Adulteration Detection in Fuels: First Results

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ABSTRACT

Fuel adulteration is a major problem, costing billions of euros to the state, companies, consumers and to the national economy. Adulteration testing in liquid fuels is usually performed by complex chemical analysis methods (e.g. HPLC-MS, GC-MS) that are time consuming, costly and require sample measurement in a lab by specialized personnel. We are exploring an alternative innovative approach that allows fast and cheap detection of fuel adulteration in the field (e.g. at a gas station) by non-experts (e.g. the consumer). The approach is based on the detection of characteristic spectroscopic “signatures” of chemical components in the fuel mix, which can distinguish one fuel from another. Fuel sample spectra, measured by optical spectroscopic methods (e.g. absorption, fluorescence, Raman , FT-IR, etc.), will be compared with prototype fuel spectral signatures using statistical methods combined with machine learning algorithms and the existence and the degree of adulteration will be determined and communicated to the user through a user-friendly interface.

Here we present the first spectra of fuels and major adulterants used in this approach. Absorption and fluorescence spectra of ten prototype fuel and adulterant samples were measured in order to assess the feasibility of each spectroscopic technique for fuel adulteration detection. The similarities and differences of the spectra already demonstrate the great potential of our approach. We expect the use of statistics and machine learning algorithms to further refine this capability and lower the sensitivity and detection limit of the method.