

Ingenia Flexible Packaging Brief

Antifog

The phenomenon referred to as fogging occurs when condensation forms on packaging as a result of a temperature differential between the interior and exterior of the package. Variations in surface tension between the water and the packaging surface lead to the formation of droplets that refract light, ultimately reducing the clarity of the packaging.

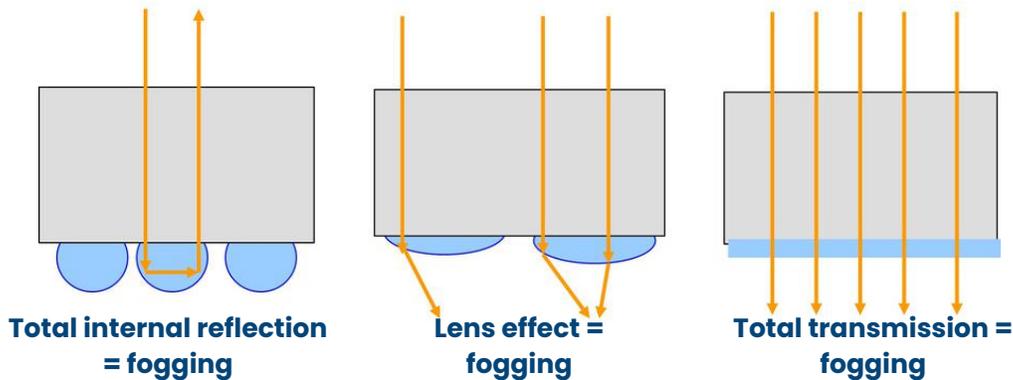


Figure 1. Schematic showing the formation of different types of water condensation on film surfaces.

To prevent the formation of water droplets on the film, an antifog additive must be added. The antifog additives have a hydrophobic tail and a hydrophilic head. The additives migrate to the surface of packaging with the hydrophilic moiety on the surface to reduce surface tension and spread the condensed water droplets into a continuous film of water. This makes the surface of the packaging appear clear. Antifog can improve the packaging film clarity, shelf appeal, and extend the shelf life of the packaged food. Antifog is used in greenhouse films, helping prevent virus spread and crop damage due to magnification of UV light, when water droplets act as a lens.



Without antifog additive



With antifog additive

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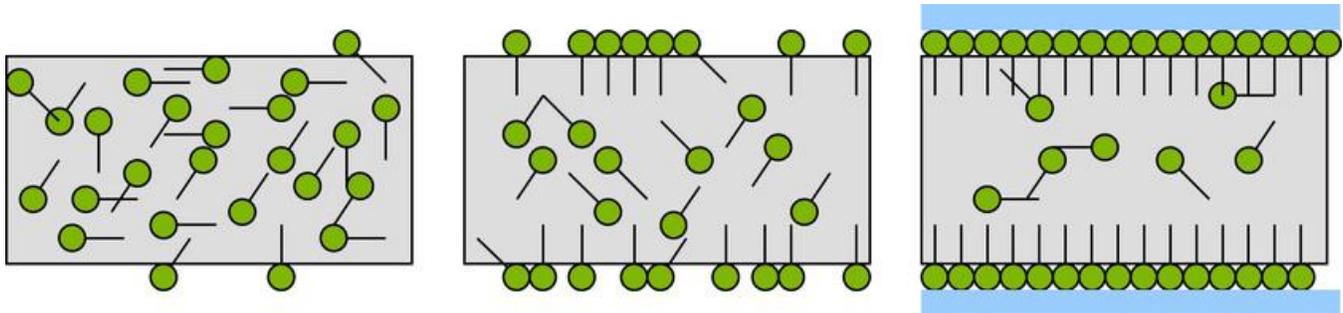


Figure 2. Schematic showing the migration of antifog additives from the bulk of the polymer film to the surface of the film.

The following factors affect the migration of antifog additives :

- Polymer used - Density, add-pack (additives in the resin). Migration is slower in HDPE, because of the crystalline and less amorphous portion limiting the mobility of the antifog additive.
- Other additives - Antifog additives can interact with other additives in the layer including slip, antistat and antiblocks which can affect the antifog performance.
- Processing temperature - Higher the temperature, greater the migration.
- Type of application - There are cold fog and hot fog applications. For cold fog applications, fast bloom antifog additives are required to achieve efficient antifog performance. For hot fog applications, migration speed, type of antifog and concentration need to be optimized depending on the shelf-life requirements.
- Film thickness - The thicker the film is, the less antifog required due to more antifog in the matrix vs same surface area. Thin films need very efficient antifog additives to achieve good performance.
- Layer composition - Tie layers tend to attract antifog, due to their amorphous structure and the polar nature of maleic anhydride in the polymer.
- Storage temperature - Higher the temperature, higher the migration, until surface is saturated.
- The greater the winding tension, the slower the diffusion.