



Cycletime Tips - General

Volume 23: Phenolic Yellowing

By Mike Van Duine

Over the last several years, I have received calls related to color shifting in natural or white polypropylene and polyethylene parts and extruded sheet. When these parts were produced, they met the OEM color standards, but upon OEM inspection, the product had shifted color. The color shift may range from yellow, green, blue and pink. This phenomenon is commonly referred to as phenolic yellowing or pinking. In this issue, we will discuss why this happens, how to identify it, and preventive measures to minimize this potential problem.

There are several potential causes for phenolic yellowing. In the cases I have experienced, the primary cause has been the antioxidant package used in the material. Polymers have an antioxidant package included during manufacturing so that they remain thermally stable under processing conditions. Without the antioxidant, the polymer will decompose, become brittle and have inferior properties. In most cases I am familiar with, hindered phenols were used as the antioxidant. Given the right scenario, a chemical transformation can occur and result in a color change. Identifying this phenomenon is relatively simple. By placing the part in sunlight, exposure to ultraviolet rays and ozone reverses the chemical reaction, and the yellowing disappears.

During storage following processing, the number of possible scenarios that can initiate the yellowing makes it problematic to determine the exact cause. The following are potential causes for the color change.

Gas Exposure: Discoloration caused by exposure to carbon monoxide, or nitrogen oxides. These can come from oil- or gas-fired heaters, lift trucks etc.

Environmental: Humid environments followed by dry storage.

Packaging: Parts stored in the dark in contact with containers made of cardboard or containers lined with unbleached craft paper, which may contain unstablized phenolic.

Preventive measures to minimize and or retard color change:

- Use a white masterbatch with treated titanium dioxide.
- Reduce storage time. Less than three weeks would be preferred.
- Protect finished product to reduce exposure to the carbon monoxide and nitric oxide gases. Use battery powered lift trucks.
- Provide adequate ventilation to reduce carbon monoxide gas levels from heaters and propane lift truck.

- Use bleached cardboard in situations where product may be in contact with cardboard.
- Check with your material supplier for the antioxidant package used. Phenolic yellowing is something you may not see every day, but the possibility does exist for this phenomenon to occur. As the old adage goes, an ounce of prevention is worth a pound of cure.

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