# BULLETIN: POLYETHYLENE MILK CONTAINERS

## 1 Introduction

High-density polyethylene (HDPE) containers have been used for decades in many applications. The first applications of this technology were milk plastic bottles and motor oil packages; since then, many applications have been developed, including containers for home uses, industrial chemicals, food, beverages and spices.

Nowadays, the total consumption of HDPE (p/p) for blow molding containers in USA is almost 1.8 million metric tons, where milk bottles range up to 363.000 metric tons and 36.000 metric tons for other food applications (see Figure 1). Chemical packages represent 454.000 metric tons of HDPE consumption, while motor oil and other motor fluids packages add other 82.000 metric tons. (1)

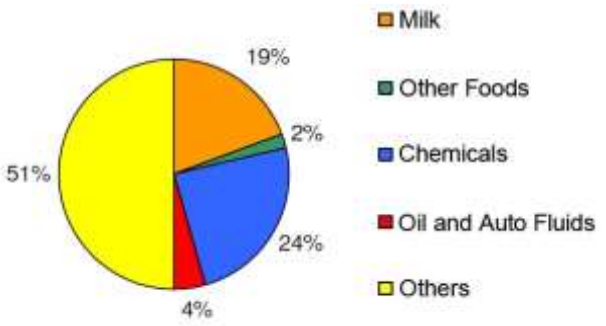


**Figure 1 Blow molding HDPE containers market segmentation according to end-use applications.**

Commercial milk bottles appeared after 1884, when milk glass bottle was invented by Dr. Hervey D. Thatcher in Potsdam, NY. In 1932, glass containers were replaced by plastic-coated cardboard containers, which in turn were substituted in 1964 by blow molded HDPE bottles. (2)

Plastic-coated cardboard containers were designed in the 20's in order to package milk in high moisture environments. For a long time, these containers were the best consumer's choice because of their easy handling, also they are not easily breakable, and provide protection to water and vapors due to the inside polyethylene coating layer. However, the major disadvantage of this package is its inability to reseal after opening; a characteristic which is provided by plastic containers to the beverages market.


**Figure 2 Example of blow molded HDPE container used for milk packaging.**

Extrusion blow molding of HDPE bottles was developed in North America at the end of the 60's; milk companies were able to run production lines for plastic container manufacturing in their own factories, in-line with milk bottling operations. Plastic bottles have been replacing plastic-coated cardboard containers in juice and milk packaging industry because of their advantages, such as:

- Containers can be resealed after opening
- They provide long term shelf life
- Good aesthetics
- This technology can be applied to many products in this market segment(3)

Other containers, such as "pouches" are also used for fluid milk packaging; however, plastic bottles are still the most common package in many countries. (2)

HDPE bottles are manufactured by extrusion blow molding (Figure 2). Continuous and intermittent modes are two variations of this process. The rotary wheel blow molding system (continuous process) has been used for the high-output production of a wide variety of plastic extrusion blow molded articles. The intermittent process is similar to injection molding since the screw turns, then stops and pushes the melt out. The most common feature in both equipments is the hanging parison or vertical HDPE hollow tube from which the bottle is blown. This parison is captured by closing it into a cooled metal mold. High pressure air is then blown,

inflating it into the shape of the hollow bottle, container or part. HDPE resins with high melt viscosity promote this parison capability.

In most applications (milk, some juices, some beverages, motor oils and fluids, household chemicals such as laundry detergent and dishwasher liquid), high barrier properties (oxygen, $CO_2$, water vapors) are not needed, which is why HDPE monolayer containers are used. In cases where additional protection is required, several layers of HDPE, or HDPE with other materials such as EVOH or Nylon, can be coextruded. (1)

## 2 How to sell more liquid milk through the packaging?

Liquid milk has been considered as an indispensable product for everyone's nutritional diet. Because of this, there was no relevant interest in the packaging marketing process and the package was just a mean for distribution and storage of this product.

Nowadays, milk competes in global markets with soft drinks, juice, tea, and bottled water. These products have reached important market shares due to their aggressive marketing strategies and packaging innovation.

Milk containers used to only show nutritional value information and bar code identification, in contrast to other products' colorful and elaborate package designs. These are the reasons why today most milk bottles have fashionable decorations.

The dairy industry has received a boost through advertising and TV campaigns; but there is a weak connection between product and customer when purchasing. The aim of marketing is to make milk look attractive for customer but packaging sometimes does not transmit this message, so a change in packaging design and distribution strategy is needed. (4)

The "MilkPEP Fluid Milk Strategic Thinking" project has made a series of recommendations in order to increase milk sales through packaging: (5)

- Improve visual appearance of current containers. This task may be done through the label, lid or the container itself.
- Make current package easier to use. For example, plastic closing systems or plastic "pouches" can be used instead of plastic coated cardboard containers.
- Develope new package configurations in order to meet the needs of different distribution channels.

