Study of the effect of the catalyst on the microstructure and film thickness of RTV siloxane

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Abstract. An RTV grade siloxane film with a different percentage of catalyst was obtained. The microstructure of the surface of polymer films based on PTB grade siloxane was studied and the effect of the K-18 catalyst concentration on the thickness and microstructure of the obtained films was shown.

1. Introduction

One of the common materials for medical products is metal. A stent is called an elastic metal structure in the form of a cylindrical frame placed in the lumen of hollow organs and blood vessels to expand the area narrowed by the pathological process [1]. For the manufacture of bare metal stents (BMS), stainless steel, alloys of cobalt and chromium, platinum, nickel, titanium, etc. are used [2]. The frequency of restenosis during implantation of stents of this type is 20–40% [3]. Antiproliferative-coated stents represent a significant progressive step in the fight against restenosis.

The development of stents with surfaces coated with polymeric materials is currently a promising area that can solve not only the problem of restenosis, but also increase the corrosion resistance and biocompatibility of a medical device [4-5]. Polymers are complex chemicals that are widely used, including in medicine [6-7]. Siloxanes are one of the most important groups of chemical polymer compounds, which is associated with a number of their advantages. In many modern scientific studies, the authors proved that the structure, degree of polymerization, molecular weight, lipophilicity or volatility affect the ability to overcome the cell barrier, absorption into the body, migration into a living organism, the ability to accumulate, degradation and toxicity. Due to its unique physicochemical properties, siloxanes are indispensable in many areas of life. They have perfect biocompatibility, therefore they are an integral part of innovative methods of treatment, healthcare and patient care [8-15]. However, various siloxanes, as well as their various physicochemical properties, require further research. Studies of effects on living organisms should relate to specific siloxanes, and not to the entire polymer group of siloxanes. Siloxane is used as the main binder in protective coatings. Such coatings are resistant to elevated temperatures, corrosion, abrasion, excellent biocompatibility and other qualities that coatings acquire through the use of silicone technology [16-17].
2. Materials and methods
The film-forming siloxane of the RTV brand is an excellent material for the manufacture of filled and unfilled adhesive coatings for stents, cava filters and other medical devices. The K-18 catalyst acted as a crosslinking agent for the RTV brand siloxane. Siloxane was mixed with 1-10% K-18 catalyst of the total mixture volume using automatic bags at a speed of 2.5 RPM second for 15-20 minutes. Then the resulting mixture was applied to a glass tray and evenly distributed using a glass rod. The resulting layer was dried in a fume hood for 24 hours. The film thickness is determined by the concentration of the catalyst in the solution and the volume of the deposited layer on the glass.

The surface morphology of the obtained CRV siloxane films was studied using a Neophot-2 optical microscope manufactured by Carl Zeiss Jena. For research, lenses were used, which made it possible to obtain an increase of 10 and 40.

3. Results and discussion
Table 1 presents the average results of the obtained polymer films based on CRV grade siloxane with various catalyst contents. 5 samples were tested at each experimental point.

Table 1. The effect of the catalyst content on the thickness of the polymer film of the siloxane grade CRV.

| Siloxane volume, ml | The volume of catalyst, % | Thickness, mm |
|--------------------|--------------------------|---------------|
| 1                  | 50                       | 0.710         |
| 2                  | 50                       | 0.710         |
| 3                  | 50                       | 0.718         |
| 4                  | 50                       | 0.715         |
| 5                  | 50                       | 0.743         |
| 6                  | 50                       | 0.750         |
| 7                  | 50                       | 0.820         |
| 8                  | 50                       | 0.737         |
| 9                  | 50                       | 0.735         |
| 10                 | 50                       | 0.720         |

Figures 1-2 show surface photographs of the obtained CRV siloxane films with various catalyst contents from 1 to 10%.
Figure 1. Images of surfaces of samples with different catalyst contents with an increase in the multiplicity of 10 a) 1%; b) 2%; c) 3%; d) 4%; e) 5%; f) 6%; g) 7%; h) 8%; i) 9%; j) 10%.
Figure 2. Images of surfaces of samples with different catalyst contents with an increase in the multiplicity of 40: a) 1%; b) 2%; c) 3%; d) 4%; e) 5%; f) 6%; g) 7%; h) 8%; i) 9%; j) 10%.
From the analysis of photographs of the microstructure, we can conclude that the surface is homogeneous, without any defects. However, small particles were found on the surface of some samples. Presumably it's dust.

4. Conclusions
CRT grade siloxane with various catalyst contents was prepared in the form of a film. The microstructures of polymer films based on a siloxane type CRT with a K-18 catalyst were studied. We studied the effect of catalyst concentration on the surface of a polymer film. It should be noted that the percentage of K-18 catalyst does not have a significant effect on the thickness of the CRT brand siloxane film and its structure.

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