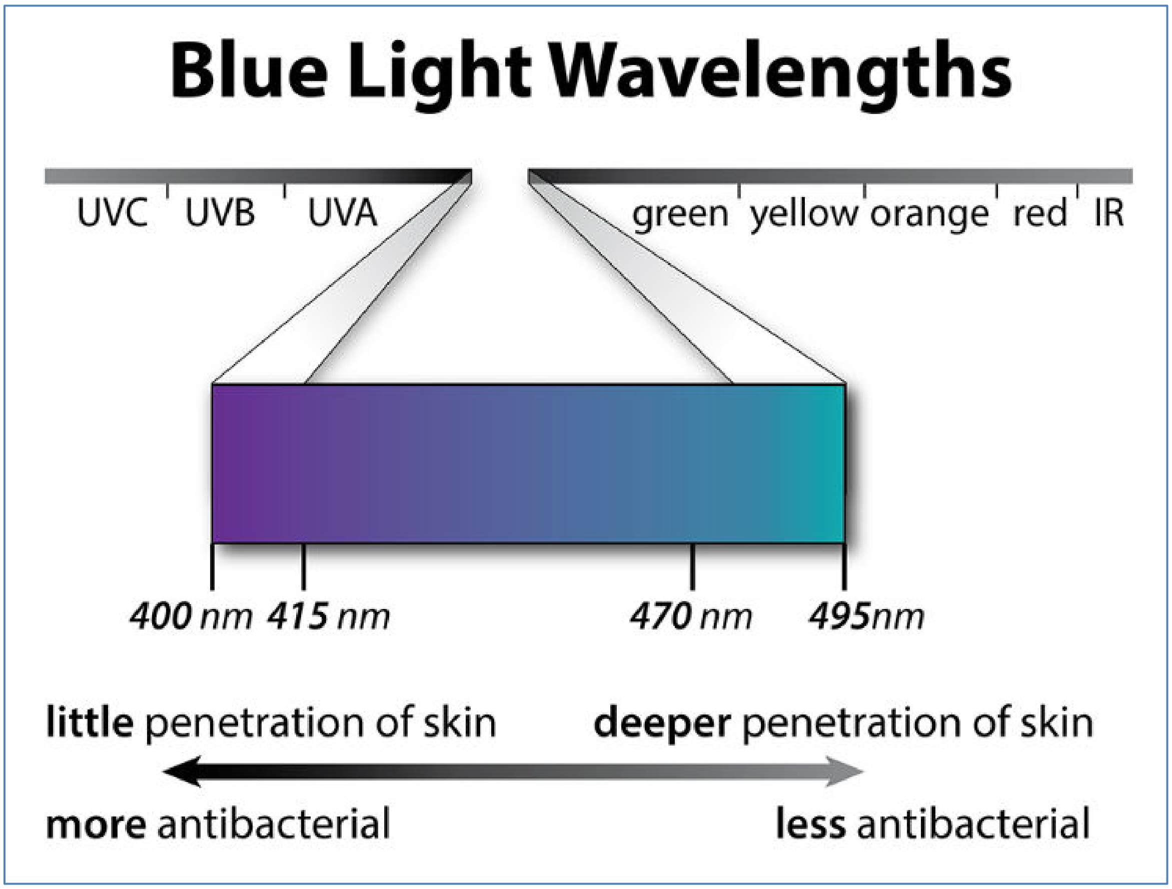
BLUE LIGHT IN PACKAGING AND METHODS TO CONTROL TRANSMISSION

Plastic packaging from retort pouches, bags, and injection molded containers are either pigmented (masstone) or tinted to control the transmission of harmful radiation. However, a percentage of harmful radiation does penetrate the package or container and this initiates degradation and rancidity in packaging. Most additive packages to prevent transmission of harmful radiation fall short of the region of blue light that controls rancidity in packaging.



The reported wavelengths that initiate the mechanisms of rancidity of all known oils are in the range of 405-430 nm being the most effective. However, wavelengths of 445-460 nm are also considered important in controlling secondary process. However, from a energy standpoint the lower the wavelength the greater the energy. Therefore, 400-415 nm are more harmful than 470 to 495 nm.

Until recently the focus among most ultraviolet absorber chemistries historically has been controlling wavelengths from 290 to 390 nm. This range being key for the protection of the plastic, colorant, and as a filter for transmitted light. However, the issue of migration, extraction, blooming, volatility, in-situ transformation over time leaving no protection and cost have been among the many variables controlling the use for each end use application.

Today advances in the range of chemistries to provide UVA protection have continued to provide greater cost for the performance and the same limitations of in-situ consumption over time. Permanence and control of in-situ transformation has been absent until now.

