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Adhering Labels and Inks to Plastic Containers

Most polyethylene milk, water and juice containers are decorated with plastic or paper labels, screen-printing, etc. Since the useful life of the container is only seven-to-ten days, the label or the ink need not adhere longer than that time. However, it is still important to have good adhesion during the shelf life of the bottle.

One of the biggest drawbacks of polyethylene containers is their poor adhesion to printing inks and glues in labels. Poor adhesion is due to chemical incompatibility and the inability of the ink or glue to “wet-out” the surface of the container,

FLAME TREATMENT

To remedy the lack of wetting-out, the area that is to receive the ink or adhesion label needs to be treated. The most common method is flame treatment. Other methods are discussed later.

In flame treatment, it is important that a gas-air mixture rich in oxygen feed the flame. The usual ratio of air to gas is 10:1. Flame treatment results in the oxidation of a very thin layer of the container's surface. The net result is enhanced chemical compatibility with inks and glues and better wetting of the polyethylene surface.

The container is in contact with the flame only a few tenths of a second. This is usually sufficient to produce the desired results. Also, the short time of contact does not slow down either container production or the filling operation. More importantly, the short time does not allow excessive heat to build up and distort the container. If treatment is desired only on one face of the container and that face needs to be oriented on a conveyor system, a vertical strip burner may be employed.

If all-around treatment of containers is required, each container can be dropped through a ring-shaped burner or rotated as it passes through a wall of flame.

EFFECTIVENESS OF TREATMENT

Determining effectiveness of treatment is especially simple for in-plant molding operations where the containers go directly from molding to treatment to decoration. Follow various steps mentioned below.

1. Pick a newly decorated container off the line and determine whether a paper label can be peeled off. For ink, press a strip of cellophane tape onto an inked area and see whether the ink comes away with the tape. If treatment is found to be incomplete, either the flame is not rich enough in oxygen or the treatment time is too short.
2. To correct, first increase the air-to-gas ratio. If this fails, check the treatment time.
3. The line speed may have increased by improved molding and filling operations. In this case, the treatment time may automatically have been reduced. Bring it back to normal by increasing the length of the flame path through the use of a wider burner or the addition of a second burner.

If containers are blow molded, treated and then stored for hours or days before use, or if they are molded and treated at one location, then shipped in bulk to the dairy, then testing containers on the decorating-filling line is inadequate. Too many defective containers can be produced before a test reveals poor treatment.

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1. In these situations, use a carbol fuchsin test. This material is a dye that can be obtained in solution form from most chemical or scientific supply houses. The treated portion of a container is painted with the solution and rinsed with water. The more highly colored the part, the better the treatment. When you determine the degree of the color you need for good ink or glue adhesion, keep a dipped container to use as a standard and compare test containers with it. If the color is at least as intense as the standard, the level of treatment is sufficient.
2. A simpler, although somewhat less reliable, test can be performed by dipping a treated container in clean room temperature water. Remove the container and note how long a continuous film of water remains on the surface before breaking up into droplets. Generally, a film retention time of more than five seconds indicates good treatment.

It is strongly recommended that treating occur just prior to affixing labels or printing. However, if there is a time lag between treating and decorating, keep the containers

clean. Exposure to a dirty, smoky atmosphere will render the treatment ineffective. Moreover, it is unsanitary.

OTHER METHODS OF SURFACE TREATMENT

While flame treatment is the easiest, most economical and fastest method of surface treatment, other methods are available, but have limited application for liquid food bottles.

A high-voltage, corona discharge, a popular treatment in film sheeting operations, has found use in some high volume blow-molding lines. This method consists of passing the containers through a corona field that is confined to a chamber. It is important to properly vent the ozone that is generated in this process. This method is advantageous in its ability to treat irregular shapes.

Yet another method calls for the immersion of the container in a bath of chromic acid to oxidize the surface. The bottle is then thoroughly rinsed with water, dried and conveyed to the printing or labeling station. This achieves the same results as flame treatment, but this chemical is toxic and this treatment is not recommended.

For more information about blow molding, contact your LyondellBasell sales or technical service representative.