Study of the effect of the catalyst on the mechanical properties of RTV grade siloxane

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Abstract. A RTV grade siloxane film with a different percentage of catalyst was obtained. The mechanical properties of polymer films based on RTV grade siloxane are studied, as well as the effect of K-18 catalyst concentration on thickness, strength and ductility the properties of the obtained films was shown.

1. Introduction

Achievements of modern medicine are impossible without the fruitful work of scientists, engineers and doctors of various specialties. One of the important results of such a joint activity was the possibility of access to the organizers of various implant materials. Despite the achievements, the problem of the development and use of modern implantable surgical materials remains relevant.

Titanium alloys are widely used as materials for implants, stents, cava filters and other medical devices due to their high strength, low density and fracture toughness. However, from modern scientific research it is known that in direct contact with bones in a humoral environment, titanium alloys cannot form a bond with bone tissue and show obvious contact corrosion, which can lead to damage to the implant and its replicative replacement [1-2].

Polymers are complex chemicals that have found a wide range of applications. These compounds are also used in medicine. Due to their mechanical properties and biocompatibility, polymers have become indispensable materials for reconstructive surgery and prosthetics. The application of polymer films to the surface is one of the effective ways to solve the problems associated with corrosion resistance and biocompatibility. When used as barrier coatings on metals, siloxane provides adhesion to the surface of the metal coating [3-6].

Siloxanes are one of the most important groups of chemical compounds, which is associated with a number of their advantages. Siloxanes are generally considered non-toxic to humans and the environment. Many authors have proven that structure, degree of polymerization, molecular weight, lipophilicity or volatility affect the ability to cross 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 are well tolerated
and are an integral part of innovative treatments, healthcare and patient care [7-10]. 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 group. Siloxane is used as components or modifiers of organic resins or as the main binder component in protective coating compositions. Such coatings are highly resistant to elevated temperature, corrosion, abrasion, excellent biocompatibility and other quality characteristics that are obtained using silicone technology [11-12].

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.

Strength tests of siloxane polymer films RTV were tested on a universal testing machine INSTRON 3382 with a loading speed of 10 mm / min. Samples of polymer films for testing were made according to GOST 14236-81, in the form of a double blade. The sample was fixed in the arms of the testing machine, which were uniformly tightened so that the sample did not slip during the test. Tests of polymer films with the definition of elongation, yield strength and tensile strength were carried out according to GOST 14236-81. Processing of the test results in determining the mechanical properties was carried out using the INSTRON Bluehill 2.0 software. The measurement error on the test machine is less than 1%.

5 samples were tested at the experimental point. The values of yield strength, tensile strength and elongation were determined.

3. Results and discussion

Table 1 presents the average results of mechanical tests of polymer films based on PTB grade siloxane with various catalyst contents.

**Table 1. Mechanical properties of polymer films.**

| Siloxane volume, ml | The volume of catalyst,% | Relative elongation, % | Yield strength, MPa | Tensile strength, MPa | Thickness, mm |
|---------------------|--------------------------|------------------------|---------------------|----------------------|--------------|
| 1 50                | 1                        | 42,52                  | 0,044               | 0,125                | 0,710        |
| 2 50                | 2                        | 55,93                  | 0,042               | 0,247                | 0,710        |
| 3 50                | 3                        | 34,09                  | 0,046               | 0,155                | 0,718        |
| 4 50                | 4                        | 29,03                  | 0,045               | 0,128                | 0,715        |
Based on the results obtained, dependency graphs were constructed that can be used to track the trend of changes in mechanical characteristics (Figures 1-3).

**Figure 1.** The diagram of the dependence of tensile strength on the concentration of the catalyst K-18 in siloxane brand CRT.
Figure 2. The diagram of the dependence of the yield strength on the concentration of the catalyst K-18 in siloxane brand CRT.

Figure 3. The dependence of the relative elongation on the concentration of catalyst K-18 in siloxane brand CRT.

4. Conclusions
CRT grade siloxane with various catalyst contents was prepared in the form of a film. The mechanical properties 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 mechanical properties of the polymer. A siloxane film sample with a catalyst content of 2% showed the best result. This sample demonstrates the following values: yield strength - 0.042 MPa, tensile strength - 0.247 MPa, relative elongation -
14.55.93%. However, it is worth noting that the percentage of K-18 catalyst does not significantly affect the final mechanical properties of CRT grade siloxane.

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