BY JOHN MICHAELIDES

HYDROCOLLOIDS IN BAKING

Continuing our series on the basic ingredients for baking, what are the different hydrocolloids used in bakery applications, what are their functions and challenges of incorporation in baked goods?

Hydrocolloids, commonly called gums, are a group of complex hydrophilic compounds or biopolymers. Among these, the hydrocolloids include polysaccharides extracted from plants, algae (mainly seaweeds) and microbes, as well as plant exudates and chemically modified cellulose compounds.

Hydrocolloids used in the food industry include the polysaccharides: algin from the giant kelp and its salts such as sodium, ammonium and calcium alginates; gum arabic or acacia gum from the acacia tree (exudate); gum tragacanth, an exudate from the Astragalus shrub; Karaya gum from a similar plant; locust bean gum from the seeds of the carob fruit; guar gum extracted from the seeds of guar tree; carrageenan, an extract of red seaweed, and Xanthan gum produced by the fermentation of the bacterium Xanthomonas. Also included are the animal protein gelatin, and pectin, which is extracted from fruits.

Researchers have shown that the addition of gums in dough formulations results in an increase of water absorption and improved viscoelastic properties.

Although hydrocolloids are used extensively in the formulation of many foods and beverages, in the baking industry the main applications are stabilization of icings and various fillings. Stable icings are must retain their structural characteristics through the shelf life of the baked goods. Commercial icings and fillings applied to cakes and sweet dough products normally contain a balanced blend of starches and gums. Gelling agents such as agar, locust bean gum, carrageenan, pectin, carboxymethylcellulose and others are commonly used.

The required properties of hydrocolloids used in icings and fillings are quite extensive. They need to produce clear gels with no interference with the specific flavour of the icing or filling. Often they need to be heat-stable and have freeze-thaw stability and irreversible gelling properties. For example, cellulose gum produces gels that are thermally reversible as the solution is heated and cooled.

Some hydrocolloids are affected by the pH of the food system. Selecting a gum that is functional in the pH range of the food product to which it is applied is very important. For example, carrageenan gels are stable in the pH range of 3.5 to 6 and guar gum is resistant to acidic environment as low as pH 3.2. Selecting a gum that is functional in low pH formulations such as those of fruit fillings is important.

Another important property is their ability to bind and hold water. In baked good formulations they need to perform in such a way as to minimize the release of water, reducing its negative effect on the interface between the baked good or pie shell and the icing or filling. Hydrocolloids are effective in doing this because of their high water retention capacity.

Selection of the proper gum is essential. Although gums have been used extensively in icings and fillings, their use in dough and batter systems has been limited. However the use of hydrocolloids as bread improvers has been more extensively studied of late. Indeed, several researchers have shown that the addition of gums in dough formulations results in an increase of water absorption and improved viscoelastic properties, while the addition of hydrocolloids such as carrageenan, xanthan gum, cellulose and sodium alginate results in an improved dough stability during proofing.

In addition, the overall quality of bread is improved by an increase of the specific loaf volume and reduction of crumb elasticity during storage. In some cases the combination of gums with various surfactants may result in further improvement of dough rheological characteristics as well as an increase in the specific volume of bread and reduced crumb elasticity.

Hydrocolloids, or gums, are mainly used in baking to stabilize icings and fillings.

Hydrocolloids' mechanism of action in food systems, especially in dough formulations, is not well understood. However, in general it is considered that their presence has a weakening effect on the structure of the starch, resulting in better water distribution and retention in the system.

One of the food categories that is becoming more and more in demand lately is the gluten-free market. Formulating baked goods and especially bread without gluten is a challenging task. However, hydrocolloids can play a very important role in the formulation of these products, providing structure and viscoelastic properties that are normally accommodated by the wheat gluten in the baked goods.

Hydrocolloids are also able to interact with the starch and gluten, limiting the retrogradation (re-crystallization) of starch, which in turn slows down the staling of bread and other baked goods, thus extending the shelf life of these products.

Hydrocolloids, because of their structure-building capabilities and texture modification, can also act as fat replacers. Some of these gums – such as guaiac, an exudate from a tropical tree – exhibit antioxidant activities due to the complex phenolic compounds they contain.
In addition, many of these compounds due to their structure and fermentability in the colon, may act as prebiotics, which have been shown to play a very important role in the healthy gut function by providing food for probiotics, the beneficial bacteria of the gut.

Hydrocolloids are highly functional ingredients and thus in great demand. Their availability in certain cases may be

affected by climatic conditions and political situations in various geographic regions. These issues exert great fluctuations in pricing of such sensitive ingredients. When we formulate products with these ingredients we need to keep this in mind and consider alternative hydrocolloids with similar functions and properties.

REGULATORY ISSUES

As formulators of functional food products we should always use ingredients that are permitted in Canada and, in the case of exports, adhere to regulations of the targeted country. We should also always adhere to Health Canada regulations with regard to making any health claims relating to these functional foods. More information about functional ingredient regulatory aspects can be found on the CFIA website: www.inspection.gc.ca. / **BJ**

Funding for this report was provided in part by Agriculture and Agri-Food Canada through the Agricultural Adaptation Council's CanAdvance Program.

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