On-line instrument for continuous monitoring of odorous compounds in Waste Water Treatment Plants – Development and applications

Authors: Michel Robert, Damien Bazin

Odor assessment is a key point in some industrial processes. Particularly, in Waste Water Treatment Plants (WWTP), the control of odors has moved from an afterthought to a primary design consideration for most collection and treatment facilities. Odorant molecules such as H_2S or mercaptans are very distinct air contaminants as they generate nuisances and can affect wellbeing and health of nearby residents. The factors playing a role in the determination of odor annoyance are: odor concentration and intensity, frequency, appreciation, duration and location. Two solutions are available: sensory approach (dynamic olfactometry) and sensor technologies (portable sensors, electronic noses, etc.). Although dynamic olfactometry represents the standardized objective method for the determination of odor concentration, it is affected by many limitations such as: only punctual measurements, no discrimination of the single chemical compounds, difficulty to store samples. Sensor technologies are interesting for online monitoring and global printing but do not allow detection at very low concentrations and discrimination of single compounds. As human sense is very sensitive, there is a need for on-line analytical instruments which can quantify odorant molecules at low ppb and ppt levels and then converts these values to odor units.

Gas Chromatography is the most suitable analytical technology when it comes to identify and quantify complex gas mixtures at low concentrations. Nevertheless, sulfur compounds are difficult to sample (from the sampling point to the analyzer), to pre-concentrate, to separate and to quantify.

Recently, we have developed and provided an automated Gas Chromatograph analyzer for the measurement of sulfur compounds produced in WWTP. All parameters from the sampling point to the detectors have been optimized to improve the analytical performance of the instruments. For the sampling lines, we have studied the effects of water condensation on sulfur compound concentrations. The injection systems have been optimized to allow loop and trap injection depending on the level of odorant molecules. Finally the specific columns and detector have been developed to obtain a robust and reliable instrument for field applications. The incoming and escaping air from the deodorization tower in WWTP in Paris have been measured and showed that the instrument is suitable for quantification at high (ppm) and low (ppb and ppt) concentrations. Another campaign of measurements in a WWTP in Dubai showed that the nature and concentration of the produced odorant compounds are different depending on the processes.

Moreover, the interface allows the communication and data transfer using modeling software with integration of online registration of Complains and recalculation of odor concentrations at specific locations and times. One instrument, using a multi stream selector is able to measure compound concentrations and odor indexes before and after deodorization tower. The measurement allows the control and the adjustment of deodorization processes, the optimization of chemical treatment and the decrease of effective costs.