

Information Sheet

SUBJECT: DISCOLORATION OF POLYURETHANE FOAM

The color stability of polyurethane foams is affected by UV light, oxidation and temperature. The presence of BHT, a common antioxidant, can also affect the color. The following report describes the various types of discoloration in more detail.

Discoloration from UV light exposure:

Polyurethane foam will yellow if exposed to UV light. The yellowing is caused by an oxidation reaction in the backbone of the polymer. Since it is the polymer itself which is being oxidized, the yellow color cannot be extracted and the foam will ultimately degrade over time.

In simple terms, polyurethane foams are made by reacting a polyol, an aromatic isocyanate and water. The isocyanate, typically toluene diisocyanate, reacts with the polyol to form the urethane polymer. If an amine forms on one of the isocyanate groups instead of a urethane linkage, this resulting aromatic amine is capable of being oxidized to a quinone. Quinones are yellow and their formation will make the foam appear more and more yellow as the oxidation proceeds over time. Since the quinone structure is part of the backbone of the polymer, the foam will appear discolored before there is any degradation of the foam. Once the oxidation starts breaking chemical bonds, the foam will lose strength. UV light accelerates this oxidation process. It is highly recommended that sponges be stored in a light tight area or cabinet to slow down the normal oxidation process.

Quinones are only formed from aromatic isocyanates. If an aliphatic isocyanate is used, quinones cannot form and the foam will not discolor. Aliphatic isocyanates are difficult to process and expensive. They are rarely used to make flexible polyurethane foam due to the extreme costs involved.

Discoloration from oxidation (Gas induced):

Polyurethane foams will also discolor if oxidized. Oxides of nitrogen from tow motor emissions, gas fired furnaces or pollution can cause a foam to oxidize and become yellow. This phenomenon may be more observable in the winter when warehouses are closed up and gas furnaces are in operation. Ozone exposure can also oxidize foam and cause discoloration. This form of oxidation is not commonly seen in an imaging environment.

Discoloration from heat:

Polyurethane foams can also become discolored from exposure to heat. This can occur if the foam is exposed to heat in end use, during storage. (on or near an x-ray generator, in a window or other heat source in a room). It is important to store sponges in a controlled temperature environment.

The color stability of a foam can be improved by using pigments or dyes to mask any discoloration or by using UV absorbers or antioxidants to retard discoloration. However the pigment dyes due cause artifacts that can be seen in imaging. Techno-Aide does not utilize these pigments for this reason.