Application of the combined scattering spectroscopy method to identify Staphylococcus with hemolytic activity in patients with periodontitis

E.V. Timchenko[1], P.E. Timchenko[1], A.V. Lyamin[2], I.V. Bazhutova[2], L.T. Volova[2], D.A. Trunin[2] O.O. Frolov[1], A.V. Zotova[1]

1 Samara National Research University, Samara
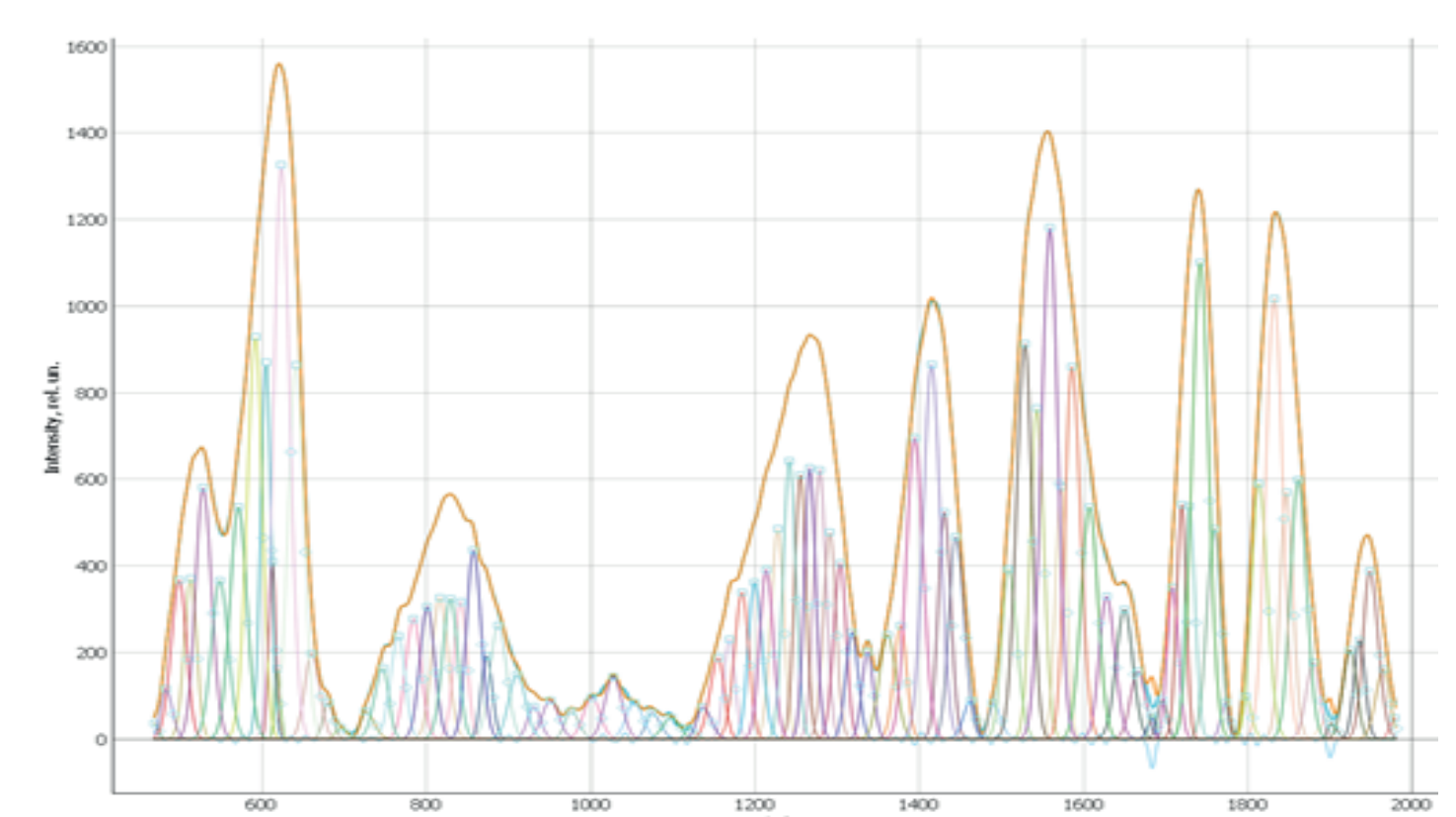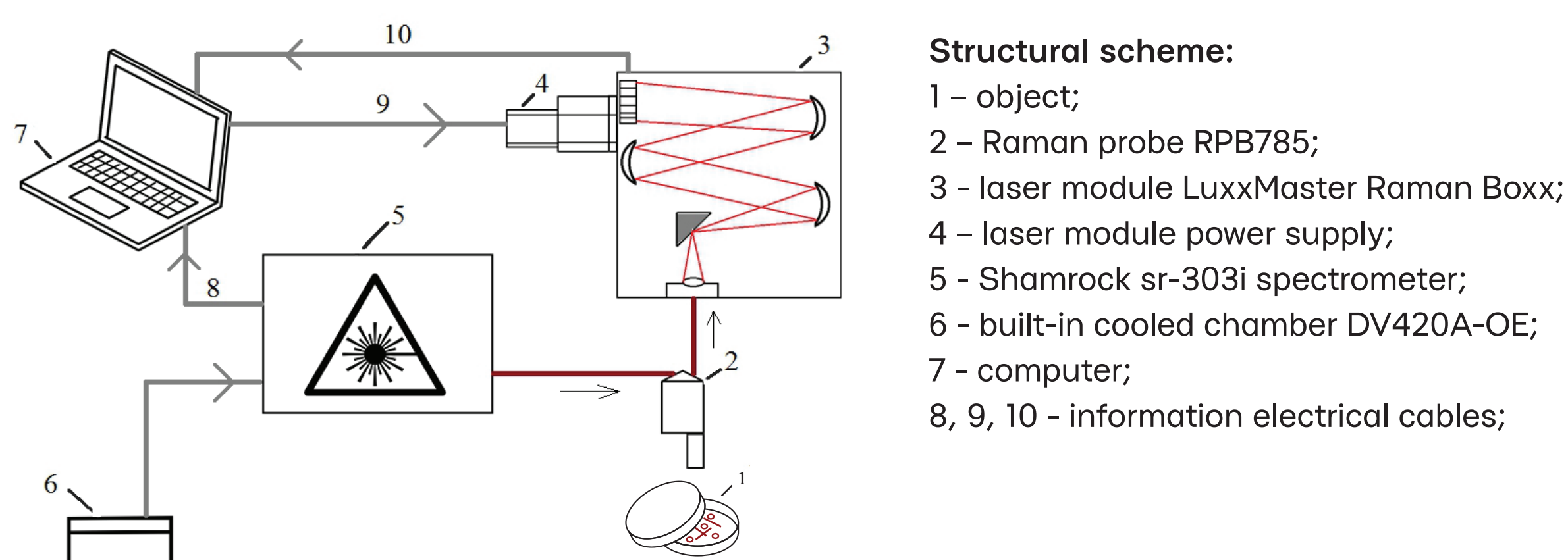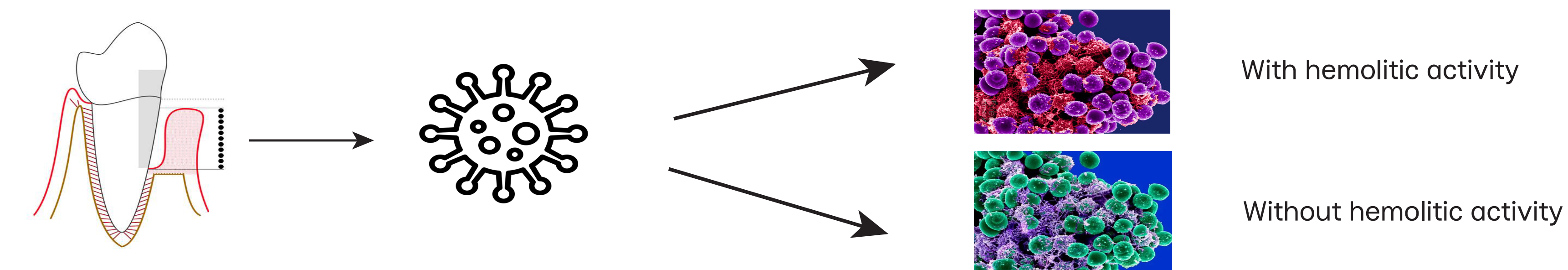2 Samara State Medical University, Samara

