MACHINE MADE CANDLES PROCESSES AND MANUFACTURING

Dear Dr. Vela:

I need to produce candles 8" long with a 1 1/2 diameter, a perfect surface. a lot of shine and very soft. What can I add to the paraffin to help me achieve this? I use molding machinery and 60-62 FR Chinese paraffin

Dear member:

My advice would be to use 1 % of Epolene C 10 or C 15 and 0.5% of a polyolefin (PB 165 SS or Vybar* 103).

In your manufacturing process, I recommend that you pour the mixture in the machine at a temperature of approximately 85-90 C and that the water used for the cooling of your machines be at a temperature of approximately 10C.

*Vybar is a registered mark of Baker Petrolite Corporation.

Dear Dr. Vela:

What do you recommend to avoid the color migration or spotting that is produced on the candle packaging film that results in the candle losing its original color? Also would like to know if some vegetable waxes can be used at 100% and the color be white.

Dear member:

Color spotting on the candle can be caused by incomplete dispersion of the color through the molten wax which in turn can be the result of a color containing oil insoluble pigment rather than soluble dye. Loss of color could be also caused by UV degradation of the color or if there is stearic acid present in the formulation by acid attack on the color changing its structure and so changing color.

Vegetable wax suppliers should be able to give product recommendations (and guidance as to whether can be used 100%) based on the type of candle to be produced.

There are two main types of vegetable wax which are the fatty acids (commonly referred to as stearic acid) and the triglycerides (otherwise known as stearines).
Only the fatty acids give a pure white product with the triglycerides at best described as slightly off white.

Molding - As vegetable waxes are more brittle and have less shrinkage than paraffin wax then molded candles using 100% vegetable wax tend to crack easier and are harder to de-mould than those using 100% paraffin wax. However this does not mean it is not possible although a lot will depend on the type / size of candle and process used as well as the type of vegetable wax used. In general 100% vegetable systems are used for molding smaller diameter candles.

Pressing – It is possible to press 100% vegetable wax however the candle will not have the same mechanical strength / toughness as candles pressed from paraffin or paraffin / vegetable blends. Machine speed may also need to be reduced to run correctly.

Extrusion – It is not possible to extrude 100% vegetable wax candles and in fact extrusion blends still require a relatively high proportion of paraffin wax.

Filling – Vegetable waxes can be used 100% to fill container candles although the addition of a small amount of microcrystalline wax (3-5%) can improve performance in terms of surface smoothness and fragrance retention.

Dear member:

Color migration towards the packaging film in wrapped candles is a common problem. This is caused by a reaction between the raw materials used in creating the packaging film with the dyes, fragrances and stearic acid used alone or in combination in candle manufacturing. The packaging film which is in contact with the candle surface begins to plasticize and this causes the color migration to the packaging and the discoloration of the candle. Although it is not possible to fully eliminate this effect completely, there are some changes you can do to reduce or postpone this problem.

There are packaging films specifically designed to wrap candles which are designed to postpone plasticization. Use a fully refined paraffin wax with low oil content, as oil accelerates this effect. Pigments do not react as easily with the packaging as dyes do but, in the majority of cases, pigments are only used for color overdipping and not for thru coloring candles. If you need to use dyes, use quality dyes and add a mixture of UV absorber and HALS additive and try to reduce or eliminate the use of fragrances and stearic acid. These steps will reduce and postpone the staining of your packaging film and the discoloration of your candles.
Dear Dr. Vela:

We are in need of some technical advice. We manufacture candles by method of extrusion, and therefore we purchase hard wax to run into the extruder. As you know, the cost of wax is quite high and doing as above mentioned does not put us in a good price range.

We do not have a melting facility to melt wax with additives.

We would like to use vegetable wax, but have found that it comes in pellet form. Can you tell me how we may use vegetable and paraffin wax in our extruder, if at all?

Thank you for your prompt attention in this urgent matter.

Dear member:

In order to provide a solution, it is important to understand the following points related to blending, formulation and proper selection of palm wax grade and paraffin component:

a) Dry vs. Liquid blending – Although dry blending solid wax is possible there is no doubt that liquid blending offers greatly improved finished product performance and consistency. The issues with dry blending is ensuring a constant blend ratio. It is difficult if not impossible to maintain a constant blend ratio when feeding two solid waxes into an extruder. Even if the waxes are run through some kind of mechanical blender before the extruder it will be difficult to achieve an evenly mixed product. Where there are differences in blend ratio there will be differences in the strength of the extrusion with possible areas of weakness that could result in flaking or crumbling of the candle. Assuming that a constant blend ratio were possible it would still be better to extrude a homogenous liquid blended product rather than two separate waxes as the liquid blend will have better strength and cohesion. If liquid blending is not possible then one alternative to buy a pre-blended palm / paraffin mix which can be fed directly into the extruder.

