Quantitative analysis of a polymer UV stabilizer has been carried out using the PerkinElmer Model LS-50 Luminescence Spectrometer (L225-0105) fitted with the front surface accessory (5212-3130).

The relationship between fluorescence emission and stabilizer concentration was found to be linear over the range observed for both native and extruded polymer samples.

Many polymers such as polypropylene, polyethylene and polyvinyl chloride contain stabilizers to increase resistance to ultraviolet light-induced degradation. These additives can be relatively expensive, and the concentration required for effective UV stabilization can be quite critical.

It is therefore desirable to monitor the concentration of the stabilizer in the parent polymer rather than relying on the calculation of the stabilizer dosing concentration based on the concentrations of the starting materials. This method allows for checking of homogeneity as well as the absolute concentration of the stabilizer.

Polymer samples were supplied as native and extruded clear sheets. These were cut into 4 cm square sections and inserted into the front surface accessory using a piece of non-fluorescent card to keep the samples flat against the accessory window. Concentration of stabilizer was given as 0.5, 1.0, 1.5, 2.0, 2.5 and 3.0 mole %.

Data was collected as emission spectra, 390 nm - 550 nm, excitation wavelength 370 nm, slits 10/10 nm, scan speed 120 nm/min.

The built-in emission attenuator (4 %T) was selected to decrease the assay sensitivity, as the samples were initially too strong for the extremely sensitive LS-50.

Figure 1 shows the emission spectra of 5 native polymer samples superimposed on the same ordinate scale. The spectra show a clear correlation between stabilizer concentration and fluorescence intensity.
Calibration graphs for stabilizer concentration vs. fluorescence intensity were prepared using Enzfitter®. Graphs were presented as intensity at 429 nm vs. stabilizer concentration for both native and extruded polymers. Figures 2 and 3 show the calibration graphs for stabilizer in native and extruded polymers respectively.

CONCLUSION

Quantitative analysis of UV stabilizers in polymers can be carried out using the Model LS-50 Luminescence Spectrometer. Linear response can be observed over the typical range of stabilizer concentrations used.

*Enzfitter is a product of Biosoft

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