Within a new field of Photonics has begun a better understanding of Plasmonics and materials that provide permanence and either a control of in-situ transformation of existing UVA or total control of in-situ transformation with no change in the absorbance per thickness of the fabricated plastic part whether film or bottle.

Many examples have been illustrated in think and thick sections over the last few years. A new material has been introduced and referred to as a Spectral Enhancer. Unlike most additives the material was designed to be used alone or in combination with conventional organic ultraviolet absorbers like hydroxy subsituted benzotriazoles and benzophenoes and triazine chemistries. These materials possess unique properties of permanence in absorbance over time, no blooming, no migration, no extraction, no volatility and have a profound ability to synergize with conventional Ultraviolet Absorbers. They are inexpensive and commercially available for a broad range of end use applications including fine denier fibers, film, injection molding, thermoforming and rotational molding.

The synergism between a Spectral Enhancer and UVA results in a red shift (Bathochromic) and significant Hyperchromicity of the existing UVA. In addition the red shift can be from 5-15 nm from the existing UVA depending on ratio of the Spectral Enhancer and UVA. In the last few years several Spectral Enhancers have been discovered and marketed globally and found greater use in more environmentally less hospitable climates in South East Asia were the temperature is above 40C and has major limits on many plastic additives.

Today we are introducing a new material that also provides permanence and broad UV Absorbance in both the same areas as a conventional UVA but in the blue region from 400 to 500 nm.

The one key property of these materials is the very low concentration range that is needed to provide the protection e.g. 200 to 500 ppm maximum.

