Fig. 2. – Absorption spectra solutions of blood at their various concentrations

BIBLIOGRAPHY

1. *Прохоров, А. М.* Физическая энциклопедия / А. М. Прохоров [и др.]; под общ. ред. А. М. Прохорова. – Москва: «Большая Российская энциклопедия», 1988. – 704 с.

2. Образовательный стандарт высшего образования 1-31 04 05 05-2018 : РД РБ 03180.53–2000 : введ. 01.09.00. – Минск : Госстандарт : Белорус. гос. ин-т стандартизации и сертификации, 2000. – 6 с.

USING NEAR INFRARED SPECTROSCOPY TO DETERMINE THE SCOTS PINE PLACE OF GROWTH

A. Khokh

Scientific and Practical Center (SPC) of the State Forensic Examination Committee of the Republic of Belarus, Minsk, Republic of Belarus
1ann1hoh@gmail.com

In the present study, we tried to assess the potential of the near-infrared molecular spectroscopy method for establishing the territorial belonging of pine wood products.

Keywords: wood, near infrared spectroscopy, growth place, chemometric algorithms, principal component analysis.

In the past few years, chemical methods of analysis, one of which is near-infrared spectroscopy, are begin-ning to be used to establish the place of growth of wood after its felling [1]. This is an instrumental express method that allows research to be performed without destroying the object. It doesn't require the use of expensive consum-ables.

The object of the study was to differentiate Scots pine wood from different places of growth based on spectrometric parameters in the NIR range.

The study used drill cores from 9 temporary sample plots (hereinafter referred to as TSP) located in Vitebsk (No. 1–3), Gomel (No. 4–6) and Minsk (No. 7–9) regions in mossy pine forests in accordance with techniques accept-ed in forest measurement [2].

On each temporary sample plot, 2 drill cores were taken from 20 trees from each tree with an age-related drill «Haglof» from opposite sides perpendicular to the longitudinal axis of the trunk at a height of 1.0–1.3 m from the ground. Later on, they were dried to reach constant weight. The spectra were obtained using a portable NIR spectrometer MicroNIR OnSite with a diode array detector (VIAVI, США) in diffuse reflection mode.

For signal processing and data analysis, the CAMO software package was used [3]. To evaluate the results obtained, the PCA method was applied.

In order to study the differences between the wood samples for each temporary sample plot, the average NIR spectra were calculated. Before this, they were preliminary processed. The processing included calculating the second-order derivative according to the Savitzky–Golay method (using 7 smoothening points).

It should be noted that the curves are very similar. However, a more thorough study of some characteristic spectral bands indicates that visible differences at each sampling site are still observed, i.e. spectra from each temporary sample plot have their specific chemical composition. However, due to the overlap between the bands in the NIR spectra, it seems difficult to conclude on those chemical compounds that are responsible for these differences.

Considering the different chemical composition of wood at each temporary sample plot, all the spectra we obtained were analyzed using the Principal Component Analysis. As a result, the spectra were found to form three separate groups (TSP No. 1–3, TSP No. 4–6 and TSP No. 7–9), which do not overlap each other. Note that for Vitebsk and Brest regions there is also a separation of each TSP within the group. At the same time, the recorded spectra for Minsk region form one partially overlapping sphere. In this case, this fact can be explained by the fact that the for-est stands on the studied TSP grow under similar soil and environmental conditions.

Thus, the obtained results showed that plantations of Scots pine from different areas can be successfully differentiated using the PCA method, however, in order to successfully separate samples within the same area, in some cases, additional studies and/or other methods of correction of dissemination and processing of spectrometric data may be required.

In general, based on the study conducted, it can be concluded that the NIR spectroscopy method is suitable for determining the place of growth of plant objects and therefore can be recommended for tracking the origin of wood and detecting facts of illegal logging.

BIBLIOGRAPHY

1. *Dormontt, E. E.* Forensic timber identification: It's time to integrate disciplines to combat illegal logging / E. E. Dormontt [et al.] // Biological Conservation. – 2015. – Vol. 191. – P. 790–798.

2. *Мелехов, И. С.* Лесоведение: учеб. для вузов / И. С. Мелехов. – 3-е изд., стер. – М. : МГУЛ, 2004. – 398 с.

3. *Kessler, W.* A Handy Tool for Chemometrics: The Unscrambler X / W. Kessler, R. Kessler // Scientific Computing. – 2010. – Vol. 27, №. 4. – P. 1–13.

BETULA PENDULA ROTH POLLEN AS A BIOINDICATOR OF THE POLLUTION DEGREE IN URBAN AREAS

A. Khokh

Scientific and Practical Center (SPC) of the State Forensic Examination Committee of the Republic of Belarus, Minsk, Republic of Belarus
1ann1hoh@gmail.com

The presented research estimates the possibility of using birch pollen as a biological indicator of the condi-tion of the urbanized territory. Minsk was considered as an example. The studies conducted have shown high sensi-tivity of pollen grains to growth conditions.

Keywords: pollen, Betula pendula Roth, bioindicator, pollution, urban areas.

Assessing the quality of an urban environment full of a variety of pollution sources is of great practical importance. The use of physical, physicochemical, chemical methods with their high accuracy cannot create a complete picture of the ecological situation since under the conditions of the anthropogenic load of the biota experiences the complex effect of all components of the environment. That is why biological methods of controlling the changes in the environment nowadays have an indisputable advantage.

This research discusses the possibility of timely monitoring of the degree of pollution in the city of Minsk using the pollen of Betula pendula Roth., a widespread species in the flora of the urbanized territories of the Republic of Belarus.

The working hypothesis was based on the assumption that under conditions of environmental disadvantage, plants will produce a greater number of teratomorphic and/or sterile pollen grains. Moreover, the more stressful the environmental situation is, the higher the percentage of abnormal pollen will be and vice versa [1].

Male inflorescences of birch were collected in the period corresponding to the beginning of flowering in the following technogenic zones of Minsk: Minsk Automobile Plant (1), Minsk Tractor Works (2), Minsk Motor Plant (3), Minsk Thermal Power Station No. 2 (4), Minsk Thermal Power Station No. 3 (5) and Minsk Thermal Power