**Figure 3 Change in milk packaging due to the need to compete with other beverages.**

A study supported by this same project gives a perception about the importance of packaging to boost sales: (5)

- 50% of consumers visit most supermarket aisles looking for something new.
- 70% of consumers make decisions about their shopping once they are inside the store, not before.
- 55% go to the store with an average 10 articles shopping list and end up buying 20.

It is therefore clear that in order to sell more milk, it must be well marketed, and the package plays a dynamic role in it, so it must be redesigned regularly to keep consumers' interest.

The designing process of a new packaging must be done as teamwork, linking manufacturing and marketing functions within the milk-producing company. Although the design of a new package takes considerable amount of time and money with no guarantee of return on investment, there are many companies that faced the same commitment

to get a newly redesigned packaging, just for keeping the brand stable in its market positioning.

Package redesign must only be done if the company becomes aware of its value as a marketing tool. This includes recognizing that the constant innovation and continuous improvement in packaging is imperative. (4)

Packaging redesign involves too many variables. Among them are:

- Bottle material and color
- Bottle shape (dimensions, contour configuration, etc.)
- Lid and label design.

In addition to package redesign, auxiliary products can be used to promote sales of dairy product (toys, add-in straws, etc.).

## 3 Material: HDPE, the quintessential packaging material. (6)

Currently, HDPE dominates the milk container market due to its low cost, durability and low weight.

Standard HDPE resins render a see-through container, offering some UV radiation protection. All vitamins, aroma substances, the highly oxidation-sensitive ingredients and fatty acids of milk are well preserved adding anti-UV additives and pigments to the resin in order to give better protection.

Almost any color is possible; however, yellow and white are main colors for milk applications. Consumers prefer white because it represents the package content in a more precise way. However, yellow-colored packages have been introduced to market (using adequate marketing strategies) increasing sales levels. Figure 4 represents a new bottle packaging developed by an American company in order to introduce their yellow-colored bottled product into the market, using labels to educate consumers about the new container benefits. (4)

**Figure 4 Use of labels to explain the benefits of a container.**

Another American company updated their image, using HDPE bottles which offer UV barrier protection and additionally a clean and contemporary appearance to the product (Figure 5).

HDPE bottles are currently being used to provide a prolonged shelf life packaging. Beverages with prolonged shelf life (60 or 90 days) help to satisfy the distribution and storage centers demands requiring a product that does not expire within few days in the inventory. These characteristics can be achieved through diverse technologies including aseptic processing, ultra-pasteurization, and micro-filtering, among others. (7)


**Figure 5 Companies use HDPE bottles for a new product image**

## 4 Bottle (8)

Milk packages have evolved from glass to plastic bottle. However, changes never stop due to the vision that milk package should be more than a simple container.

Bottles with innovative contour shapes help to fulfill functional and even emotional consumer needs. In milk packages design process, it is necessary to consider each element of the consumer chain, such as: size, shape, handling and graphics printing.

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A milk brand (Figure 6) designed a bottle which can be licensed for milk packaging. This packaging meets the requirements of distributors, sales, food service operators and most importantly, the final consumer.

This container has certain advantages over regular ones and that is what made the product sales to rise:

- Rounded edges and an accordion-shaped base provide higher strength, easier handling and less liquid spills.
- Smaller size reduces cost, in a better packaging.
- A narrower base lets it fit better in the consumer's fridge.
- Bottle design withstands heavy loads, eliminating plastic crates for transportation, thus minimizing distribution and storage costs.


**Figure 6 - New milk container design**

This type of packaging motivates the consumer to buy the product.

**Figure 7 - Bear-shaped package design for selling fruit punch for children**

Other segments are also marketing their products effectively through a new package design. Figure 7 shows a bear-shaped bottle used in Europe for fruit punch beverage packaging for children.

## 5 Label. [4]

The label provides an easy and cheap method to promote a product and allows a continuous change in design in order to keep consumers' interest, adding value to package by including information for customers, coupons, recipes, etc.

A company located in Ohio takes advantage of their labels in order to connect with consumers. During Christmas, the company offers a line of collectible bottles (Figure 8 - left) featuring different season's characters.


**Figure 8 Example of Christmas promotion (left) and stretchable labels with coupons (right).**

Another company modified their label to include a coupon for some other products of the same business, including sauces and sour creams; and in the same year they planned to sell the bottles advertising space to other corporations (Figure 8 - right).

Historically, adhesive and/or pressure-sensitive labeling has been used in milk jars, and "wrap-around" labeling has been used in bottles decoration. Sometimes, this label type is not much useful because of their limited space; nevertheless, some companies (Figure 9) have satisfactorily used colorful labels to promote their product.

