LASER-BASED STAND-OFF DETECTION OF POTENTIALLY HAZARDOUS MATERIALS VIA LIGHT INDUCED FLUORESCENCE (LIF)

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The release of chemical, biological and explosive (CBE) hazardous materials is a very important and recurring topic concerning personal safety and security. Consistently, the public is shocked by attacks of varying dimensions. Therefore, it is important to find methods, which provide the ability to detect and identify hazardous materials at an early stage without having contact to the danger area, inducing the correct counteractions in time to reduce the risk to the public and the emergency services. Especially the detection of biological agents is a major challenge. The great variety of such hazardous substances, their different physical states as well as their different ways of currency, contamination and incubation complicate the detection additionally.[1]

Laser-based stand-off detection methods are distance-pillowed, discrete and reliable, which provides promising opportunities and results to early detect and identify various hazardous materials over long distances. **LIF** is a comprehensive method, in which the substance itself is excited to emit characteristic radiation. These fluorescence signals are distinguishing for the excited molecules and thus allow a relatively accurate classification. Particularly important is the application under real outdoor conditions in order to consider the atmospheric effects. These include, inter alia, the transmission of the laser light, the interference of background radiation, and different weather conditions, respectively. Furthermore, the detection system must be practiced in busy areas, which limits the laser radiation to the eye-safe wavelength range below 400 nm.[1,2] For this reason, all **LIF** measurements were studied on a free transmission range at a distance of 20 m from the laser source upon 355 nm excitation. A number of different chemical and biological substances were tested for their characteristic fluorescence signals and fluorescence lifetimes. The latter are investigated by a gated iCCD camera and analyzed with dedicated software for spectral pattern recognition. The direct comparison of all results leads to a first classification of the various compounds. Finally, the substances are aerosolized to simulate a possible realistic propagation of these materials. The preliminary results confirm classification capabilities of the method.

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[2]. S. Wallin, A. Pettersson, H. Östmark, A. Hobro, *Anal. Bioanal. Chem.* **2009**, Review.