

Comparative analysis of the secondary structure of blood serum proteins from patients with multiple myeloma and healthy donors

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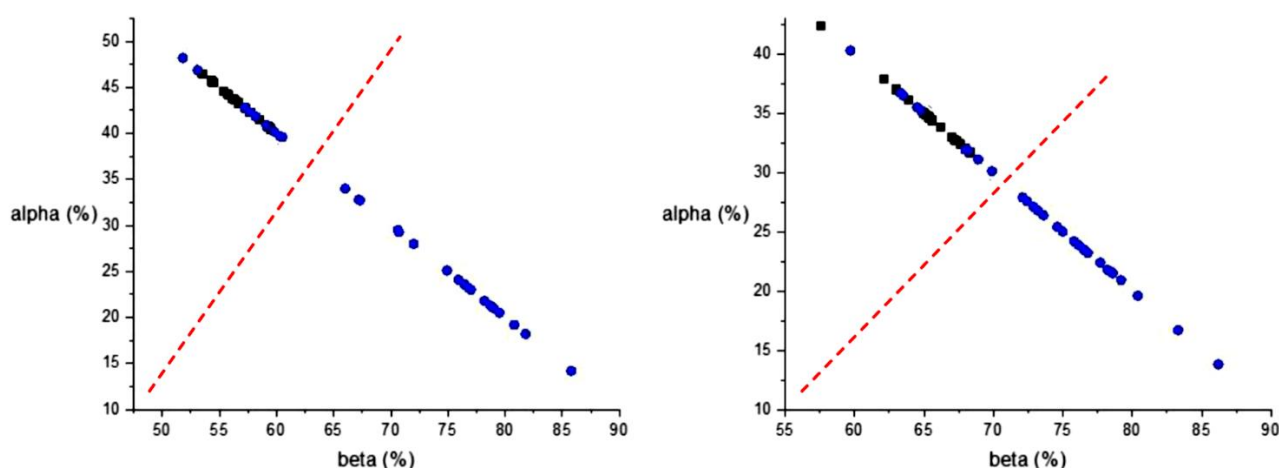
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Multiple myeloma (MM) is a blood cancer characterized by uncontrolled reproduction of clonal malignant plasma cells in the bone marrow, which leads to excessive production of one type of immunoglobulins or their fragments, for example, free light chains. Such immunoglobulins are called "paraproteins" or "M-proteins". This disease accounts for approximately 10% of all oncohematological diseases and is incurable.

The work is devoted to the development of a screening technique aimed at identifying signs of multiple myeloma based on the analysis of IR spectra of blood serum. In this work, a comparative analysis of two different methods was carried out: IR transmission spectroscopy with isotope substitution of the solvent and ATR IR spectroscopy, where the serum was studied without any additional sample preparation. The absorption spectra were analyzed using the Fourier self-deconvolution method and the second derivative method. Based on the results obtained, for each technique, quantitative criteria for the rapid separation of blood serum samples based on the presence or absence of a pathological protein characteristic of a given disease were proposed.

We have demonstrated that the approach used makes it possible to separate groups of healthy donors and patients with MM according to the content of α -helices and β -layer structures in the secondary structure of samples. Based on the results obtained, it can be concluded that the proposed approach is suitable for detecting signs of MM, provided that paraprotein is present in blood serum samples.



In the ATR experiment, a comparative analysis of the effectiveness of the approach was carried out for samples in the liquid state (left panel) and in the form of films dried on a crystal (right panel). It was found that for the points corresponding to serum samples of healthy donors, the values of α/β ratio lie in the range of $0.68 \div 0.87$ for liquid samples and in the range of $0.46 \div 0.74$ for dried films. For secreted MM samples, the ratio

values are $0.17 \div 0.42$ and $0.16 \div 0.39$ for liquid samples and films, respectively. Part of the points corresponding to the samples of MM patients in which paraprotein secretion was not detected fell into the region of healthy donors.

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