b) Palm in extrusion formulations – Whilst it is possible to successfully extrude palm paraffin blends it should be remembered that palm is not a wax but a fat and so has different characteristics. Palm does not have the same cohesive strength as paraffin and can be considered more brittle. With this in mind it is important to determine the correct blend ratio for the application. Too much palm, and then depending on the type of palm used, the extrusion may become too weak resulting in cracking / crumbling or have an increased risk of cracking / chipping during and post extrusion finishing / milling. The palm content will also be governed, to
some extent, by the type of paraffin used. The harder, more brittle the paraffin then the formulation may potentially contain less palm. Although the ratio will depend on the candle, type of extruder, process conditions and any post extrusion finishing it should be possible to achieve a palm content between 30-60%.

c) Palm selection – With so many different ‘palm waxes’ available it is important to select the most appropriate for extrusion. Selection will depend on the type of candle, process conditions and grade of paraffin used. Too soft and the extrusion will tend to break / crumble easily. Too hard and the extrusion maybe to brittle resulting in cracking and chipping especially during milling / finishing. Palm waxes with melt point 57-60$^\circ$C and IV10-14 have been found to give good results in extrusion blends and could be considered a good start point for formulating the right extrusion blend. However for specific applications other palm variants might be more suitable.

Palm Waxes with a melt point of 57-60$^\circ$C and with Iodine Value of 10 to 14, such as G-4792 (SM2000) have been found to give good results.

Hope this information helps.

Max J. Budwick
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Dear Dr. Vela:

We have molding machines about 8 cms in diameter and we want to manufacture rustic candles with shadows with refined paraffin, stearin, and Vybar. We would like to know at what temperature the water and wax should be and if there is a special process to achieve this type of rustic finish.

Dear member:

In order to get a “rustic” finish what you need is thermal shock, so the colder the water the better (8-12 $^\circ$C). In terms of the paraffin or your mix the temperature should be at approximately 10 $^\circ$C above the melting point.

In my opinion, to make rustic candles, you don’t need vybar or stearin. Furthermore, it’s easier to get this finish with individual aluminum molds than with machines. Refrigerating the mold will help you to achieve this effect.
I hope that this is useful, but above all I hope that your definition of “rustic” candles is the same as mine. If not, please let me know.

Dear Dr. Vela:

There’s this fear that using palm wax and other types of vegetable and/or animal based wax can harm machinery because of the acid content of these products. Is this a valid fear? What properties should we require of our suppliers to make sure that we’re using vegetable and/or animal-based waxes that don’t damage our machinery?

Dear member:

In our experience with palm wax, we haven’t had any problems such as those the member asks about, although it is possible that wax with a high acid content can affect equipment when it is made of materials such as copper, bronze, or other soft metals. Ideally, it is recommended that one uses tanks and machines made of stainless steel to avoid any possible reaction with the wax, but this does not mean that tanks made of materials such as carbon steel can’t work without a problem.

Another factor that can affect the functioning of vegetable wax is the product you are going to mix it with: if the paraffin you’re going to mix the vegetable wax with contains high levels of sulphide, the vegetable wax and the paraffin can react and change the color of the final product.

I should point out that not all vegetable or animal-based waxes have a high content, as the acid level depends a great deal on the production process itself which can vary from factory to factory. To avoid damage to your machinery, I would recommend first identifying what material(s) the equipment which is going to come in direct contact with the vegetable and/or animal wax is made of. You should also ask your supplier to include the acid content in the product analysis certificate they offer you, for your reference. Once you have this information, it’s a matter of speaking with your supplier to determine if you are at risk for jeopardizing your production and what you can do about this.

I don’t mean to say that one risks endangering one’s equipment and/or production when using all palm waxes, but it is important that you work closely with your supplier to avoid any problems and not automatically rule out working with vegetable waxes which, with the high cost of hydrocarbons these days, have become a real alternative to petroleum-based paraffin.
Dear member:

The FAA (Free Fatty Acid the wax contains) does have a small impact on the machinery. However, to have the impact on the machinery the FAA value should be over 30%. In our case the FAA (acid) value is 0.4 – 1.0% which means almost no effect on the machinery.

According to our factory, our wax contributes no effect to the machinery. It’s safe for machines.

Dear Dr. Vela:

What can I do to have less shrinkage in my jar filling line?

Dear member:

There are three factors that will affect your shrinkage.

a- The crystalinity of the wax
b- The wax penetration
c- The jar diameter

The more crystalline the wax you are using, like a fully refined wax, the more shrinkage you will have. So the answer is to change to a less crystalline wax, such as semi-refined or slack wax as your base wax, or you can also try a “single pour wax.”

Generally it can be said that crystalinity and penetration go hand in hand, the harder the wax the more crystalline it will be. However, this applies to paraffin wax as micros are less crystalline but can also be hard. Some alternative waxes (non-paraffinic waxes) will “break the rule” as they can be hard (low penetration) and also have low shrinkage at the same time.

Several wax suppliers offer “single pour” solutions, which are a blend of various waxes designed to significantly reduce shrinkage in filling applications and avoid the “second fill” process. For a “single pour” type of wax, you’ll be looking for a wax with +/-80 ddm penetration. There are very few straight waxes that "single pour", and the one’s that will have several undesired qualities.