INTRODUCTION:

In today's world, various inflammatory diseases of the oral cavity have become widespread. They can be caused by many factors. One of the possible participants in the pathological process in oral diseases may be bacteria, in particular coagularegative staphylococci with a certain pathogenic factor, which have been the most important opportunistic pathogens in medical practice for the last century. However, despite the presence of a significant number of pathogenic factors, including hemolytic activity, the role of this microorganism in oral pathology is still poorly understood.
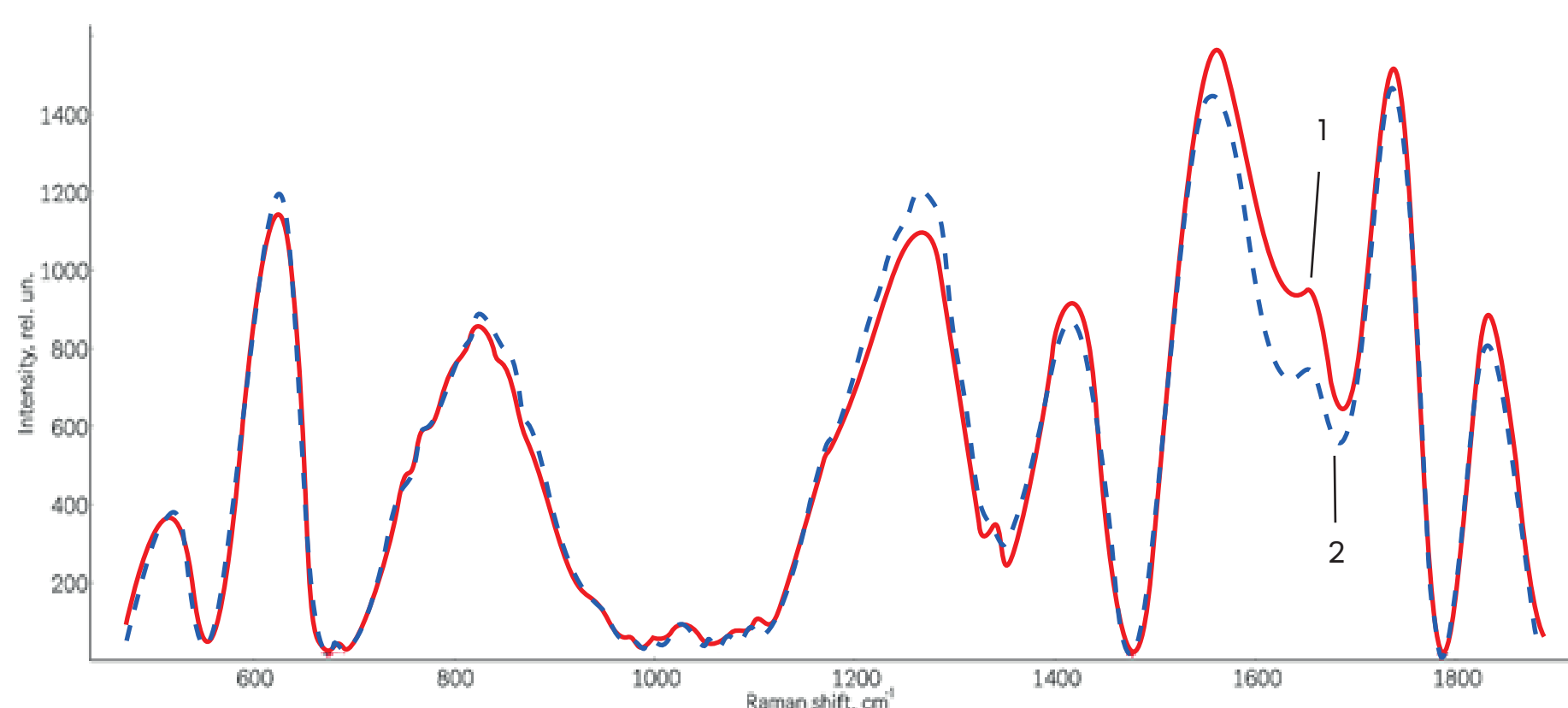
MATERIALS AND METHODS OF RESEARCH

Twelve strains of Staphylococcus epidermidis, isolated from clinical material from people with chronic parodontitis, were used as research subjects. Identification of all isolated strains was carried out using the MALDI-ToF mass spectrometry method on the MicroflexLT (Bruker) device using the standard sample preparation method and mass spectra libraries.

The Raman spectroscopy method was used as the main method of research of STAPH epidermal strains with hemolytic activity. All experiments were carried out at a laser power of 350 MW and exposure time of 60 seconds. Further processing of spectra of the BR was carried out in the program Mathematica, based on the resource «Ramantool v.1.0.175» and discriminant analysis.

