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## PRODUCT BULLETIN

# SAFETY FACTORS Clear Gel Candle Formulations

Today's candle market is experiencing a tremendous growth due to the increased popularity of and uses for candles. One of the most unique, versatile and attractive candles available is the "clear gel candle." Clear gel candles are available in a combination of sizes and shapes, and may include fragrances and colors, as well as unique design elements. Clear gel candles may also be formulated for a variety of consumer purposes.

Similar to traditional wax candles, clear gel candles are commonly produced from a hydrocarbon base stock. The use of a gelled hydrocarbon base stock provides the additional advantage of transparency. Penreco produces and markets a series of gels\* for use in the manufacture of clear gel candles under the **Versagel®** brand name. These gels may be custom formulated to incorporate fragrances, finely dispersed decorations, and other active and/or inert components.

While Penreco does not manufacture candles and is not an expert in the field of candle manufacturing, it has, as a service to its customers, prepared a list of factors which should be considered by a candle manufacturer **before** formulating a clear gel candle. Penreco has compiled this list of criteria, which are identified as "Safety Factors," from candle industry data and resources, and internal evaluations of clear gel candle formulations.

This list is not intended to be a comprehensive list of factors to be taken into consideration when formulating a clear gel candle. It also does not eliminate the need for the candle manufacturer to perform strict safety tests concerning the burning and flaming characteristics of any candle.

\*Patents pending.

### SAFETY FACTOR LIST

#### **1. Formulation Ingredient - Gel**

Penreco sells a series of candle gels under the **Versagel®** brand name. The gels have a patent pending status and are formulated with a narrow cut hydrocarbon oil of exceptional safety relative to the flash point. Via the COC method, flash points of 450 °F and sustained burn (Fire Point) of 500 °F are typical. Penreco also has optimized polymer type and concentration to produce a gel of exceptional clarity and maximized viscosity to resist cold flow of the gel in the container of choice. Each **Versagel®** grade is designed for different fragrance capacity with **Versagel® CLP** designed for fragrance loads of 0-4%, **Versagel® CMP** designed for

fragrance loads of 3-6%, and **Versagel® CHP** grade designed for suspension of ingredients such as glitter, and specialty pigments.

## **2. Formulation Ingredient – Fragrance**

Penreco does not sell fragrances but has developed excellent relationships with several of the leading fragrance companies. Fragrance selection becomes critical as it relates to compatibility or solubility in the gel. Each fragrance is a complex mixture of many aroma chemicals, perhaps 30-50 different chemical ingredients, combined to produce a fragrance in which the polarity of the mixture needs careful consideration.

A fragrance with a non-polar (hydrocarbon compatible) character is most preferred. This non-polar character does not deteriorate the gel strength and has excellent solubility. The second variable in fragrance selection is the fragrance's flash point. Most fragrances have flash points of 140 °F and higher. A most preferred fragrance flash point would be 170 °F or higher. In summary, the fragrance types to most avoid would be polar fragrances with flash points below 170 °F. A quick check for fragrance polarity can be done with mineral oil. A non-polar fragrance should be 100% soluble (with no separation) in mineral oil at the following ratios:

25% fragrance / 75% Mineral oil

75% fragrance / 25% Mineral oil

## **3. Formulation Ingredient - Dyes**

No information has been found which shows that the dye influences candle safety.

## **4. Formulation Processing or Mixing**

When processing the **Versagel®** candle gel series, Penreco has insured that the polymer concentration is uniform throughout the gel. Care must be taken in not only selecting the correct fragrance but also in completely and uniformly mixing the fragrance into the gel before packaging the gel into the container. Incomplete mixing of the fragrance can cause an irregularly burning flame.

## **5. Gel Candle Wicks**

Penreco does not sell wicks or make wick recommendations for final consumer packages. We believe the slower burn rate of gelled candle technology (perhaps 40-50% slower than wax) may, unfortunately, encourage manufacturers to use “oversized” wicks.

Prewicked wick systems are available with the wick attached to a 20mm metal clip. Wick sizes are diverse and must be test burned by the manufacturer to make sure they work with the gel and additive combination. Different sized containers and additive combinations (colors, specialty pigments, fragrance load, etc.) can affect how the candle will burn. These wicks and tabs can be manufactured to any length and wick size up to 2mm in thickness including the wax coating. Cotton and paper cored wicks are generally not used in gel candles, whereas zinc

cored wicks stand straight in hot gel during manufacture and burning. Wick length and placement are important details that can contribute to candle safety. Wicks not trimmed to less than 1/4 inch creates a potential for a very large flame with non-uniform combustion, which, when not centered properly, can create localized overheating of the container and "pool". Such conditions can cause uneven temperature dissipation, a potentially unsafe condition.

There are a number of suppliers that offer sample sets to candle manufacturers for their use in determining the best wick for their specific application for about \$25, including Atkins & Pearce, Inc (Covington, KY. Ph. (606) 356-2395).

## **6. Gel Candle Containers**

Penreco has studied and burned countless experimental candles in containers, jars, glasses, and mugs of different sizes and shapes. As mentioned in the wick choice, the characteristics of the "pool viscosity" and pool temperature are influenced by the wick size and container selection. Container diameter will influence "pool temperature" and can hinder the safe dissipation of generated heat. The container also becomes important at the end of the burn cycle during the burning of the last few grams of candle gel. Therefore container composition (glass, tempered glass, clay, etc.), container center of gravity and base stability, and container diameter are all factors to be considered.

## **7. Gel Candle Consumer Use Instructions:**

Penreco feels proper consumer education to also be an important aspect of gel candle safety. Points are as follows:

1. Never burn a candle unattended.
2. Never burn for more than four hours.
3. Always trim wick to 1/4" above the gel surface before use.
4. Never burn the last inch of a candle.

In summary, we have attempted to identify key safety factors. However, this report should not be construed by the manufacturer as license to bypass clear and decisive safety testing of all variables before launch.