

WHITE PAPER: Delivery Systems for Clean Label Flavors

INTRODUCTION

Clean label is much more than a trend in the food and beverage industry. Today, it is part of the overall movement towards natural and transparent products. Consumers of all ages – especially those within the trend-setting Millennial and Generation Z demographic cohorts – demand products that eliminate ingredients they perceive as negative. In an effort to meet these demands, food and beverage companies seek to eliminate chemicals, preservatives, and artificial flavors or colors.

While an obvious route to clean label is through changing ingredients, it is not always feasible as a result of formulation requirements, regulatory standards, cost constraints and consumer flavor expectations. Delivery systems provide a means to achieving clean label while taking these constraints into consideration. Some processing technologies – such as hydroalcoholic extraction, emulsions, and encapsulation – provide routes to clean label. In this paper, the technical team at Trilogy Essential Ingredients presents a number of these delivery systems and reviews how they function.

BASIC EXPLANATIONS OF CLEAN LABEL FLAVOR DELIVERY SYSTEMS



Figure 1: Orange Oil Processing

Hydroalcoholic extractions use water and alcohol to remove the alcohol soluble compounds from essential oils and related products. This process was developed to address the needs of a number of industrial applications, including those in the citrus juice industry. The citrus fruit harvest can be optimized by utilizing the peel and

flesh to produce flavorings, functional food ingredients and animal feed. The cells of the outer peel are rasped and pressed to expel the tiny amount of fragrant and flavorful essence of the essential oil

may be used as is to flavor confections, icings and other food products. However, in the case of water-soluble beverages, a hydroalcoholic extraction or “wash” is required. This process is especially effective for beverages where the finished consumer product requires clarity and little to no color. The use of these extracts is not limited to only beverages. They can also be used in brines, flavored vinegars, baking applications, fruit preps, pie fillings and fruit glazes.

Washed extracts are made by liquid extraction through mixing the aqueous ethanol and essential oil followed by a rest period to allow for physical separation. The aqueous ethanol, known as the water phase, is collected and clarified through filtration to produce the finished extract. Ethanol is an effective solvent for the flavor compounds present in essential oils. Water is added after the oil has been dissolved into the ethanol to remove undesirable components (primarily terpenes and waxes) which are not water soluble and can create cloudiness in beverages. Some of the flavor-giving compounds remain in the ethanol and water. This method eliminates the need for synthetic solvents such as propylene glycol or polysorbate 80 that keep terpenes and waxes from dropping out of the finished product



Figure 2: Beverage Emulsion Manufacturing

Emulsions represent an alternative way to deliver an essential oil or oil soluble flavor composition to an aqueous system. Beverage emul-

sions are homogeneous dispersions of oil in water that use food grade gums derived from plants as an emulsifier. This method is ideal for applications where clarity of the finished product is not necessary or cloudiness is desired. Vegetable gums – usually gum Arabic (acacia) or modified starches (from waxy maize, tapioca, etc.) – are typical emulsifiers. They

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are dissolved into water by mixing at high speed. An oil soluble flavor or essential oil is then added to the dissolved gum mixture. The material is then mixed on a high-shear mixer, then finally homogenized with high pressure and mechanical energy through a small orifice to produce a stable, uniform emulsion that is somewhat viscous.

Homogenization makes oil soluble flavors water soluble by using the physical properties of the gum. The gum molecules have one end that is oil soluble and one end that is water soluble. Homogenization aligns these ends in such a way that oil droplets are surrounded in gum, with the water soluble end facing the water and the oil soluble end inside the oil droplet. This is known as micelle aggregate. This arrangement of the gum molecules allows the oil droplets to disperse in water, delivering the full flavor of the essential oil.

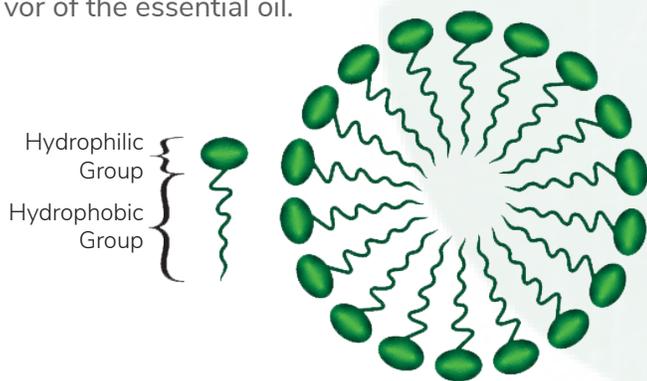


Figure 3: Hydrophilic/Hydrophobic Micelle Aggregate

Emulsions provide the opportunity to achieve clean label status because they don't require the use of ingredients that consumers tend to avoid, such as polysorbate 80, propylene glycol, glycerin triacetate, monoglycerides or diglycerides, MCTs, xanthan gum, triethyl citrate and the like.

