SIMONA PMC

How to Avoid Pinking & Yellowing of Polyolefin Polymers

GLOBAL THERMOPLASTIC SOLUTIONS

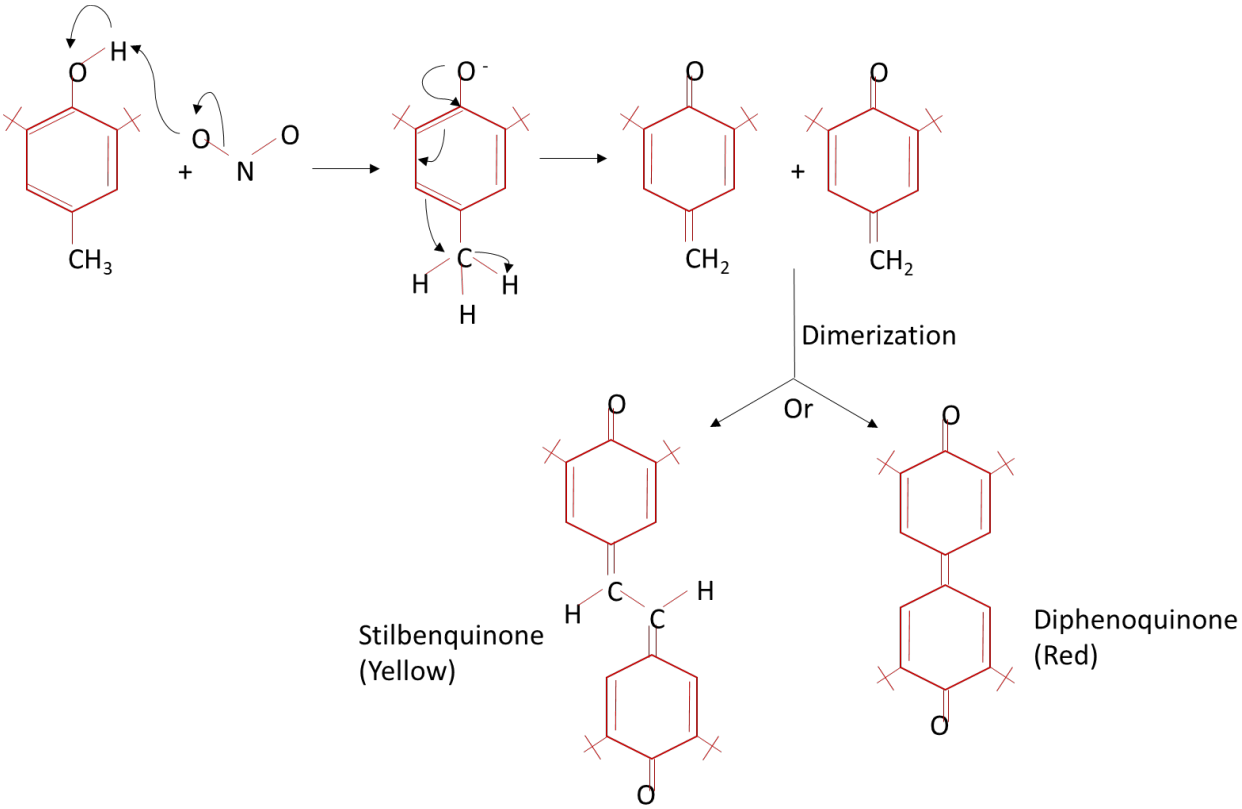
What is Pinking?

Pinking, yellowing and gas fade are all terms used to describe the same discoloration phenomenon. Typically seen in polyolefin materials, although also possible in other polymers, this discoloration is usually caused by over-oxidation of phenolic compounds. Many polymers include phenolic-based antioxidants in order to help with processing and thermal stability of the material. Phenolic compounds will oxidize in the presence of NOx, SOx and other oxidation gases. A common source of these gases is the burning of a fuel, like natural gas or oil, such as in for trucks or heaters. This is why discoloration can be worse or occur faster in the winter months, when sheets are exposed to these gases in a more enclosed warehouse or process environment. Some lower grade cardboards can also release SO2 over time, causing discoloration as well. Thankfully, this discoloration is cosmetic-only and does not affect the physical properties of the plastic.

Chemical Process

Phenolic antioxidants work by acting as sacrificial molecules. They donate hydrogen atoms in order to prevent free radicals from oxidizing the polymer instead. When a phenolic is oxidized, it forms a quinone complex which ranges in color from yellow to pink. Pink is more common in light colored or white polymers as these colors contain TiO2 commonly and titanium-based quinones are pink in hue.

A very simple antioxidant example is BHT. The example mechanisms below shows how this molecule oxidizes in the presence of a reactive oxygen species to form some version of quinone:



How to Avoid and Treat Pinking Issues

The discoloration that comes from these oxidation reactions is completely reversible. UV light changes the quinone structure such that it becomes colorless. How much UV light is required depends on your UV source (sunlight being most common), how severe the discoloration is and how close you place the sheet to the UV source. Typically, 40 minutes minimum is required to reverse the discoloration. If the discoloration is minor, you can also try wiping the surface with isopropyl alcohol on a rag. Sometimes this can help remove the antioxidant at the surface that is discolored and restore the original color.

There are also several methods to avoid pinking or yellowing from happening in the first place. First, avoid allowing plastic sheets or parts to sit for extended periods of time in warehouse storage. Use sheet up within about 90 days of when it arrives to minimize the time the plastic is exposed to fork truck or heater fumes. If this is not possible, adding a polybag cover or wrap can help reduce the exposure to fumes as well.

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