Almond processors face many challenges when trying to ensure consistent end products. Image credit: Flickr user U.S. Department of Agriculture (CC BY 2.0)

Per capita almond consumption has increased by more than two hundred percent since 2005. This might be nothing but an interesting fact on trivia night for most consumers, but it's both a business opportunity and a challenge if you're an almond processor. It's not easy to satisfy surging demand while adjusting for natural variations in raw material and producing consistently appealing end products.

To meet these challenges, it's important to commit to careful color measurement and quality control throughout the entire processing cycle, from raw material selection to end product packaging. This, in turn, requires a careful consideration of the color measurement tools you're using for the job.

Color Measurement Techniques

While the food processing industry has historically relied on colorimetry, it is increasingly turning to spectrophotometry to measure and control color at various stages of the processing cycle. There's a good reason for this shift.

Colorimeters measure the relative amounts of the primary red, green and blue light components reflected or transmitted by a food product—but spectrophotometers measure light reflection and transmission over the complete spectrum of light wavelengths visible to the human eye (i.e. 380 to 780 nanometers). The end result is that spectrophotometers are better able to measure color characteristics in solid and semi-solid food products, making them better suited for nut processing applications.

Spectrophotometry in the Nutfood Processing Cycle

In fact, spectrophotometers can help maintain nutfood color specificity through all four common phases of the food processing cycle:

1. Food Product Color Formulation

Color and appearance of any food product are vital for attracting consumer interest. Even minor differences can have a heavy impact, which is why marketing research team often test several potential colors of products like nut butter with focus groups before landing on the option with the greatest appeal. Your marketing team's technicians can use a spectrophotometer to register the color range and specifications for the chosen color, providing a target for the rest of the processing cycle.

Colorimeters can, of course, provide the same type of color information with gradients along the standard L-a-b or LCH coordinates, but they are inadequate for measuring color variations caused by metamerism (i.e. the phenomenon under which two colors appear identical under one set of lighting conditions but as different colors under different lighting) or for measuring variations caused by differences in colorant strength.

Spectrophotometers can establish an objective set of coordinates that account for metamerism variations, that identify colorant strength, and that can include or exclude reflectance variations caused by geometric characteristics of the raw nut meat material. This makes them a far more reliable option.

2. Standards and Tolerances

Once commercial production is underway, there are still plenty of steps in the process where quality issues can crop up, of course, from selecting nuts all the way up to the final milling. Spectrophotometers have historically not been utilized throughout these processing stages because of their complexity and bulk, but a newer generation of hand-held units is eliminating these issues.

Food technicians who employ hand-held spectrophotometers at all stages can better ensure that the product achieves its target color at the end of the cycle. Consider just the step of skin removal: even a very small amount of leftover skin fragments can add reddish pigments to the batch, changing the color of the final product. Spectrophotometers help your technicians spot these issues early, before they're too difficult to correct.

3. Communications Among Processing Stages

But raw material variations in nutfoods sometimes just don't become apparent until a late stage in the production cycle. You might regularly deal with color variations during roasting operations as a function of the concentration of oils in the raw material, for instance.

Spectrophotometers still offer a workaround. Your technicians can use them in a feedback loop to alter processing times and conditions in earlier operations so that you are able to achieve consistent colors across multiple batches of the final product.

Variations in lighting conditions along a processing line can also create appearances of color difference that might not actually be valid, and here, again, spectrophotometric measurement eliminates any uncertainty.

Uncertain lighting conditions in the plant can sometimes make it challenging to accurately assess color variations. Image credit: Flickr user Prayitno (**CC BY 2.0**)

4. Quality Control

For better or for worse, the United States department of Agriculture, the Food and Drug Administration and other regulatory authorities rely on color as a significant indicator of food safety—color accounts for at least 20% of the grade rating for nut butter in the USDA's regulations. Using spectrophotometers at the final stage of your processing cycle helps ensure that your products meet and exceed applicable regulations and quality standards before you send them off to market.

Hand-held and portable spectrophotometers have become easy to use during every stage of nut processing. Nutmeat processors who continue to rely on older color measurement techniques may find themselves at a competitive disadvantage when faced with processors who use spectrophotometers to achieve uniform and consistent color in their final products.

HunterLab is a leading provider of spectrophotometers for the food industry and can help you choose the products that will let your company stay on the cutting edge. Get in touch to learn more about our solutions.