The jar diameter will also play a role in the result. The wider the jar, the more likely it will tend to shrink. So, do your testing on your wider jars, if you achieve the desired result in your larger diameter, most likely you will be able to use this wax in your smaller diameters as a “single pour wax”.
As mentioned before, most “single pour” waxes are complex blends usually comprised of 3-5 different components, and will be tailored to your specific need.

Dear member:

Avoidance of shrinkage in filling jar candles is quite complex, since there are various elements that come into play and at the end it is rather difficult to eliminate the shrinkage totally, but there are ways and means to reduce it considerably.

Paraffin waxes are composed of “normal paraffins” and “isoparaffins”. The high content of “normal paraffin” is seen in low oil content fully refined paraffin waxes and this type of product usually shrinks the most.

Slack waxes with oil in the 2 to 5% range, tend to shrink less and, when adding a polymer such as Weissen, which is high in "isoparaffins", it tends to create a balance that restrict to some extent the shrinkage.

The other factor is to narrow the temperature gap between the jar and the wax being poured. It is advisable to preheat the jar and to heat the wax to a temperature not higher than 15 to 20 degrees Fahrenheit above the melting point of the wax.

Therefore:

a) Use a slack wax with oil content above 2%
b) Add a polymer to create a better balance of “normal” and “isoparaffins”
c) Preheat the jar, prior to filling.

Dear Dr. Vela:

I want to start a production line of fragranced candles using molding machines. I'd like to know if I need a separate tank for each fragrance or if I can use the same tank for different aromas.

Dear member:

This decision will depend on the volume of candles/fragrances you want to produce. You can use the same tank as long as you thoroughly steam-clean it every time you change fragrances: otherwise you will have contamination.
Dear Dr. Vela:

In view of the constant rising cost of fully refined paraffin wax, we are forced to look for alternative sources of raw materials. In this regard we would like to learn more about the usage of palm wax. We produce molded candles though water-cooled ejection molding machinery. How about the shrinking process & release of the palm wax in the molds? How about the stability of the colored candle by means of through coloring of the wax and the stability of fragrances in palm wax versus paraffin wax? Any additional information that could be useful for an eventual switch is welcomed such as mixing paraffin wax with palm wax.

Dear member:

a- Some vegetable waxes have been formulated to be used straight, others need to be blended; however, most of them do not present problems in the molding machines.

b- As presented in Margarita, there are many types of vegetable waxes in the market, some more refined than others. The colors to be used are also different from the ones you use for paraffin. You should consult with your color and wax supplier for a solution.

c- Fragrances for hydrogenated triglycerides and paraffin wax candles are different, vegetable waxes, some vegetable waxes offer a better compatibility with fragrances, as with the color, working with your fragrance and wax supplier will help.

d- Most of the presentations at this year's and last year's conferences in Venezuela and Argentina dealt with these issues.

You can consult the ALAFAVE technical library at www.alafave.org (log in as a member and click technical documents under the membership section) to find some of the answers, and as stated before, talking to your suppliers for more information on these issues will help. If they are selling you something they should know how it should be applied.

Dear Dr. Vela:

I am starting up a new candle factory with a capacity to process 60 MT of molded candles per month. Would you please give me some suggestions regarding the most important elements that I must consider while laying out and installing the plant equipment (machinery distribution and work areas, cooling system, working and blending tanks, steam delivery, etc.)
Dear member:

If you start setting up a large candle molding production from scratch, I suggest to contact a reputable manufacturer of candle making equipment, specialized in molded candles. There are various methods for the production of candles, for example: molding, pressing, extruding, drawing, dipping and filling. Therefore, it is important to work with a company specialized in equipment for the particular production method you are interested in. These companies will be able to submit layouts, equipment proposals and installation guidance of all aspects for a turn key operation.

If you need further guidance and/or recommendations, you can contact me.

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Dear Dr. Vela:

Does the fill temperature affect the burning quality of a candle and, which is the appropriate temperature for molding?

Dear member:

I really do not relieve that the burning quality of the candle is affected by the pour temperature, as the burn quality basically depends on the type of wax used, the wick chosen, the candle diameter and the use of fragrances and color. Ultimately, the correct balances of these factors determine the burn quality of the candle.

With regards to the correct molding temperature, this really depends on several factors and without having all of the details, it is difficult to generalize. For example, there are some paraffin waxes that must be raised to 100 C in order to obtain certain textures or characteristics in the finished candle, but this is only for those specific cases where a special effect is expected.

Anonymous

Dear member:

The fill temperature does not influence the burn quality. The burn performance is between the paraffin or blend and the type of wick.

The adequate molding temperature depends on the type of paraffin or the wax blend that you use. Normally, for a petroleum wax or a blend of these (micros,
additives, etc) the average pour temperature would be 15 to 20 degrees C above its melt point. For a special candle finish or effect, the temperature would vary, but for a normal candle this would be an adequate temperature range.

For a paraffin and vegetable wax blend, the temperature should be higher and you must make sure that the blend is properly mixed and homogenous. My recommendation would be 80 – 100 C, but this as well also depends on the type of blend.

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