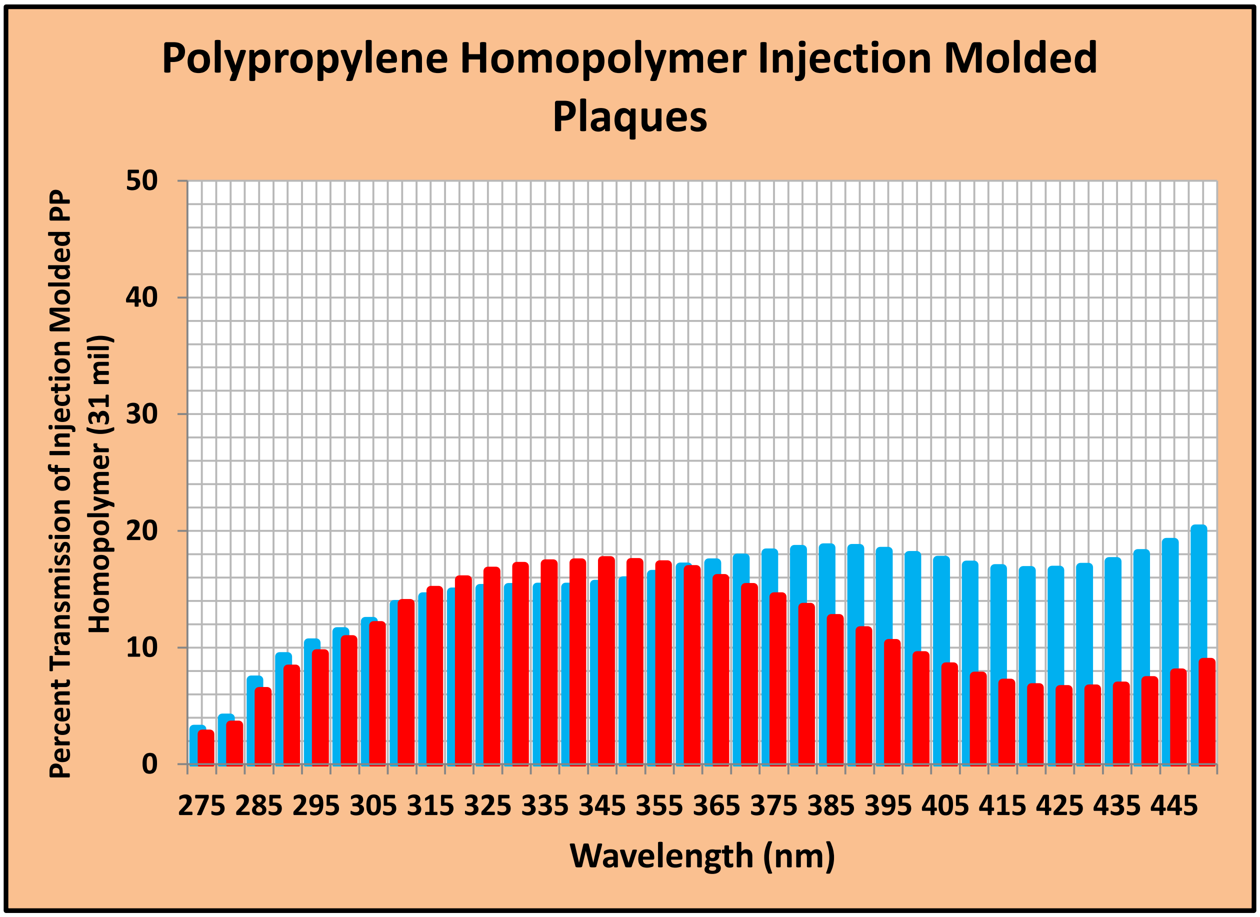


Figure 1: Blue is 200 ppm and Red is 500 ppm Enhancer

Very strong absorbance in the actinic region below 300 nm and broad protection beyond common cut offs of conventional UVA in the market.

Compared to conventionl UVA like Maxgard 2800 shown below the loadings are significant orders of magnitude lower.

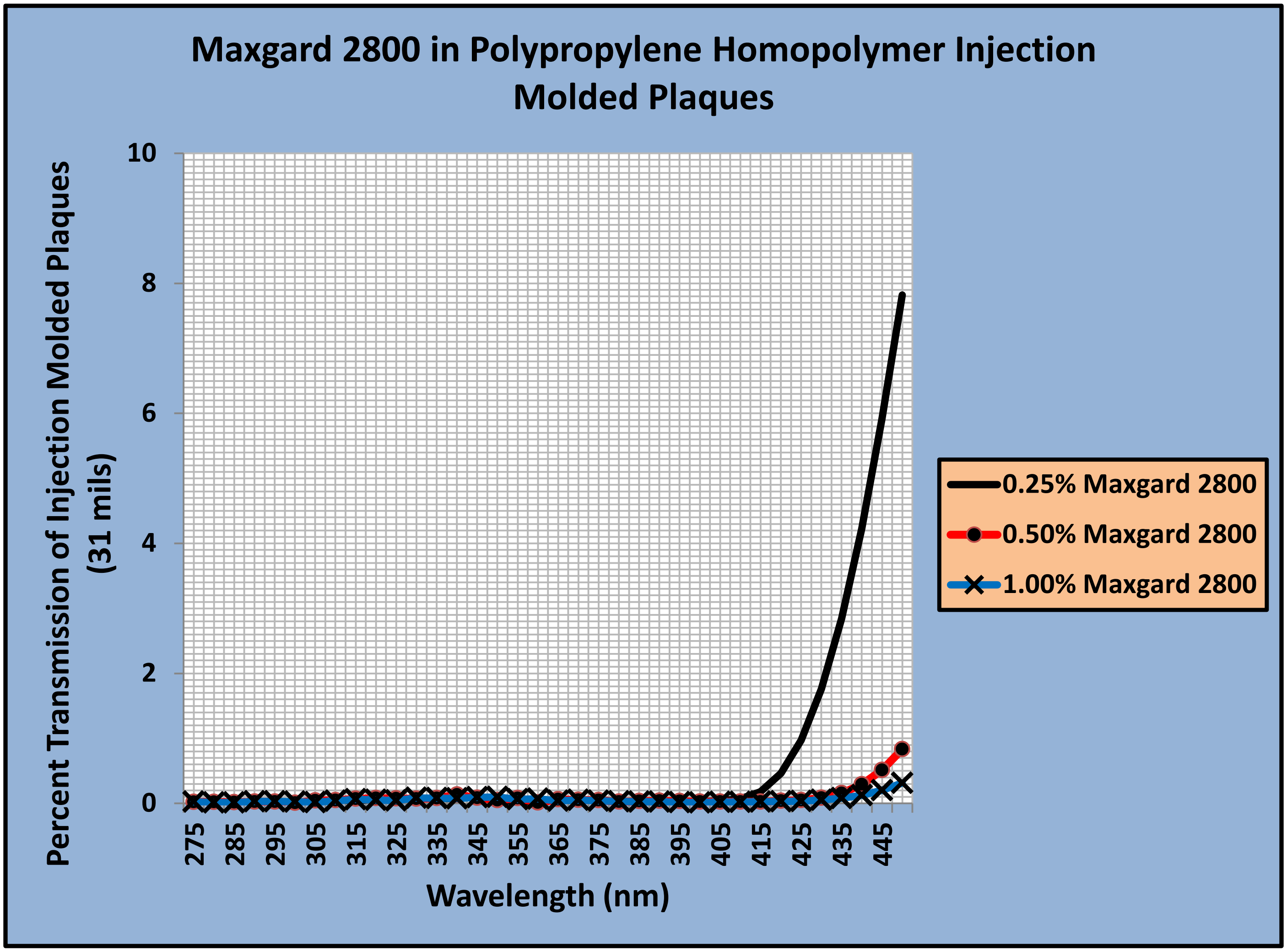


Figure 2: Maxgard 2800 spectra in polypropylene homopolymer

In Figure 3 using the lowest concentration of Maxgard 2800 of 0.25% and a Spectral Enhancer designated Uvita SME 3811 we get a red shift and hyperchromic increase in absorbance from the Maxgard 2800

