

Abstract

Viability Analysis of Spore-Based Biosensors in Sterilization Processes [†]

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[†] Presented at the 5th International Symposium on Sensor Science (I3S 2017), Barcelona, Spain, 27–29 September 2017.

Published: 30 November 2017

The use of microbiological tests is the state-of-the-art method to validate the efficacy of several sterilization processes, for instance, gaseous H₂O₂ from aseptic filling machines. In these tests, microbiological spores are used as a probe due to their high resistance to the sterilization process under investigation. As the viability of the spores is highly reduced due to the sterilization, their efficacy can be assured. However, these microbiological methods are slow and time-consuming; the results can be obtained at the earliest after 24 h. Recently, a first type of spore-based biosensor was suggested to evaluate sterilization processes in aseptic filling machines within a few minutes. It consists of a glass substrate with temperature sensors and several interdigitated electrodes (IDEs) as transducer elements, where the spores can be immobilized on one of the IDEs, whereas the other IDE is utilized as a reference sensor (differential measurement setup). The spore-based biosensor is then exposed to a H₂O₂ gas stream (e.g., 10 m³/h) and heat (e.g., 240 °C); as a result, a signal change (e.g., impedance) can be measured. Nevertheless, little is known about the principle of this biosensor and the relation between the viability of the spores and the sensor signal. In this work, therefore, micro particles (e.g., PMMA, SiO₂) will be used as a model system for the spores to investigate their physical (e.g., morphology) and electrical (e.g., capacitance, impedance) properties after sterilization with H₂O₂ and heat.

Acknowledgments: This work was financially supported by BMBF, Germany, Project: “ImpediPack” (Fund. No.: 03FH012I3).



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