Title Tocopherol stability in controlled release packaging films

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Abstract

Increasing the shelf-life of packaged foods is of great interest to the food science community. Controlled release packaging (CRP) materials have been developed that are capable of releasing protective compounds (antioxidants, antimicrobials) into the food at rates suitable for long term protection. While the technical challenges of development have been met, FDA approval must be granted before these materials can be used commercially. One critical step in the FDA approval process for food contact materials is to ensure that no toxic products are formed during processing, and that sufficient levels of the added compound are retained to provide the stated functionality.

Tocopherol was chosen as an active compound for incorporation into CRP films as it is a natural, potent antioxidant with positive consumer recognition as Vitamin E. It has been used at low levels as a polymer stabilizer, with no problematic degradation reported. Tocopherol containing films were produced by cast film extrusion of LDPE, PP and a 50:50 blend of these polymers. Multiple extrusion conditions were chosen within standard processing parameters to apply varying degrees of thermal and mechanical stress on the polymer melt. Resulting films were analyzed for their physical properties, recoverable tocopherol, volatile and non-volatile degradation products, as well as antioxidant activity assays.

This study showed that tocopherol recovery is high (92-100%) for all polymer compositions and processing methods, but greatest loss was seen in PP films subjected to high shear. GC-MS analysis shows only polymer additives, with no volatile degradation products formed from tocopherol. A reduction in the level of polymer volatiles was also noted. Analysis by LC-MS has provided tentative identification of two tocopherol dimers and tocoquinone, all previously documented degradation products of tocopherol. Little variation was observed between different processing methods. Antioxidant assays demonstrate that extracts from the tocopherol containing films exhibit as much, or greater antioxidant activity as unprocessed mixed tocopherols.

While further work remains to confirm the identities of the products identified and provide accurate quantification, this research supports the safety and antioxidant effectiveness of tocopherol containing