

## Locust Bean Gum: Good as Gold

By Lynn Kuntz, Editor-in-Chief

When it comes to managing water and providing texture, gums are effective ingredients in the product-development arsenal, and locust bean gum (LBG) is no exception. It is extracted with water and alcohol from the endosperm of the seeds of the European carob tree, *Ceratonia siliqua*, an evergreen that grows in the Mediterranean area. The seeds grow in pods and have a uniform size—about 200 mg—leading medieval jewelers to use them as a standard weight, hence the origin of the carat. (Locust beans were known as *keration* in Greek, or *qirat* in Arabic.)

### Function follows form

Today, the seeds are used to produce locust bean (or carob) gum, a galactomannan polysaccharide with a molecular weight of 400,000 to 1,000,000, made up of long chains of the sugars galactose and mannose. The main chain consists of (1-4) linked  $\beta$ -D mannose residues, and the side chains are (1-6) linked  $\alpha$ -D galactose. Its composition varies, but it usually has approximately 3.5 randomly distributed mannose residues for every galactose residue, although that number can range from 2.8 to 4.9. This structure can affect the properties: Less galactose increases the chains' flexibility, but increases their extensibility. This structure is similar to that of guar gum, but the uneven side-chain distribution makes it less soluble and less viscous. It forms weak, thermally irreversible gels due to the association of the parts of the chains lacking galactose residues. Reducing temperature and water activity can increase this association, allowing the formation of a 3-D network and gel. This is the reason LBG works so well in ice cream: The weak gel produces a smooth texture and doesn't give ice cream a slimy mouthfeel, plus the gum provides meltdown resistance.

The structure also influences LBG's hydration properties. While it can undergo some swelling in room-temperature water, it requires higher temperatures, 60 to 90°C, for complete hydration. "Locust bean gum reacts differently dependent upon the temperature used," explains Rodger Jonas, national business development manager, P.L. Thomas & Co., Morristown, NJ. "Higher temperatures will result in full activation, but room temperature will result in an approximate 35% utilization of the gum's capabilities." Salt, sugar and other ingredients that compete for water can slow the hydration rate.

To avoid lumps when using LBG, proper dispersion is needed. "There are a few ways to help disperse LBG," says Grace Wang, food scientist, TIC Gums, Inc, Belcamp, MD. "Use an agglomerated powder, use an aspirator, dry blend with sugar, or disperse in oil. The first two methods don't require any extra blending steps, unlike the other two. Once dispersed, though, LBG does need to be heated to at least 165°F for full hydration and functionality."

The resulting solution is pseudoplastic (decreasing viscosity with increasing shear) and this characteristic becomes stronger with increasing higher LBG concentration and molecular weight. After high-temperature hydration, LBG will form "a viscous, short-textured solution," says Joshua Brooks, vice president of sales, Gum Technology Corp., Tucson, AZ. "Locust bean gum viscosities typically fall within a range of 2,500 to 3,500 cps. By itself, locust bean gum is considered to be a thickening agent and will not form a true gel, a gel which will retain the shape of the vessel from which it is poured. It could be considered to be a pseudo gel, amorphous in shape once poured."

### Two gums are better

LBG is synergistic with several gums, producing more viscosity than would be seen with merely an additive effect. The most-common synergy used in the food industry is with xanthan gum, where a mixture creates a strong, rigid gel. “When used alone, locust bean gum gives a smooth, thick and creamy mouthfeel,” notes Wang. “When combined with xanthan, a gum that it is synergistic with, a gel forms. At higher loading levels, the gel can be firm and elastic.”

LBG can also act in concert with κ carrageenan, softening its brittle, nearly sliceable texture “to be more like a gelatin-type, elastic gel,” explains Brooks. “This gel will also be thermoreversible.” LBG can also synergistically increase gel strength in agar and viscosity of cellulose gums.

## Best uses

Locust bean gum is suitable for a number of applications. “Since it provides a creamy mouthfeel, it is typically found in cream-cheese spreads to impart richness and spreadability,” says Brooks. “It is especially useful in preventing syneresis in this and many other applications. In barbecue sauces, since it is short-textured, it will also create a smooth mouthfeel without creating an undesirable stringy quality. LBG’s ability to bind water makes it “an excellent choice for frozen applications, such as ice cream with its many freeze/thaw cycles,” he continues. “The gum will slow down and reduce the size of ice-crystal formation as the moisture is retained within the ice cream.” He also lists fruit preps and variegates as other common applications, because it “will create a nice, short, smooth texture and can also provide a little bit of film formation, which will prevent the fruit prep from migrating into a pie shell.”

LBG can offer a number of other advantages. “The label is very clean, and the product is natural. It can also be made organic,” says Jonas. “Flavor systems are widely unaffected by any notes provided by locust bean gum. The gum does provide some entrapment capabilities.” It also provides a short texture for fat mimetics, he says, “and is used to aid in meeting this requirement. Dairy products are a prime target.”

According to Wang, the biggest drawback to LBG is price and sourcing, “because it is derived from natural plant sources, and there are always availability and crop concerns.” However, she says, “as customers look toward natural ingredients, locust bean gum might be looked at for its excellent thickening and sensory properties.”