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**Figure 9 Example of a new, colorful pressure-sensitive label.**

Figure 10 shows a new concept of wrap-around adhesive labeling. These labels are called rotating or spinning labeling, and their main feature is that they have two types of labels: a fixed inner label which contains different information and a removable external label that can rotate over the first one in order to show the information through a window.

This type of label provides up to 75% more space for brand information, nutritional values in multiple languages and larger letter size for impaired and elderly consumers and occasional marketing.

**Figure 10 Example of new rotating labels that offer 75% more advertising space.**

One disadvantage of rotating adhesive or pressure sensitive labeling is that they are not eco-friendly due to the unwanted paper fibers or the adhesives they introduce to the recycling system.

Stretchable and heat shrinkable labels are trends in beverage labeling. These labels have similar features: both effectively promote milk and use eco-friendly adhesives, just like the wrap-around label.

In the single container category, commonly the stretchable label uses less material and is the most cost-effective method provided for advertisement space. However, if a total coverage is desired, the shrink label is the perfect one.

The shrinkable label in single portion bottles provides a larger and more powerful advertisement space, in order to attract consumers (Figure 11). These labels can also be used to wrap entire packages with unique shapes, which are demanded by consumers who look for ergonomically improved containers.


**Figure 11 Containers with full-size, heat shrinkable labels.**

For one-gallon, half-gallon or quarter-gallon containers, heat shrinkable labels are not the best option, while stretchable labels are the best way to obtain graphics for advertising in 360° space.

Stretchable labels are very easy to remove allowing then the recycling process of the container; These kind of labels are less expensive than heat shrinkable ones, reason why they represent the most economical and ecological option for 360° labeling in high-volume containers.

The wrap-around 360° label is less expensive for one-quarter or smaller containers. Nevertheless, the adhesive used in these kind of labels may cause jams frequently in the production line, therefore, when considering the total cost of the label, it must be taken into account the time that production line is not operating.

Table 1 summarizes the features of different labels available in the market:

**Table 1. Attributes of commercial labels.**

| Attributes | Stretch | Shrink | Wrap Around | Pressure |
|---|---|---|---|---|
| High Speed Application | x | x | x | x |
| No adhesives | x | x | | |
| 360° Graphics | x | x | x | |
| Handling of complex geometry | x | x | | |
| Low cost of equipments | | | x | x |
| Possibility of adding coupons | x | | x | |

## 6 Lids. [9]

Lids and closure systems are in charge of keeping beverage inside the container. They also maintain product freshness, provide a barrier to dirt, oxygen and moisture, and prevent leakage through openings. Additionally, they can be used for promotions as marketing tools, adding improvements in dispensing, and can even turn a regular container into a collector's item. All in one, the lid can be the easiest way of adding value to the product and creating a difference in the competitive beverage market.

**Figure 12 Lids and closure devices designed for satisfaction of different customer needs.**

All flat lids accept printed labels, or can be printed on directly, not only for customer information purposes, but also for promotional issues. Let's see the example of cartoons characters printed on lids. If the one-gallon milk container lid has famous cartoons characters printed on it, children will drink the milk as fast as they can in order to complete their lid collection. Additionally, the lid label may contain discount coupons on shopping for that product or any other item of same brand.

Other ideas to promote milk (or any product) through the lids are:

- The lids can be identified with a particular milk brand in order to make the container more noticeable.
- The lids which include a liner and a tamper-evident ring can use their inner part to offer prizes.
- The lids can come in different fashionable colors, such as a clear transparent purple or a neon yellow, while the liners can have holographic images.

Another creative idea is to make reusable bottles designed with children favorite heroes, including lids with the same images. This offers the consumer a product with a higher added-value.

## 7 Conclusions

In the past, milk processors had seen the package as a cost that had to be reduced to a minimum. Nevertheless, the global trend in the milk market has proven that it is necessary to adopt the vision that containers are much more than that: they are a powerful marketing tool that helps to sell and to compete with other beverages in the market.

Ergonomic bottles, colorful labels and collectable figures lids are some of the ways in which package helps to sell more milk. However, there are endless opportunities: the producer has to make the commitment of adapting to a new market vision in order to offer an innovative product. Milk sales will increase as long as customers receive a product with a higher added value, and milk producers will be able to consolidate their brand within the aggressive market of carbonated beverages, juices, etc, that have put the milk aside for a long time.

High-Density Polyethylene (HDPE) represents the most functional and economical option for the production of fluid milk containers. Venelene® resins offer a balance of properties (opacity, strength, impact resistance and processability), which allows the production of containers with innovative low-thickness designs, which, while

helping to position the product in the market, also contributes to maximize shelf life of dairy products.

## 8 References


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