

The aim of the project is to elaborate a procedure of determination of instrumental odour indexes of odorants mixtures and to identify complex interactions (synergism, masking, neutralization) between the odorants in the mixtures imitating the odours from municipal landfills and sewage treatment plants. The assumed task will be accomplished using the sensor panels and the prototypes of electronic nose instruments comprised of semiconductor sensors and PID-type sensors. Gas odour mixtures will be assigned to particular instrumental odour index using correlation olfactometry investigations and the electronic nose prototypes.

The scope of research engulfs seven tasks:

1. Design, construction and investigation of characteristics of a generator of reference odour mixtures.
2. Verification of prepared gas mixtures with respect concentration using the chromatographic techniques: GC-MS, GC-FID, GC-PID, GC-FPD, GC-NPD, GC-ECD.
3. Measurement of intensity and hedonic quality of the odour mixtures by a sensory panel and elaboration of the mathematical models describing complex odour interactions (synergism, masking, neutralization).
4. Training of the electronic nose prototypes (6-, 14-sensor ones) comprised of semiconductor sensors and PID-type sensors using the reference odour mixtures prepared.
5. Determination of instrumental odour indexes based on the results of chemometric analysis of the measurement data set obtained from the sensory investigations and electronic nose prototypes.
6. Validation of the procedures of determination of instrumental odour indexes based on the test odour mixtures and dedicated instrumental odour indexes.
7. Verification of correct operation of electronic nose prototypes based on the proposed instrumental odour indexes and field olfactometry investigations carried out in the vicinity of municipal landfills and sewage treatment plants.

Recent years witness significant increase in the interest in application of artificial senses in the field of chemical and industrial analytics. Special attention is drawn to a device, which is meant to mimic human sense of smell – an electronic nose. The electronic nose instruments provide holistic analysis of gas mixture composition, without separating it into particular components (as it is done in case of chromatographic methods). The electronic nose devices are characterized by significant reliability of obtained results (high reproducibility, repeatability and objectivity of measurement) and thus they are successfully applied in chemical and industrial analytics. As far as design is concerned these devices are equipped with a set of a few/several gas chemical sensors and a suitable reference-comparison system capable of identification of simple and complex odours. Operation of the electronic nose instruments resembles human sense of smell – the sensors are the analogues of the smell receptors in nose epithelium and they change chemical information into analytically useful signal. This signal is sent to the identification system, which is human brain and in case of the electronic nose a suitable mathematical-statistical algorithm.

Literature data provide many examples of the electronic nose utilization in various fields (for instance medicine, safety, food industry, pharmaceutical and chemical industry). Combination of sense of smell with the electronic nose operation is difficult and time-consuming task as it requires creation of a data set from the investigations: olfactometry and electronic nose ones, often supported with chromatographic investigations. Chemometric analysis allows interrelation of different signals (nose perception, sensor signal) and creation of a new information in the form of instrumental odour index. The new information (instrumental odour index) about gas odour mixtures will be utilized for calibration of the electronic nose instruments with respect to the gas mixtures of municipal origin and in future it will be generalized with respect to calibration of the electronic nose devices for other odours.