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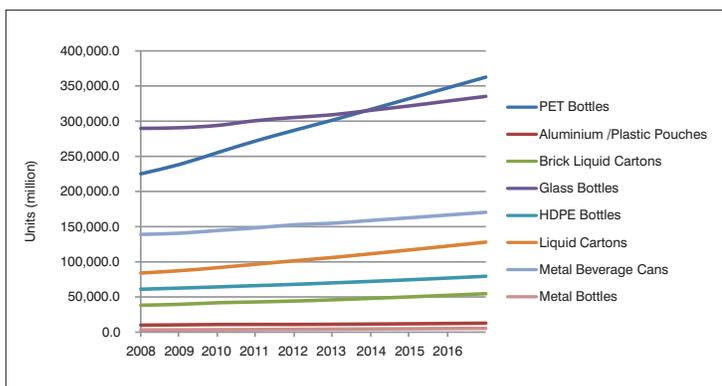
How to improve PET packaging for UV-sensitive beverages

Enhance content protection without compromising design flexibility, production efficiency or recyclability



THE CHALLENGE

PET continues to grow in popularity as an effective packaging material for beverage applications. It is robust, lighter in weight compared to other materials such as glass and metal, and easily recyclable. The material also offers a high degree of design flexibility that enables packaging designers and brand managers to differentiate their products. Add low-cost production capability to the equation, and it's clear why there is a steady rise in worldwide production of PET containers for beverages.



However, like glass, transparent PET offers limited protection against ultraviolet (UV) wavelengths present in natural light and certain types of man-made lighting. PET can block wavelengths shorter than 315nm, but transmits light in the UVA spectral region, between wavelengths of 315nm and 400nm. Many of today's beverages are sensitive to UV light, or contain ingredients that are not stable in the presence of UV. This is typical with beverages that are rich in vitamins, coloured or contain flavouring.

WHY IS EXPOSURE TO UV LIGHT A CONCERN?

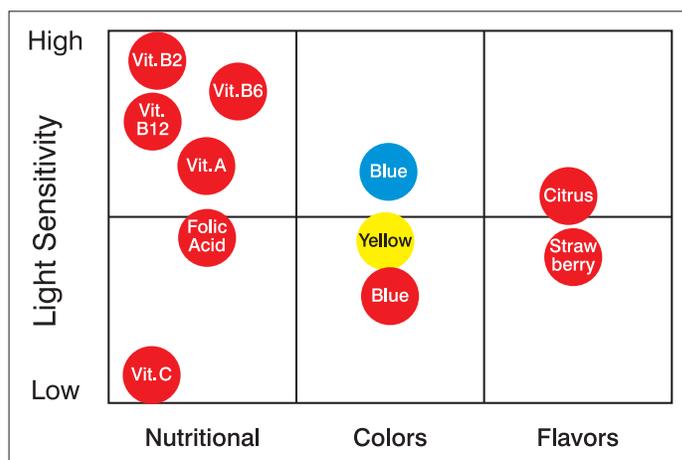
UV light causes photo-oxidative degradation, a reaction that can adversely affect the taste,

odor or color of a beverage. Degradation will affect shelf life, but it could also damage the image and integrity of a brand if consumers have a negative experience with the product.

Full bottle sleeves, opaque PET packaging or a combination of both, are used today to protect UV-sensitive products, but these methods can be limiting for packaging designers. In certain high-volume markets, such as juice and energy drinks, clear or transparent packaging allows brands to showcase the content.

Some energy drink brands, for example, use vibrant colors as marketing tools to provide differentiation and enhance consumer appeal. In the juice market, glass-like container clarity in a polymeric container can be used to help position a brand as 'premium' on the store shelves.

During processing, opaque bottles and sleeves can also increase production complexity with higher addition rates for opaque colors and additional process steps required for shrink wrapping sleeves. Both also add complexity to the PET recycling process and are generally not recommended by association bodies such as the European PET Bottle Platform.