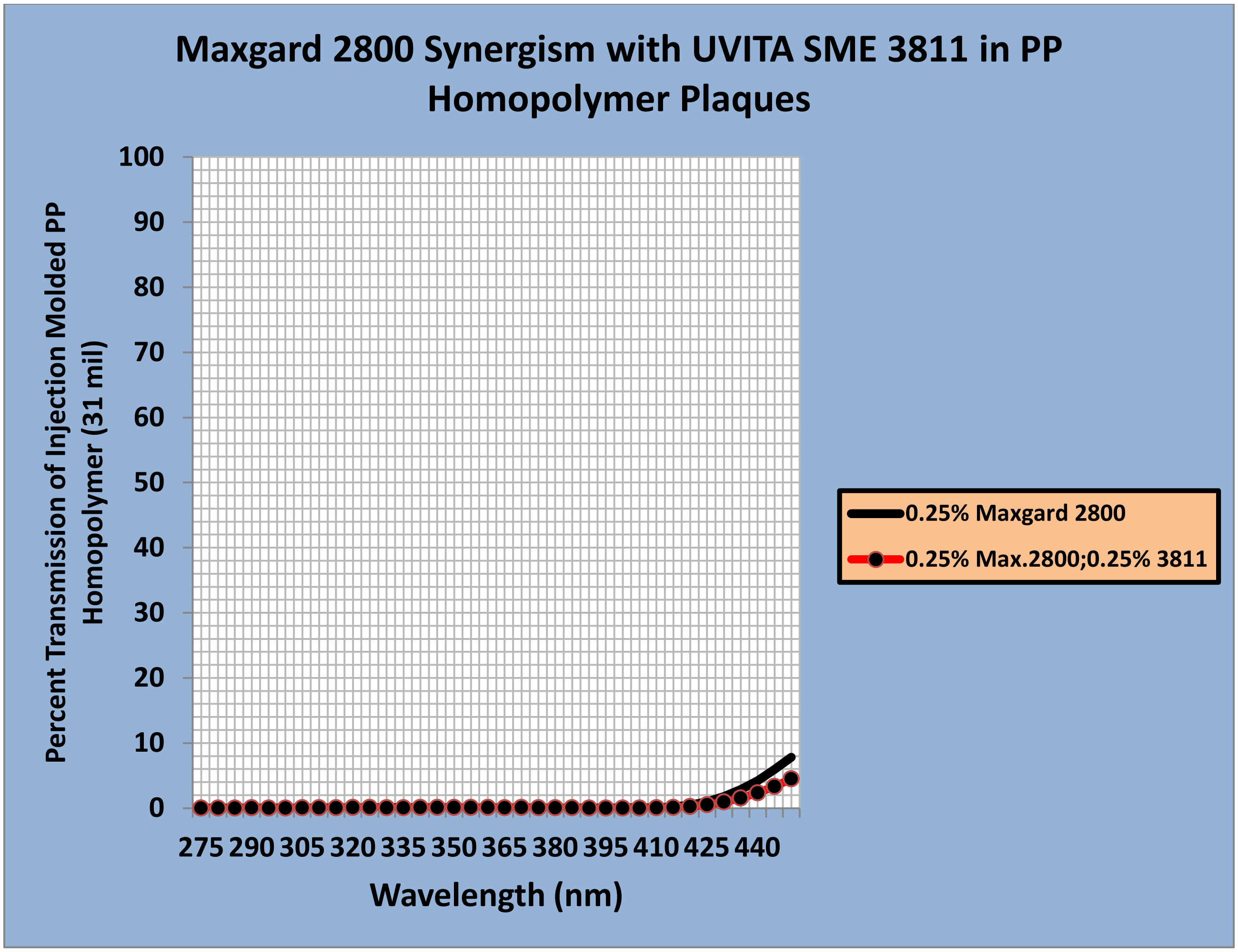


Figure 3: Maxgard 2800 and UVITA SME 3811 in polypropylene with protection against blue light.

In both cases we achieve protection from blue light in the visible region. In both cases concentration of the additive to achieve a particular transmission in polypropylene is dependent on thickness and the percent transmission desired.

In the past this has typically been at higher loadings and cost with the associated limitations reported in this document.

This progress report in the field of Plasmonics for May 2018 shows we have yet to discover the range of possible types nor combinations of Spectral Enhancers available.

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