With hemolitic activity

Without hemolitic activity

Gaussian Split

Structural scheme:
1 – object;
2 – Raman probe RPB785;
3 - laser module LuxxMaster Raman Boxx;
4 – laser module power supply;
5 - Shamrock sr-303i spectrometer;
6 - built-in cooled chamber DV420A-OE;
7 - computer;
8, 9, 10 - information electrical cables;

RESULTES OF RESEARCH

Figure 1. Average raman spectra of samples studied: 1 - without hemolytic activity (28 raman spectra), 2 - with hemolytic activity (27 spectra)
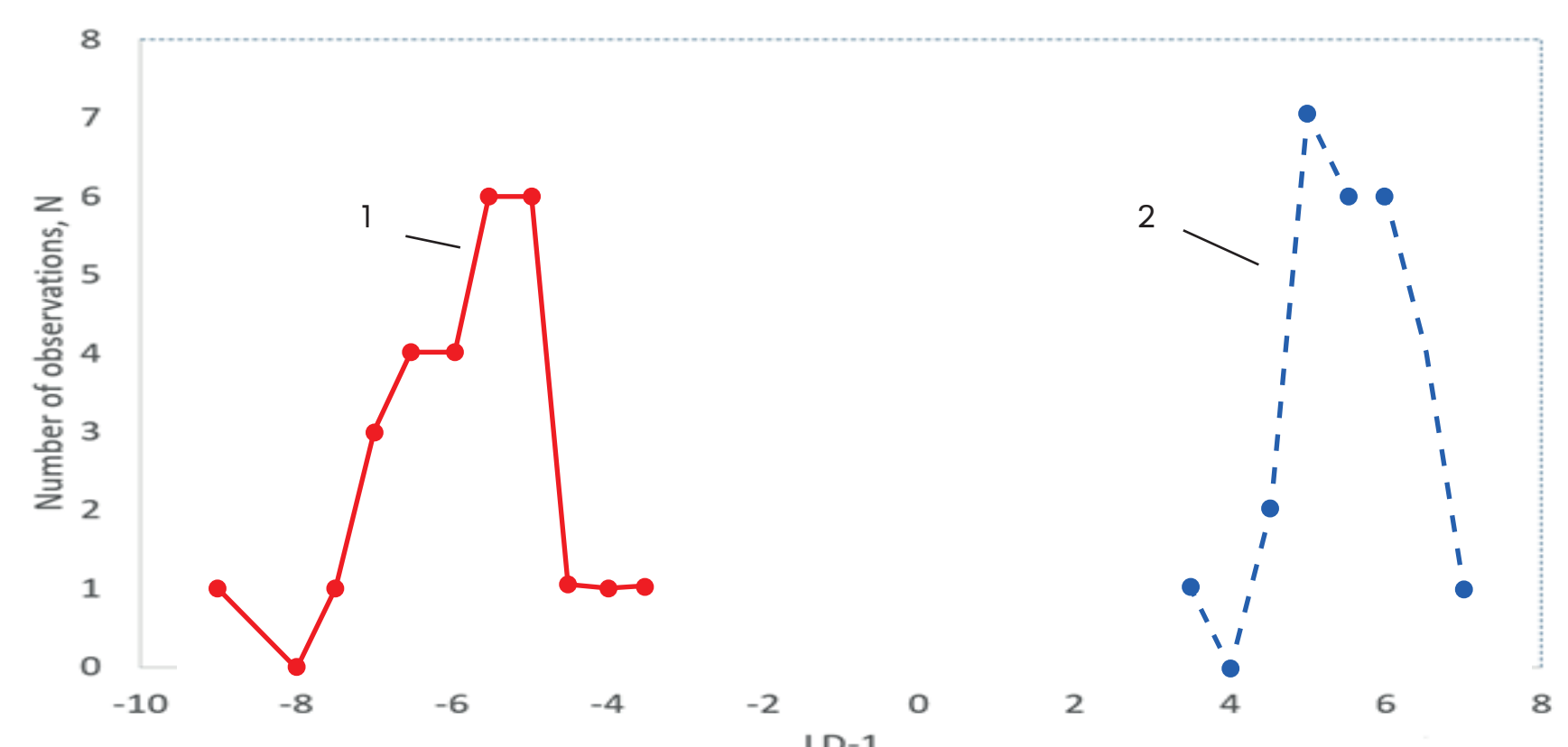
Figure 2. The graph of values of LD-1 - linear discriminant function of bacterial samples: 1 - without hemolytic activity (28), 2 - with hemolytic activity (27).

CONCLUSION

As a result of the research carried out using the method of spectroscopy of combination scattering and detailed mathematical processing of KR spectra, differences between the strains of epidermal staphylococcus with hemolytic activity and without hemolytic activity were found, which are observed on the Raman line ~1650cm-1 (Amide I vibration (collagen-like proteins)).

In the future, the results obtained can be used as an express assessment of pathogenicity markers of staphylococcus and other opportunistic microorganisms.