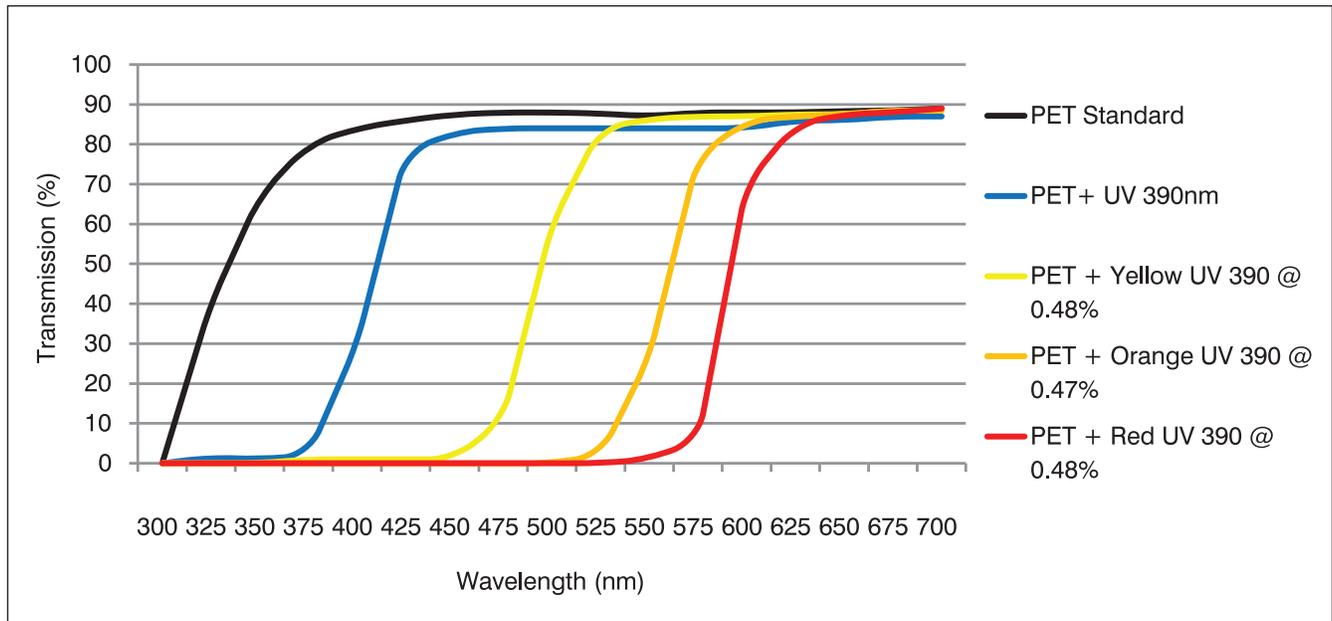
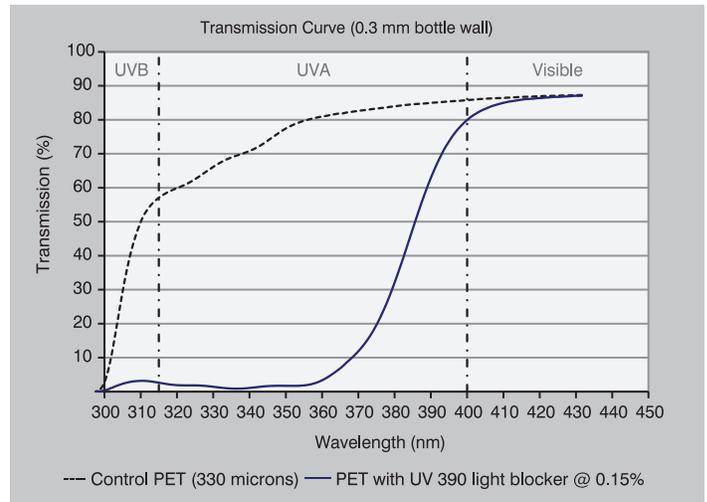
A lack of UV protection in clear and transparent packaging also affects beverage formulators, who are limited to creating products that are 'UV-safe' or contain preservatives to counter the risk associated with UV exposure. However, there is growing consumer demand for healthier, preservative-free foods and beverages, and this often involves using an increasing number of UV-sensitive ingredients.

All these factors are forcing the industry to take a closer look at how PET packaging and beverage content function together in order to develop products that have aesthetic appeal, are easy to recycle and most importantly, reduce the risk of inferior product quality.

THE SOLUTION

For brand owners and converters, adding a UV barrier additive during preform molding is an effective way to prevent UV-initiated product degradation in clear and transparent PET containers.

