

L2. Chemometric methods for environmental pollution monitoring

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At present time in Russian Federation and abroad there are a lot of methods and technologies for environmental pollution monitoring. In the majority they are based on both the conventional methods of chemical and physical analyses in laboratory and in-process management, as well as modern methods of chemometric analyses.

Chemometric methods are widely used for solution of highly specialised tasks of control of waste condition (humidity, ash level, etc.), as well as control of the process of waste processing. It is suggested to use the integrated system of methods for on-line monitoring of waste field at the stages of processing and reclamation. The characteristic feature of this approach is the considering of composition of man-caused fields typical to Russia. It is based upon the well known chemometric technique as Principal Component Analysis, which aims to reveal the hidden structural interrelations in data set. This method is applied to evaluate the current state of a waste field as well as to predict its evolution in future. Mathematical model of conversion of substance inside the field forecasts its properties at geological environment assimilation.

One more ecological problem, that is sorting of plastics in waste, is being solved using chemometrics. Environmental and economic reasons make recycling of mixed industrial and household waste more attractive. Usually low amount of recycled waste can significantly be increased by sorting as the purer fractions of different plastics can easier be reused. There are the pilot experiments on in-line sorting of the multi-component waste flows based on the near infrared spectroscopy (NIR). NIR measurements are rapid, simple and need no special sampling preparation. The apparatus is available as a portable unit that gives results in a matter of minutes with the help of computerized controls. However, successful problem solving depends on extracting the needed information. A factor limiting significant advancement in these areas is that data obtained from such instruments are typically highly correlated and corrupted with noise, making it difficult to obtain necessary information. To extract it, a special mathematical data processing is applied.

Another application of the method of multivariate analysis is the selection of the ways of processing of large-capacity heterophasis industrial and household waste with their following reuse as a reclaiming material; the utilisation of highly-polluted sewage with the isolation of valuable components; the creation of new technological processes with industrial waste as raw material.

Thus, the use of mathematical apparatus of multivariate analysis allows to optimise the solution of the widest range of environmental tasks.

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