

SUPPLEMENT DEVELOPMENT

Hydrocolloids: Delivering Healthy Supplements

As supplements diversify, hydrocolloids are key to producing capsules and foods that deliver active ingredients.

by Nesha Zalesny

Consumers are increasingly viewing food as medicine as holistic health comes to the fore. They are making dietary decisions to help support a variety of health concerns. From vitamins, collagen, plant-based protein, to healthy fats and oils, consumers are looking for supplements to support or enhance their nutritional goals. Whether in the form of bars, functional beverages, or capsules, when it comes to nutritional supplements, delivery systems matter. Hydrocolloids can form the foundation of these delivery systems.

Traditional or Plant-Based Bars

As people begin to return to work and other reopening activities, convenient snacks in the form of a bar are bound to increase. Consumers looking for an energy boost or a dose of protein pre- or post-workout seek out bars that will deliver health. Nutritional bars have very specific water activity requirements to maintain stability



over their shelf life. Formulators have to add just enough water to the system, usually as part of the corn syrup or glycerin. The syrup is necessary for blending and hydrating all the ingredients and imparting a pleasant chewiness. A dry, powdery bar is not a pleasant eating experience.

For traditional bars, gum acacia—also known as gum arabic or E 414—is commonly used for both binding and, in Europe, a source of fiber. Gum acacia is not currently defined by the US Food and Drug Administration (FDA) as a fiber, though leading gum acacia manufacturers are working hard to get it recognized again. Gum acacia works well because it can be added at high levels without changing the viscosity of the corn syrup much. Gellan gum (E 418) in its low acyl form has also been used as a binding agent for bars formulated with protein crisps. The low acyl form of gellan gum can hydrate directly in corn, brown rice, or tapioca syrup with heat (>95°C), shear and a small amount of sequestrant. While hot, gellan gum does not alter the viscosity of the syrup, so the addition of inclusions and blending to form the bar is relatively simple. One other ingredient to consider is konjac (E-425(i) or (ii)), which can bind and is defined as a fiber by the FDA. Collagen, which is derived from gelatin, can be added not only as a protein source but also to support a variety of health and wellness goals. Collagen, like gelatin, is considered a food ingredient, not an additive, so it

has no E number.

Minimizing Ingredients in Bars

A leading trend for bars is “extreme clean label.” These bars generally contain five ingredients or less. These ingredients may include date paste, a fruit concentrate (for flavor), ground cashews, ground almonds, and egg whites. The date paste and fruit concentrate are sources of energy; the nuts and egg whites are great sources of protein. But, these ingredients may not be suitable for consumers with allergies or a vegan lifestyle.

Manufacturers are introducing alternatives to nuts such as chia, quinoa, or sunflower seeds. However, substituting plant-based protein for egg white is not a simple drop-in solution. The egg white in this system is not just a protein source, it also provides binding. Maneuvering in such a simple ingredient label is definitely not easy to do. One solution may be a blend of chickpea protein isolate and citrus fiber. The combination may offer a balance of protein content and water binding that will help the bar maintain quality over its shelf life while still maintaining a clean label. Citrus fiber also is an ingredient, not an additive, so it does not have an E number.

Sugar reduction is another trend consumers are supporting. The water activity requirement for shelf life stability makes this especially difficult. Simply put, sugars add solids that lower water activity. Gum acacia (E 414), can help formulators add solids



without adding a lot of viscosity. Soluble corn fiber can also be used to add solids without adding a lot of viscosity. Other solutions may include low viscosity CMC (cellulose gum or E 466) or low viscosity guar (E 412) which also serve to add solids but do not add so much viscosity that the bar becomes difficult to process. Like all hydrocolloids (except gelatin), CMC and guar are long-chain polysaccharides that are not digested. They are technically fibers, though their use levels are generally very low, so they do not contribute much to the fiber content.

Protein Supplements in Beverages

When most people think of protein supplements, they think of large vats of powder that bodybuilders regularly mix with water. Protein shakes are not just for dedicated gymgoers anymore. Protein helps increase satiety as well as provide essential nutrients. Demand has increased significantly during the COVID-19 pandemic. There have been great strides in texture and flavor especially within the ready-to-drink category. Consequently, a wide variety of consumers look to protein shakes for an on-the-go meal or snack.