Encapsulation, which can be simply described as dehydrated emulsion, is another technology for delivering clean label solutions. The starting material – gum Arabic (or another vegetable gum) based emulsion – is similar to a beverage emulsion with



Figure 4: Encapsulation via Spray Drying (pilot scale)

slightly different proportions of water, gums, and flavor materials. Flavor encapsulation can be achieved through a process known as spray drying. Spray drying is the conversion of liquid, usually oil soluble, into a water dispersible fine powder. Following a homogenization step similar to the beverage emulsion manufacturing

process, the emulsion is pumped through an atomizer and sprayed into a heated chamber where the water is evaporated. The encapsulated gum or starch is collected as the finished dry flavor.

CONSUMER DEMAND AND PERCEPTION

Ingredients with names that are difficult to pronounce or chemical sounding can be a problem for many consumers. Examples of these kinds of functional ingredients are polysorbate 80, mono- and diglycerides, propylene glycol, and xanthan gum. These ingredients often get put on prohibited ingredient lists by food manufacturers, restaurants and grocers due to perceived consumer demands. Some consumers have the misconception that all chemicals are bad for them. This concern, defined as chemophobia, makes the use of some flavoring (and fragrance) ingredients problematic. It has been suggested that perhaps as many as 20% of consumers exhibit some form of chemophobia. A little information, which is sometimes twisted to misinformation, can create a quagmire.

The processes outlined in this paper lend themselves to clean label because they do not require the use of “chemicals”, so to speak, to make flavors soluble. For example, ethanol and gum Arabic are both natural sounding and easy for consumers to identify.

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MARKET FACTS*

75%

of consumers will pay more for products with clean labels

\$180B

Sales of clean label products expected to be reached by 2020

> 50%

of consumers consider recognition of ingredients to be an important factor in product choice

*Source: Natural Products Insider

ATTRIBUTES AND ADVANTAGES OF CLEAN LABEL DELIVERY SYSTEMS

The three clean label delivery systems presented in this paper feature tangible benefits to processors, including:

Labelling nomenclature

- Hydroalcoholic extractions can yield products that typically read as “Ethyl alcohol, water, and natural flavor” or “Ethyl alcohol, water, and natural extractives of (X)” as opposed to “propylene glycol, polysorbate 80, natural/artificial flavor”
- Beverage emulsions labels are also clean in nature, and are typically read as “water, gum acacia, and natural flavor”
- Spray drying labelling examples are “Gum acacia and natural flavor” or “Gum Arabic and natural flavor”

Natural & Organic

- These delivery systems are all natural, including the carriers
- Using these processes, products can be organic certified more easily. USDA organic has many requirements for a product to be certified, with one of the most stringent being the source of

raw materials. Ethanol and gum Arabic are easy to source organically from

Cost effective

- Hydroalcoholic extraction does not require significant capital investments for expensive equipment. This is true on any scale, from lab to pilot or large scale-production
- Beverage emulsions combine a relatively low material cost with strong flavor impact
- While both beverage emulsion and spray-drying systems require a significant initial capital investment on equipment, once implemented, both technologies deliver long-term payback (provided the equipment is well maintained)

The Trilogy Difference

- The technologies behind the three cleaner flavor delivery systems discussed here are not new inventions, but through process and equipment innovations Trilogy Essentials has improved upon them. The technology of process controls and some of the pieces of equipment themselves have been optimized for our finished flavors

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CONCLUSION

A thorough understanding of delivery technologies can make a big difference in the quest to achieve clean labels. Using delivery systems that are inherently “cleaner” can provide food and beverage manufacturers with a simple, direct path to consumer-preferred products.

Trilogy Essentials can assist manufacturers in this endeavor. Decades of cumulative experience in flavor development, applications, and manufac-

turing have optimized the company’s processes, minimizing manufacturing losses and allowing us to create premium finished flavors that satisfy clean label demands. Trilogy’s ability to maximize the potential of the equipment used in these delivery methods – to “make the machines hum” – can help solve clean label challenges. [soluble](#)

QUESTIONS? WE’D LOVE TO HEAR FROM YOU!

Contact Liz Pisano, Business Development Manager

✉ episano@trilogyei.com

☎ 410.612.0691

