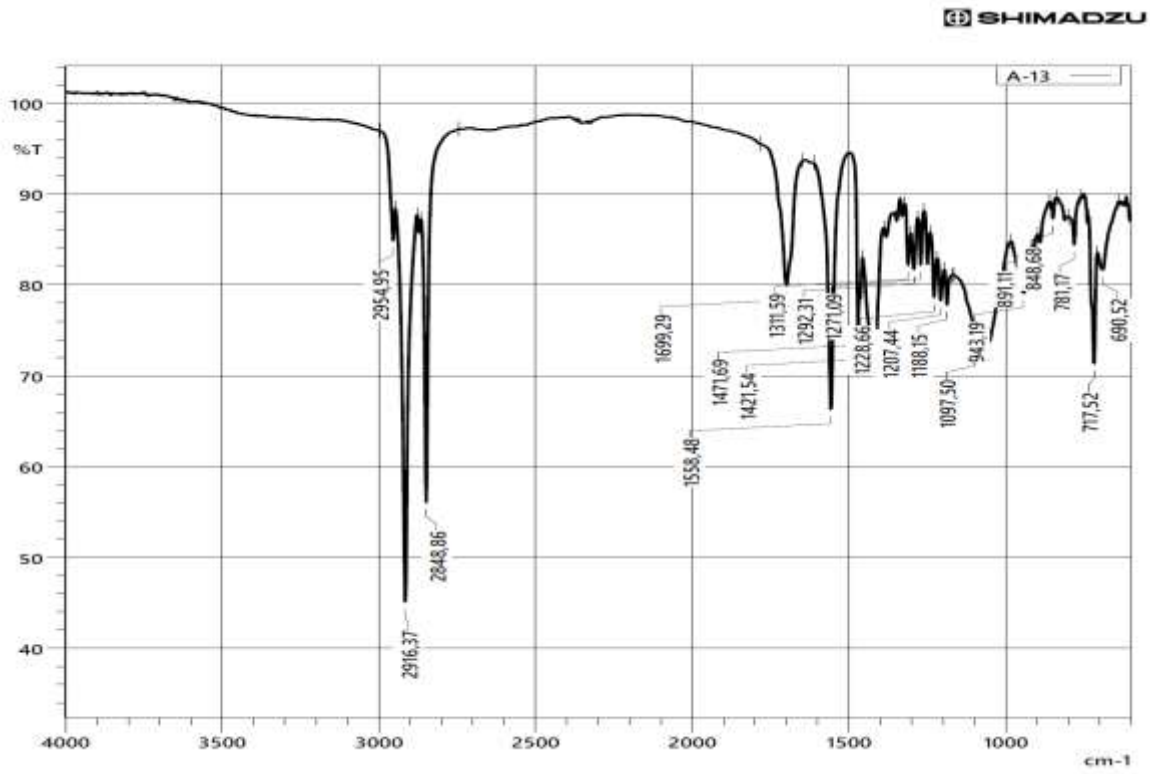

Figure 1. IR spectrum of orthosilicic acid ester with isoamyl alcohol

The alcohol was added to the silicic acid with stirring, heated to boiling point and boiled with stirring for 6 hours. The resulting solution (orthosilicic acid with isoamyl alcohol) was filtered and dried under vacuum at room temperature for 3 hours.

Based on the IR spectra, the reaction scheme of orthosilicic acid with isoamyl alcohol can be proposed as follows:

$$nH_2SiO_4 + 2nHOCH_2CH_2(CH_3)CH_2CH_3 = HO(Si(OC_5H_{11})_2O)_n + H_2O$$

Table 1 shows the solubility in various solvents of orthosilicic acid esters with isoamyl alcohol.

Table 1. Solubility in various solvents

Water	do not dissolve
Toluene	dissolve very well
Ethanol	dissolve well
Sodium alkali (10%)	do not dissolve

Academicia Globe:
Inderscience Research

ISSN: 2776-1010 Volume 3, Issue 4, Apr, 2022

Conclusion

As a result of research, new organosilicon substances were obtained based on local raw materials:
- Sodium metasilicate (liquid glass) was obtained from quartz sand using alkali metals and the sodium metasilicate solution was filtered to obtain a homogeneous, transparent, high-quality raw material.
- Organosilicon compounds were synthesized from the obtained orthosilicic acid by esterification with isoamyl alcohol. The best molar ratio of silicic acid to alcohol (1:10) and the best time - 6 hours for the reaction were found.
– The obtained results of the analysis on the SHIMADZU device showed the chemical structure of organosilicon compounds
- Studied the solubility of the obtained products in different solvents at room temperature.

References

1. Andrianov K.A., Khananashvili L.M. Technology of organoelement monomers and polymers. - M., 1975. - 400 p.
2. Bajant V., Hvalovski V., Ratouski I. Silicones. Organosilicon compounds, their production, properties and applications. - M., 1960. - 710 p.
3. Korneev V.I. Soluble and liquid glass / V.I. Korneev, V.V. Danilov. - St. Petersburg: Stroyizdat, 1996. - 216 p.
4. Sobolevsky M.V., Muzovskaya O.A., Popeleva G.S. Properties and applications of organosilicon products. - M., 1975. - 296 p.