Those large vats of protein powder that most people think of for protein supplements were usually whey protein concen-

trates or other by-products of the dairy industry, usually from cheesemaking. Whey protein concentrate or isolate is a value-added product from a waste stream. Ready-to-drink protein shakes usually have a combination of milk powder with additional whey powder. These usually have a combination of carrageenan for suspension of the protein and cocoa solids (if present), as well as microcrystalline cellulose (cellulose gel E 460(i)) and CMC (E 466) cellulose gum for a creamy, full mouthfeel. Cellulose gel and gum also help with suspension during processing. Carrageenan is a great choice for this system as it is synergistic with milk caseins and a very low use level is possible (0.015%–0.025%).

Plant-Based Options

Modern bodybuilders and average consumers alike are looking for alternative sources of protein, these include plant-based or organic options. A novel source of plant-based protein generated during the production of locust bean gum is carob bean protein—also known as locust bean protein. Other plant-based sources such as pea, chickpea, soy, or brown rice are common in plant-based protein drinks. Gellan gum (high acyl form) is the ideal choice for suspending these proteins in ready-to-drink shakes. Gellan gum forms a flu-

id-gel network for suspension that is independent of protein source, also at low use levels (0.025%–0.035%). Other viscosifiers, such as carob bean gum (LBG) (E 410), guar (E 412), or cellulose gel and gum are often added to provide a creamy texture. LBG and guar are available in organic form and therefore suitable for an organic protein shake.

Alternatives to Gelatin

As is the case with plant-based foods, consumers are seeking capsules that fit within their lifestyle and dietary choices. Hydroxypropylmethyl cellulose (HPMC), also known as hypromellose or E 464, is a film former. It is the film-forming property that makes it a great choice for capsules. It can be used either on its own, or combined with other gelling agents to offer a range of capsule solutions that help meet consumer expectations. HPMC capsules can be formulated to not dissolve in acidic environments, which make these systems ideal for the delivery of probiotics or DHA. Moving DHA past the stomach is imperative to reduce fishy burps that can result from fish oil supplement intake.

For softgel capsules, carrageenan (E 407) or a blend of carrageenan and starch can be used to produce a vegetarian version of a soft capsule made with gelatin. Carrageenan is also a film former but has a higher melt temperature than gelatin. This makes it a good choice for use in countries with warm and dry climates.

A newer less well-known hydrocolloid that can also be used for capsules is pullulan. Pullulan (E 1204) is a fermentation product similar to gellan gum or xanthan gum. It has a very high solubility, so it goes into solution at high concentrations and it also forms films. Simple pullulan films have been used successfully in the past for breath-freshening strips or cold medication delivery. New technology allows it to be used for capsules as well. Like the breath strips, pullulan capsules dissolve quickly and eas-

ily, which may offer new delivery options for ingredients that can be absorbed in the stomach.

Replacing gelatin in supplement capsules generates a series of processing challenges ranging from reduced production speeds to added equipment modification costs. The unique properties of gelatin are difficult and expensive to replicate or replace.

The nutrition supplement industry, whether in bars, beverages, or capsules, helps consumers meet many different health and wellness goals. Each delivery mechanism poses its own challenges and opportunities to producers. Supplements can be formulated into a wide variety of applications from bars to beverages to capsules. For consumers, a range of delivery options provides a variety of supplement choices—nutrition bars for on-the-go, beverages for nutrition and hydration, and capsules for the more nutraceutical minded. In all these systems,



› Equate High Performance Blueberries And Cream Flavored Protein Shake

hydrocolloids have and will continue to play a critical role in the future. Hydrocolloids help formulators deliver a world of options within this market. ▼

Nesha Zalesny is a hydrocolloids technical consultant and co-author of *The Quarterly Review of Food Hydrocolloids* produced by IMR International since 1991.



› Vitl Skin and Beauty Food Supplement, Vegan (UK).