

ABSTRACT

TITLE: EVALUATION OF OXYGEN TRANSMISSION RATE OF PACKAGING FILMS ON GROWTH OF CLOSTRIDIUM SPOROGENES AND MEDIA OXIDATION REDUCTION POTENTIAL IN PACKAGED SEAFOOD SIMULATING MEDIA.

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Studies with packaged fish have shown that obvious spoilage can be delayed by removing oxygen. However, anaerobic pathogenic *Clostridium botulinum* may thrive in reduced oxygen packaging, causing packaged fish to become toxic prior to obvious spoilage. In an attempt to mitigate development of reduced oxygen atmospheres within fresh seafood packaging, FDA has specified a minimum oxygen transmission rate (OTR) for seafood packaging films of 10,000 cc/m<sup>2</sup>/day at 24°C. However, this specification does not take the actual package design into consideration. It is suspected that a specification that combines film OTR with descriptive parameters of the package, such as film area, may offer a better structure for specification. Additionally, while it is generally accepted that *C. botulinum* is an obligate anaerobe, it remains unclear if a particular concentration of oxygen is capable of preventing toxigenesis. Like *C. botulinum*, *C. sporogenes* is an obligate anaerobe but nonpathogenic, so it was used as a surrogate for *C. botulinum* in this study.

The objective of this work was to develop a scientific rationale for a new seafood package OTR specification, and to study the relationships among film OTR, package area and storage temperature on *C. sporogenes* spore outgrowth in regular and anaerobic media.

Commercially available packaging films with a wide range of OTR were used in the study. OTR as a function of temperature was determined in the range of 10-35°C at 0% and 50% relative humidity (RH). Films were converted into packages with areas of 8x8 and 18x14 inches. Inoculated petri dishes were sealed in these packages using multiple vacuum/ nitrogen gas flush cycles. Inoculated packages were incubated at 10, 15, 20, 30 and 35 °C. Dynamic oxygen concentrations were measured in packaged media and package headspace. Oxidation reduction potentials (ORP) of media were measured before and after incubation.

As expected, oxygen levels in high OTR films increased quickly to an approximate level of 12% O<sub>2</sub>. Oxidation reduction potentials tended to become more positive with rising oxygen levels, suggesting that sample ORP plays an important role in predicting potential outgrowth of spores.

Results suggest that a critical parameter for inhibiting outgrowth is the time required to raise oxygen concentration sufficiently to increase ORP above some critical value. It was found that package area, within a practical range of package dimensions, is not sufficiently important to provide an avenue for modifying FDAs OTR guideline. Since film OTR plays a key role in this process, this parameter may continue to offer the most convenient approach toward ensuring safety of fresh seafood.