Q&A Almonds

with
GUANGWEI HUANG

The heat is on: A deep dive into almond roasting

There's more to roasted almonds than meets the eye, says Guangwei Huang, Associate Director, Food Research and Technology, Almond Board of California (ABC). That's because the deceptively straightforward process of roasting sets in motion a cascade of physical and chemical events that turn almonds into a feast for all senses.

And none of it, Huang insists, happens by accident. "Roasting emphasizes the natural attributes of almonds — deepening the color and flavor profile, and creating a crispier, crunchier texture." he says.

Huang's spent considerable time investigating the finer points of roasting science, and his efforts have cast light on what occurs within the almond kernel when subjected to a range of temperatures across a span of time. So, we connected with him to discuss the insights he's gleaned and how almond processors can optimize their own roasting operations.

Q First, there are two main types of roasting—dry roasting, and oil roasting. How do they differ?

HUANG | The major difference is the heating medium – hot oil or hot air. Oil has a higher heat-transfer coefficient than air, so even if the oil and air are at the same temperature, the oil will roast almonds to a given degree in a shorter time than the hot air will. A percentage of the oil will get absorbed into the product, so the flavor profile of oil-roasted almonds will be slightly different. There will also be texture and color differences that will depend on the roast temperature and time, and on the type of oil.

Dry roasting is the more common method for the snack and retail sectors; because you're not adding oil to the product, there are fewer concerns about oil quality, flavor and the potential for residual oil oxidation.

Q Regardless of method, what, precisely, happens to an almond when we roast it?

HUANG | The first thing that happens during roasting is that the almond kernel heats up, and once the temperature approaches the boiling point it loses moisture from evaporation.

After the kernel is dehydrated and its temperature reaches above 250°F, that's when the Maillard reaction occurs between amino acids and reducing sugars naturally occurring in the almond. This generates a desirable darker color—what's known as non-enzymatic browning—and flavor compounds, like short-chain aldehydes and heterocyclic pyrazines. These compounds give the roasted almond a nutty flavor, while other chemical reactions break down fatty acids into a completely different set of volatile flavor and aroma compounds, like short-chain aldehydes. These compounds give the roasted almond a nutty flavor.

Q How do we know the proper temperature at which to roast almonds, and for how long?

HUANG | While a higher temperature will produce a stronger flavor in less time, those flavor compounds can dissipate or fade quickly. Because higher roasting temperatures cause quick moisture eruption from the almond kernel and thus greater damage to the cellular structure, this tends to shorten the roasted almond's shelf life.

So, we encourage processors to roast almonds at the lowest possible temperature, for as long as possible, to achieve a light roast. The flavor from a light roast can last longer, and the shelf life of the finished product can extend longer.

Q Are there any other factors to account for in the roasting process?

HUANG | If the roaster has issues with even heat distribution, the processor needs to make modifications to ensure that the heat distribution becomes as even as possible. That's because inconsistent roasting is a big concern. If there are zones within the roaster where some almonds are at a higher or lower temperature—sometimes a 10- to 20-degree difference—that portion of the product on the conveyor may be over- or under-roasted.

Again, over-roasting is a particular concern because it reduces the almonds' shelf life, usually through oxidation and rancidity.

Processors also look at air-flow rate because that affects heat penetration into the almond. When processors determine time and temperature roasting parameters, they consider the initial moisture content and temperature of the almonds.

Q How should processors handle almonds following roast?

HUANG | After roasting, almonds should be cooled quickly but gently with slightly lower-temperature air. The key is not to let residual heat continue to raise the product's temperature, causing unexpected and unwanted quality changes—and that can happen without proper cooling and without sufficient air circulation. You don't need forced-air circulation, but just a flow of cooling air.

Then package the almonds properly. Roasting alone initiates some degree of oil oxidation—and we want to stop the propagation of that oxidation by removing oxygen from the packaging environment, either through nitrogen flushing or vacuum. Pack the product in high-oxygen-barrier materials like aluminum pouches or metal-coated plastic bags that provide good oxygen barriers. This provides a much longer shelf life.

Q I've heard talk of something called two-step roasting. What is it, and what advantages does it bring?

HUANG | Two-step roasting first applies a lower temperature just hot enough to heat the almond kernel slowly and allow water to evaporate gently—preserving that important cellular structure. Then, when the moisture level falls to 2.5 to 3 percent, the process uses a higher temperature to get the Maillard reaction going to generate the desired flavor, color and aroma.

In the end, you have an almond with the characteristics consumers want, but with a longer shelf life. Remember: Everything's tied to how the roasting process maintains or keeps the integrity of the cellular structure of the kernel. This all helps to maintain a longer shelf life.