– cluster 8 (stTRC_74-stTRC_85), region: Brest; districts: Brest, Malorita.

Thus, using the algorithm of the offered cluster analysis makes it possible to analyze great volume of quantitative dendrochronological data that combined with other TRC characteristics (general tendencies of graphics, visible periods of oppression, correlation and synchronicity coefficients and etc.) will allow to solve the tasks connected with the growth place identification of the cut pine tree and the affirmation of the declared place of its preparation with great probability.

BIBLIOGRAPHY

1. *Khokh, A. N.* The automation of forensic-botanical expertise with dendrochronological analysis / A. N. Khokh // MULTI-modal Imaging of FOREnsic SciEnce Evidence tools for Forensic Science. – Kraków, 2017. – P. 42–43.

CONIFEROUS SPECIES IDENTIFICATION ON THE BASIS OF THE SPECTROMETRIC INFORMATION

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The paper discusses the possibility and describes some approaches to application of spectroscopic methods for species affiliation of felled wood.

Keywords: wood identification, infrared spectroscopy, statistical methods, principal component analysis, softwood.

Currently, the wood species identification is carried out using microscopic analysis methods mainly that is a sufficiently long and time-taking process. At the same time, such tasks can be successfully solved using data from spectroscopic methods based on differences in the chemical composition (in particular, the ratio of the components number), thereby identification wood samples of different species [1].

In this study, infrared spectroscopy methods were used [2].

The object of the study were test samples of Scots pine (*Pinus sylvestris* L.), fir spruce (*Picea abies* L.), common silver fir (*Abies alba* L.), European larch (*Larix decidua* L.) and blue spruce (*Picea pungens* Glauca) from the Ksiloteka-collection of academic chair and forest protection of the Belarusian State Technological University. The choice of species used in study is determined to the fact that soft timber is widely used in the vast majority of industries where wood materials can be applied.

Infra-red spectra were recorded on the "Thermo Fisher Scientific" Nicolet iS10 FT-IR spectrometer, USA, equipped with a ZnSe beam divider. The spectra were recorded in the 4000 – 650 cm^{-1} range with a resolution of 4 cm^{-1} after averaging the accumulated spectrograms. Each spectrum was constructed by averaging of 128 measurements, at three different points on each sample. To reduce the level of experimental noise and errors in the analysis, a second-order derivative was calculated using the Savitsky – Golay method (a polynomial of order 2, 19 smoothing points).

Research indicated the IR spectra of the five coniferous species to be similar. However, the use of statistical analysis methods allows to differentiate samples according to species identification on the basis of differences in spectra. The further spectra processing was carried out using statistical methods for analyzing multifactorial dependencies aimed at solving discriminatory tasks.

The Principal Component Analysis, used in the modeling of spectrometric information obtained by infrared spectroscopy method, has showed that the samples can be divided into five clusters and these clusters coincide with their botanical affiliation.

Botanical species of common silver fir and European larch are localized in the negative values scope for factor 1 (clusters 1 and 2), while samples from three other clusters (clusters 3-5) – Scots pine, fir and blue spruce have positive values of the factor 1 axis. In this case, the samples of Scots pine have positive values of the factor 2 axis, while the value of factor 2 is characterized by a negative value for spruce samples. Particularly worth mentioning is the applicability of this model for the different spruce species identification based on factor 3 (clusters 3 and 4). Thus, basing on spectral data obtained by infrared spectrometry, in combination with multivariate data analysis, it is possible to conduct the coniferous species discriminatory analysis without a detailed chemical

test. During the experiment, the species / taxonomic affiliation of all the wood samples examined was correctly identified, despite the fact that the wood species under study are characterized by similar spectrometric profiles.

In the short term, basing on the results obtained, it would be possible to create an express method for unknown timber species identification, including microelement research of modified and technologically processed wood.

BIBLIOGRAPHY

1. *Ramalho, F. M. G.* Rapid discrimination of wood species from native forest and plantations using near infrared spectroscopy / F. M. G. Ramalho, J. M. Andrade, P. R. G. Hein // Forest Systems. – 2018. – Vol. 27. – № 2. – P. 008.

2. *Larkin, P.* Infrared and Raman spectroscopy: principles and spectral interpretation / P. Larkin. – USA: Elsevier. – 2017, 228 p.

SEASONAL VARIATION OF PINE MICROELEMENT COMPOSITION

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The article is devoted to practical aspects of investigation of chemical composition of wood as a source of evidentiary information.

Keywords: wood, Scots pine, microelements, X-ray fluorescence analysis, vegetation period.

The seasonal variation is one of the forms of temporal variability for perennials and its study has scientific and applied significance [1].

There are a lot of information on the chemical property of plants, depending on the seasonal state that provides the imagine of the processes general nature. Information on the seasonal variability of pine wood on all the microelements we studied could not be found.

The objects of our research were old-growth forest stands on the territory of the "Berezinsky Biosphere Reserve" State Nature Protection Institution. In total, 3 temporary sample plots (TSP) were laid in different types of forest, according to the methods adopted in the field of forest science and dendrometry.

The quantitative content of microelements was determined using an energy-dispersive X-ray fluorescent spectrometer ElvaX. The degree of seasonal variation in the pine wood chemistry was estimated by three parameters: the average data of the quantitative content of microelements in pine wood, selected in summer (June) and autumn (September), and the coefficient of variation.

Taking into account the average data on the elements concentration change in the wood, as the growing season progressed (from summer to autumn), the following trend has been noted (table 1).

Table 1

Concentration of elements in pine wood at the end of the growing season

Changing of elements concentration	Forest type		
	Moss-grown pine forest	Long-live pine forest	Sphagnous pine forest
Increasing	Ag, B, Ni, Ti	Mn, Ti	Mn, Cu
Dilution	Cr, Fe	Cr, Fe, Ni, Mo	Cr, Fe, Ni, Pb, Ti, Ag
Approximately one level preservation	Al, Cu, Cl, Mn, Pb, Zn, Mo	Al, B, Cl, Cu, Pb, Zn	Al, B, Mo Zn

A common feature for all 3 types of forest by the end of vegetation is a chromium dilution in wood concentration in about 3 times.

The sphagnous pine forest (marsh) is characterized by the largest number of elements that decreases its concentration in autumn.

For a long-live pine forest (half-moistened growth conditions) a significant increase of Ti is observed by the end of vegetation. The Ti concentration in this period remains at the highest level in comparison with the moss-grown and sphagnous pine forests.