

DESIGN OF A SENSOR FOR THE BLOOD AB0 GROUP ANTIBODIES DETECTION

D.V.Kolesov¹, G.A.Kiselev², A.A.Kudrinskiy³, M.A.Moiseev³, I.V.Yaminskiy³
¹*Biosensor Academy*, ²*A.N.Frumkin Institute of physical chemistry and electrochemistry*
RAS, ³*Moscow State University*

A huge number of patients around the world await suitable for transplants. AB0-incompatible organ transplantation may be the solution to this problem. The human blood groups are determined by a set of antigenic characteristics of red blood cells - erythrocytes. The ABO blood group system is the most important blood type system in transplantation. It is characterized by presence on the red blood cells of two types of antigens A and B and associated with them alpha (anti-A) and beta (anti-B) antibodies in the blood plasma. A number of studies [1] have shown that removal of blood group anti-A and anti-B antibodies from patients' blood can reduce the risk of hyperacute organ rejection in AB0-incompatible transplantation.

For the successful solution of blood purification problem, the method of monitoring the presence of antibodies in the serum should be developed. One of the best candidates for the sensor is microcantilever gauges. This technology is based on the conversion of energy of the complementary interaction to the mechanical deformation of the cantilever and has been actively developing in the last two decades. This type of sensor has high sensitivity and selectivity, but also allows monitoring in real time [2].

Experiments by the antibody determination were carried out on the Atomic Balance BioScan instrument (Biosensor Academy, Moscow). The device can simultaneously record small deflections of the two cantilevers. We have developed a technique of chemical modification of gold surface of the cantilever with antigens type A and B. The investigation object was the solution of monoclonal antibody beta released from mouse serum. Concentration of antibody in buffer solution was 300 times less than the natural concentration of antibodies in human blood.

During the experiments, two cantilevers were modified with antigens A and B, respectively, and then placed in the flow liquid cell of the device. After the equilibrium establishment, the buffer solution containing antibodies was injected into the liquid cell. There was a complementary binding of antibodies from the solution to antigens on the surface of one of the cantilevers. As a result, forces of intermolecular interaction in the sensory layer change during the formation of antigen-antibody complexes. The target signal is the difference between the two cantilevers deflections. After achieving the plateau, the total difference of surface tension caused by the interaction of antigen-antibody complexes on the surface of the cantilever was 0.75 N/m.

Then the recovery of sensory layer with a 10% urea solution was conducted, and re-injected the investigated solution. During the second part of experiment, the difference of the forces of surface tension amounted to 0.65 N/m. The time to plateau has increased from six to ten minutes. This is evidenced by the partial decomposition of the complexes formed in the first stage.

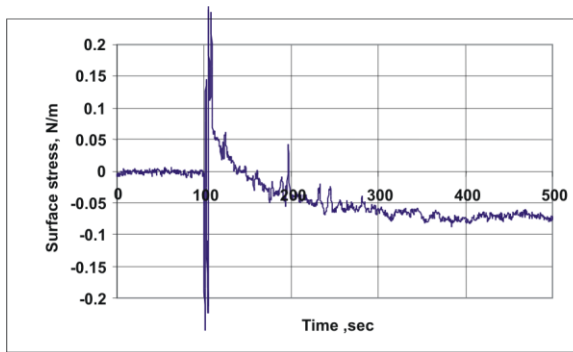


Figure 1 Development of the forces of surface tension during the formation of AG-AT complexes on the surface of the cantilever.

References

1. Squifflet J.P. et al. Lessons learned from ABO-incompatible living donor kidney transplantation: 20 years later. *Exp Clin Transplant* 2004, 2:208–213
2. N.V. Lavrik, M.J. Sepaniak, P.G. Datskos. Cantilever transducers as a platform for chemical and biological sensors // *Rev. of Sci. Ins.*, – 2004, – Vol.75, – No.7, – pp.2229-2253