Universal chemiluminescent assay for oxidative and antioxidative processes in chemical and biological media: Fundamentals and application aspects

Belyakov VA, Fedorova GF, Naumov VV, Trofimov AV, Vasil’ev RF
Institute of Biochemical Physics, Russian Academy of Sciences, 119991 Moscow, Russia

Presented are the fundamentals of a versatile chemiluminescent assay to monitor oxidation processes in a variety of chemical and biological media with the emphasis on oxidation in the presence of antioxidants. The reason for this emphasis resides in a paramount role of antioxidants in numerous areas of biology, material science, chemical technologies and analytical techniques. The method utilizes chemiluminescence generated in oxidation of hydrocarbons, a well-known phenomenon. The mere fact that antioxidants suppress oxidation and thereby quench the light emission opens a direct opportunity for the use of chemiluminescence in the antioxidant analysis. The developed method allows to monitor both the antioxidant concentration and reactivity. Considered examples illustrate the potential of the presented approach to examine analytes dissolved in different phases, i.e., in liquids (hydrocarbon and aqueous solutions), in the solid state (polymers) and in gas (atmospheric air). The chemiluminescent detection of antioxidants in the ambient air constitutes an unprecedented observation. The biological role of such antioxidative air-pollution species is found to be harmful. Other biologically relevant examples refer to the distinguishing between antioxidant of different strength, which are present in the same probe (in blood plasma and plant extracts) and studies on anti- and prooxidative activities of tocopherols.

Acknowledgement: Funding by the Russian Academy of Sciences (Division of Chemistry and Material Sciences) is gratefully appreciated.