SAFETY FOOTWEAR
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HYDROLYSIS
IN POLYURETHANE INJECTED SOLES LEAD TO SOLE SEPARATION

Hydrolysis is the chemical breakdown of a compound due to the reaction with water. We are talking about Polyurethane (PU) which is used to make midsoles and outsoles. Our soles are made of PU (Polyurethane) in order to be anti-slip, anti-static and oil/acid resistant. Because PU has organic origins, it is biodegradable over time & ultimately renders the polyurethane to a number of benign compounds.

PU can gradually absorb moisture over time and deteriorate. The polyurethane gets harder, more porous and, at some point, starts to crumble. In extreme cases, it can disintegrate completely & the sole might fall off your boots.

Hydrolysis in safety footwear only becomes a serious issue when four factors combine to create the ideal environment:

- Water
- Temperature
- Darkness
- Time

Therefore, lengthy storage (longer than 18 months) in a hot & humid climate is potentially the perfect catalyst for hydrolysis in which the plasticizer (which makes the soles flexible) leaves the PU sole, and the soles become very soft, then brittle, and begin to crack and break into very small pieces.

Hydrolysis is a double decomposition reaction, with water as one of the reactants. Simply put, the oxygen atom in water bonds with the carbon atom of the polyesters in the Polyurethane. This carbon-oxygen bond is unstable, and eventually also breaks down, leading to the gradual disintegration of the polyester Polyurethane.

Most high-quality Safety footwear manufacturers use polyester-based PU since it is the most suitable material – despite hydrolysis as it offers good chemical resistance & antistatic properties. For this, all footwear manufacturers have to deal with the problem of ageing Polyurethane.

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Please note that hydrolysis isn't visible from the outside because the ***deterioration takes place from within*** and even new-looking boots may have a crumbling construction, so we strongly recommend taking your old boots on a test run before you wear them at a regular factory, especially if they have been sitting around in the cupboard. ***The most evident sign of the presence of hydrolysis is sticky footprints left on the floor surface***

New Polyester Polyurethane formulations & the addition of more sophisticated chemicals significantly retard the process of hydrolysis. Polyether Polyurethane is not susceptible to hydrolysis but cannot be used in the outsole as it is not Oil & Chemical resistant. However, it is used in the midsole where the outsole is of Nitrile rubber.

Proper storage can help to prevent hydrolysis: footwear is best kept in dry, well-ventilated conditions & they should never be exposed to high temperatures. These factors scientifically speed up the process of hydrolysis. There are significant differences in when hydrolysis sets; at the moment, we estimate that it starts around 18-24 months after manufacture. It's worth considering that the manufacturing date might well be some time before the purchase date when you bought your safety footwear.

How to protect your boots from hydrolysis:

- 🕐 Store your boots in a dark, dry & well-ventilated area
- 🕐 Encourage the wearer to properly aerate the footwear after use.
- 🕐 Keep your boots away from surfaces of heat
- 🕐 Clean your boots regularly
- 🕐 Wash off muck and manure with water at the end of the trip
- 🕐 Do not wear PU-soled footwear where gumboots would be suitable.
- 🕐 Wear your PU-soled footwear at least once a week.

The effects of Hydrolysis cannot be seen as a fault/defect but simply a characteristic of the compounds used to create the PU soles.

However, if worn regularly and the shoes are then in the fresh air & sunlight the product will not experience this process. In fact, the shoes should then last for many years. 4 to 5 years old footwear is quite commonly seen in good condition when maintained and polished regularly.

Contact the JCB team today to get advice on any subject related to Safety Footwear by dropping an e-mail to info@jcbfootwear.in