

Beauty and the Yeast

By R. J. Foster, Contributing Editor

It's ironic that we use extracts of one thing to enhance something else. That is exactly the case, though, with yeast. While better known for adding bubbles to beer and volume to bread, these unique microorganisms can also build richness and depth of flavor in an array of food products.

The strain event

The most-common yeast cultures raised for extraction are of the baker's and brewer's persuasion—strains of *Saccharomyces cerevisiae* or *S. uvarum*, grown on molasses-based substrates. "Torula yeast, *Candida utilis*, is a more-aggressive yeast that has a little different base flavor," notes Kevin McDermott, technical sales, Savoury Systems International, Inc., Branchburg, NJ.

Lactic yeasts, such as *Kluyveromyces fragilis*, are fermented on lactose from whey to yield lightly colored and flavored extracts, according to Karen Gallagher, marketing manager, Synergy Flavors, Inc., Wauconda, IL.

Transforming yeast cells to yeast extracts is typically done by autolysis. Mature cells are disrupted by a thermal or osmotic shock, and then degraded by the cell's own enzymes. Modifying factors such as time, temperature and pH, and adding salts, proteases or peptidases, provides opportunities for tailoring the composition and characteristics of the resulting extracts. Utilizing AMP deaminase, for example, facilitates the conversion of adenine-monophosphate to inosine-monophosphate, dramatically improving the flavor-enhancing properties of the finished extract.

Finished extracts undergo a high-temperature treatment to inactivate any remaining enzymes, followed by removal of any insoluble materials, such as cell walls. Presence of such insolubles is indicated by names such as "autolyzed yeast" or "whole-cell yeast." Finished yeast extracts are available in three general forms: liquid yeast extracts (50% to 65% solids), viscous pastes (70% to 80% solids), and powders produced by spray or drum drying, always at temperatures selected to avoid deactivation of vitamins or other desirable heat-sensitive components.

Double agents

Yeast extracts can be used to impart flavoring characteristics that will vary with origin. "Brewer's yeast will have a darker profile as a result of the brewing process, more beery, and the influence of hops will increase the level of bitterness," Gallagher says. "Baker's yeast extracts tend to be more savory, with cereal notes. Lactic yeast extract has more dairy and cheese notes."

McDermott says, "Torula imparts an earthy note well-suited to savory and smoky products such as barbecue."

With protein levels ranging from 50% to 75%, yeast extracts provide an abundance of amino acids that act in concert with reducing sugars to form Maillard reaction flavors and aromas ranging from deep savory notes to baked cheese or chocolate.

Yeast extract's unique flavor-enhancing effect, however, comes from an uncommon combination of glutamic acid and nucleotides. Glutamic acid was first extracted from kombu seaweed in 1908 by a Japanese scientist, Kikunae Ikeda, who determined it was the source of the seaweed's "deliciousness" or "umami." In 1912, speaking to the Eighth International Congress of Applied Chemistry in Washington, D.C., he described umami as "...the complex flavor of asparagus, tomatoes, cheese and meat, a common, and yet absolutely singular, taste which cannot be called sweet, or sour, or salty, or bitter..." Later research revealed that umami could also be achieved using the nucleotides inosinate (IMP) and guanylate (GMP), a combination often referred to as I+G. And, while processors can utilize either I+G or monosodium glutamate (MSG) to develop umami, combining MSG and I+G delivers a 10- to 15-fold increase in the umami effect.

"Yeast extracts have natural umami taste through amino acids like glutamic acid," McDermott says. "But they also come in forms with naturally high levels of nucleotides, which help bring the glutamic acid to the taste bud to strongly boost the umami character." In use, the extracts provide the effects of the individual ingredients, MSG and I+G, labeled as a single ingredient—"yeast extract."

Yeast extracts are commonly used to improve or enhance savory notes in products, including snacks, soups, seasonings, sauces, condiments, coatings, salad dressings, sauces, broths, beverages and meats. McDermott notes that, while completely water-soluble, yeast extracts may not be the best choice for clear liquids, as they can impart a beige tint to the finished product. Usage levels will vary by application and intended effect—up to 2.5% (finished-product basis) when used for flavoring, and from 0.2% to 1.0% when added for flavor enhancement.

Hold the salt

According to a report from Packaged Facts, Rockville, MD, "Low- and No-Sodium Foods and Beverages in the U.S." (May 2010), the average American consumes approximately 3,800 mg of sodium per day, or 165% of the recommended daily intake. Further, the report notes, growing health concerns are fueling the reduced-sodium food and beverage market, which rose to almost \$22 billion in 2009.

But salt reduction is tricky. Removing salt from a formulation can leave a product seemingly flavorless. Non-sodium salts can result in bitter or metallic flavor notes. Umami flavor from yeast extracts helps compensate for the flavor impact of salt removal, replacing flavor depth while helping mask metallic, bitter and other off flavors often associated with sodium alternatives. High-nucleotide-containing extracts can provide the flavor-enhancing effect of the salt that has been removed from the formulation. Yeast extracts can also restore balance between sweet, sour, salty and bitter notes thrown off-kilter by sodium removal.

Salt is, however, an important ingredient in the autolysis process. The challenge facing extract manufacturers, says McDermott, is creating extracts with the lowest possible amount of sodium while still achieving sufficient protein breakdown and providing the best possible final-product flavor profile.

In addition to replacing potentially less-consumer-friendly products like hydrolyzed vegetable protein (HVP), MSG and salt, yeast extracts offer labeling benefits, including all-natural, vegetarian, kosher, Halal, lowfat, *trans*-fat-free and nonallergenic.

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