W.; Scheffer, S.; Goodrich, N.; Griffiths, M. W.; Shelf-life of Milk Packaged in Plastic Containers With and Without Treatment to Reduce Light Transmission. *Int. Dairy Journal.* 1998, 8, 629-636) performed a study on photoprotective properties of materials that required a twenty day period to expose the samples. As another example, while Saffert *et al.* report two studies (Saffert, A.; Pieper, G.; Jetten, J.; Effect of Package Light Transmittance on the Vitamin Content of Pasteurized Whole Milk. *Packag. Technol. Sci.* 2006, *19*, 211–218; Saffert, A.; Pieper, G.; Jetten, J.; Effect of Package Light Transmittance on Vitamin Content of Milk. Part 2: UHT Whole Milk. *Packag. Technol. Sci.* 2008, *21*, 47–55.) that explore package performance related to retaining nutrients in milk, they conducted the study under conditions that required days of exposure.

Given the above, a robust scientific method to rapidly quantify photoprotective performance of packaging concepts in a way that allows relative comparisons between the packaging concepts and is relevant to the conditions used for such packaging concepts in their targeted real-world applications is needed. These methods are needed to allow for the creation of performance design models for packaging concepts, and to allow for efficient design of photoprotective packages that achieve the required balance of performance attributes for a given package cost, weight, material usage, or other design requirements.

SUMMARY OF INVENTION

~~In one aspect,~~Embodiments of the present invention relates to a method for predicting the photoprotective performance of a material, the method comprising: (a) providing a sample comprising one or more photosensitive entities; (b) providing a cell having controlled optical properties to contain the sample at a pre-determined temperature between about -20°C and about 100°C; (c) providing a light source that generates a light beam with a spectral signature between about 290 and about 1000 nm and an intensity between about 0.01 and about 5 W/cm^2; (d) placing the photosensitive entity into the cell, rendering a sample cell; (e) placing a

embodiments, the sample comprises one or more photosensitive entities selected from 2, 3, 4, 5, 6, 7, 8, 9, 10, or more of the given classes.

In further embodiments, the measuring comprises a test method selected from the group consisting of HPLC (high performance liquid chromatography), GC (gas chromatography), IR (infrared) spectroscopy, NMR (nuclear magnetic resonance) spectroscopy, UV-VIS (ultra-violet, visible) spectroscopy, MS (mass spectrometry) coupled with other techniques (e.g., GC-MS and LC-MS), fluorescence spectroscopy, ion chromatography, thin layer chromatography (TLC), analytical wet chemistry, and/or electrochemical analysis (e.g., polarography, voltammetry). In particular embodiments, the analytical method is HPLC (high performance liquid chromatography) or GC (gas chromatography).

In ~~another~~ an aspect, the present invention relates to a device for quantifying the photoprotective performance of a material, the device comprising: (a) a sample supply and control apparatus comprising: (I) a cell having controlled optical properties, the cell capable of containing a sample comprising one or more photosensitive entities; (II) a sample temperature sensor for monitoring the temperature of the sample within the cell; (III) a temperature control for maintaining the cell at a specified temperature between about -20°C and about 100°C; (IV) a dry air supply for delivering low-humidity air to one or more exposed surfaces of the cell; and (V) an agitator for maintaining sample homogeneity within the cell; (b) a light generation and control apparatus comprising: (I) a light source, wherein the light source generates a light beam with a spectral signature between about 290 and about 1000 nm and an integrated intensity between about 0.01 and about 5 W/cm^2; (II) a light beam collimating lens; (III) an infrared filter; (IV) a shutter; and (V) an iris; and (c) a test material holder positioned between the light generation and control apparatus and the sample supply and control apparatus such that, when a test material is placed in the test material holder, the light beam impinges upon the test material and any penetrating light impinges upon the cell.