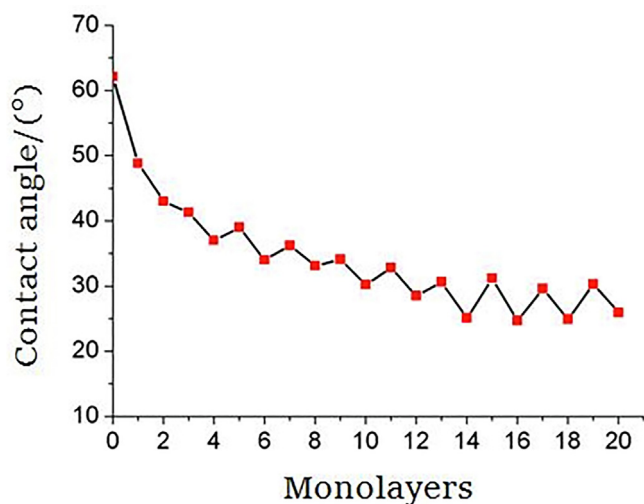


**Fig. 3.** SEM images of nanofilms (CS/CMC)<sub>10</sub> on silicon plates without cross-linking a) and cross-linked with glutaraldehyde and b) at the initial concentration of polyelectrolytes 0,01 M.



**Fig. 4.** Contact angle change with water on a film surface of a steel implant in each outer monolayer of polyelectrolytes.

#### 4. Conclusion

During applying thin nanofilms on the surface of solid samples, it is necessary to take into account their chemical nature and to select a certain type of treatment for each carrier. For steel and titanium implants, the optimal solutions are a mixture of sulfuric acid and hydrogen peroxide. The initial concentration of polyelectrolytes affects the thickness and quality of the films. For chitosan, CMC and PAA, the optimal concentration is 0.01 M. It is necessary to determine the initial uniform coating of nanolayers on the surface of solid samples for each specific method of film production.

#### CRedit authorship contribution statement

**Alyiya Ospanova:** Conceptualization, Funding acquisition, Supervision. **Balzhan Savdenbekova:** Writing - original draft, Methodology, Formal analysis. **Zhanar Kubasheva:** Writing - review & editing, Visualization. **Balnur Baltabayeva:** Investigation. **Nikolay Uvarov:** Supervision.

#### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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