Standard PET blocks UV wavelengths up to around 315nm, but at 330nm it allows over 50% transmission, which is already enough exposure to initiate degradation for certain ingredients. With a light barrier additive added at 0.15%, UV transmission can be kept below an acceptable level for many applications.





For beverage applications where an even higher level of content protection is required, beyond UV light waves and into the visible light spectrum, a combination of UV absorption additives and specific colorants can provide effective protection.

FIVE WAYS UV BARRIER ADDITIVES CAN OFFER VALUE FOR PET APPLICATIONS:

1. RISK REDUCTION

Reducing the risk of quality degradation helps maintain brand integrity and consumer loyalty while minimizing the possibility of product recalls. A great deal of money and resource is invested in product development and tailoring packaging to maintain product quality is a way of providing insurance for that product

2. SHELF LIFE EXTENSION AND GLOBAL CONSISTENCY

Extending shelf life can reduce the chance of product degradation, but it also enables production flexibility. For example, a brand or manufacturer could use a single site for production that serves various locations or geographies that may have varying supply chain demands and point of sale environments. An additive that provides broadband

UV blocking can be used to meet content protection requirements around the world.

3. FORMULATION FLEXIBILITY

With UV protection, formulators have more flexibility to use UV sensitive ingredients

and not rely on the formulation alone to be UV-stable. This can help brands meet the increasing global demand for healthier drinks with fewer preservatives and stabilizing compounds.

4. CONTAINER DESIGN FLEXIBILITY AND PRODUCTION EFFICIENCY

Packaging designers are not limited to opaque and sleeve constructions when designing containers for UV-sensitive beverages. Clear and transparent designs enable designers to react to market demands. Where UV barrier addition rates are low, they can also offer cost and process efficiencies over opaque coloration or sleeve shrink wrapping.

5. SUSTAINABILITY

UV barrier additives that don't affect PET clarity or quality during recycling help brand owners improve their sustainability credentials and in general enable more recycled PET to be used when producing new containers.

KEY CONSIDERATIONS WHEN USING UV BARRIER ADDITIVES IN PET

1. CONTAINER DESIGN AND THICKNESS

Some container designs and shapes have different thicknesses at different points in the container. There is a potential for 'weak spots' where the barrier additive is less concentrated and this could affect protection levels. It is always recommended to test the container at multiple points in the wall section (at least at the thickest

and thinnest locations) to fully assess the UV barrier capability. It is always recommended to base your additive addition rate on the thinnest point in the wall section to ensure adequate protection across the entire container.

2. PET COMPATIBILITY

Introducing additives always has the potential to pose challenges for production and technical teams. 'Plate-out' or mold deposit is a common problem when using additives in the injection molding process to make preforms. When additives are not specifically designed for use in PET or the processing parameters, they may migrate from the polymer matrix and form tiny deposits on the mold. This can lead to inferior preform quality and increased downtime. Careful selection of barrier formulations can reduce the risk of plate-out and related processing issues.

3. CONTAINER CLARITY

Some UV additives can affect the clarity of clear and transparent PET containers. Where clarity is critical, it is important to specify high-performance additives that can be added at low addition rates and do not discolour the polymer or cause haze.

CAN UV BARRIER ADDITIVES WORK FOR YOU?

PET is a popular packaging material that continues to meet the demands of the beverage industry. Effective UV light blocking additive technology optimizes PET container performance to provide greater protection for UV-sensitive beverages. If you want creative freedom and the confidence to design containers and beverages that resonate with consumers, improve your sustainability credentials and streamline manufacturing, UV barrier additives for PET can work for you.

SPEAK TO THE PET EXPERTS

PolyOne's ColorMatrix business has extensive knowledge of the PET beverage industry and has been supplying advanced liquid colorants and additives to brand owners and converters around the world for over 25 years. ColorMatrix™ UV 390 additive is an effective liquid UV light blocking additive and the only UV barrier additive for PET that is currently recognised by the Association of Plastics Recyclers and the European PET Bottle Platform for having no negative effect on the recycling stream.

THE COLORMATRIX TEAM CAN HELP

- Using advanced modelling tools to assist in calculating UV transmission curves for your specific application
- Configuring UV barrier formulations that can meet your protection requirements
- Developing colorant and UV combination solutions for higher protection applications or where specific aesthetic effects are required
- Consulting on global food contact requirements and regulatory approvals

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