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FROM THE EDITOR-IN-CHIEF

Field Analysis: A Return to This Topic

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Chemical analysis if often performed at the place of a test object rather than in a stationary laboratory. The transfer of analysis out of the laboratory is one of the main trends in the development of chemical analysis. This trend is due to, on the one hand, the continuously increasing demands in field analysis and, on the other hand, the rapid growth of the potentials of such analysis.

One of the possibilities is the appearance of mobile laboratories. Thus, the Troika train designed at the Institute of Atmospheric Physics of the Russian Academy of Sciences and the All-Russia Institute of Rail Transport has been used to monitor the composition of ambient air in a number of Russian regions since 1996. Monitoring involves the determination of O_3, NO_x, CO, SO_2, NH_3, methane, and other volatile hydrocarbons, ozone-decomposing substances, and radon. In some cases, remote analysis is used. The train is equipped with gas analyzers, chromatographs, and mass spectrometers. Another example of mobile laboratories is provided by the Epopatrul' laboratory on a catamaran boat designed in St. Petersburg for monitoring the water composition in the Neva River, Ladozhskoe Lake, and the Gulf of Finland. An automobile laboratory is commercially produced by Agilent. This laboratory serves to detect chemical warfare agents and biological weapons, as well as man-made toxic agents. However, automobile chemical laboratories have long been designed in many countries for detecting poison gases and adopted by their armies. Other mobile laboratories are also known.

Mobile laboratories use more of less traditional analytical procedures and instruments, almost the same as in stationary laboratories. The instruments are only sometimes modernized to make them more reliable and resistant to moving.

Much more routine field analyses are performed with portable instruments. Among these are portable but not very small and relatively heavy (8–12 kg) instruments like a mercury analyzer by the Russian Lumex Company and also miniature analyzers of, for example, gases and dissolved oxygen of a mass of no more than 0.5 kg and a price of no more than $500. Instruments of the latter type are quite diverse; they are only slightly bigger than cell phones. Gas analyzers are most abundant. Miniature analyzers are very simple to use and can be used by unskilled people. They are usually intended for determining a single substance in one medium (water, air) and do not require the knowledge of an analytical procedure: it is a constituent of the device. The devices most often do not require calibration, because calibration characteristics were also inserted into them during the course of production. The analytical signals are processed in such a way that, after pressing only one button, the device presents analyte concentration on an LCD display in the specified units, for example, in percent.

Some instruments of this type, if they reversibly react to changes in substance concentrations and their response time is short, can work in a continuous mode. Such devices and sensors are of a particular importance, for example, in coal mines and at dangerous plants. There are instruments accumulating analytical signals from a certain substance and acting as chemical dosimeters.

However, miniature instruments are not only analyzers. We also know very small portable instruments for X-ray fluorescence, portable gas and liquid chromatographs, and some other instruments for multicomponent analysis, to say nothing about photometers and reflectometers.

Chemical and biological test means, not only instruments, are also quite important for field analysis. These means are even simpler and cheaper than minianalyzers. Paper strips, indicator tubes, tablets, ampoules, and other tests for chemical analysis are finding increasing use as they become more sophisticated. The main lines of sophistication are enhancing selectivity and improving the precision of determinations. The legalization of good tests, i.e., their inclusion into standard documents as allowed, recommended, or even obligatory analytical means, is an important task. The US Environmental Protection Agency actively includes test means, in particular immune tests, into its guidelines and standard documents.

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