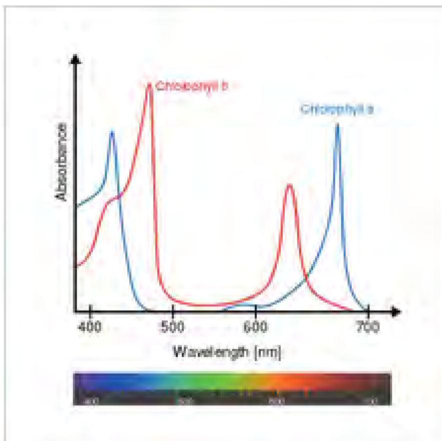
FOCUS: FOOD SAFETY IN THE VALUE CHAIN

Hyperspectral imaging shines a light on foreign objects and reduces food waste



The absorption spectrum of both the chlorophyll *a* and the chlorophyll *b* pigments. The use of both together enhances the size of the absorption of light for producing energy.

KAREN DAVIDSON

Leafy greens are tender to eat but tough to handle. The perennial problem is about to get easier with hyperspectral imaging that will help processing plants extract foreign material and save hundreds of thousands of dollars per year in food waste. In the next five years, processors expect to share more precise information with growers on which genetics and field practices lead to the tastiest greens.

That's a gargantuan promise explained by Doug Alexander, director of engineering for Ippolito Produce Inc, Burlington, Ontario. The company that specializes in a range of vegetables and ships all over North America has a big appetite to innovate.

"Leafy greens such as spinach, kale and arugula are hard to inspect," says Alexander. "They all have low densities compared to their weight. Imagine your front lawn with plant material blowing all over."

The variability of leafy greens is in colour, size and species. Baby spinach, for example, is the size of a loonie whereas curly spinach can be the size of your palm.

A leopard frog in your spinach? Easily detected and rejected. But the optical sorters must distinguish between various shades of green, slight gradations similar to a paint chip sample. Even with today's technology, optical sorters don't spot foreign material very well. What happens is that the machines over-inspect, discarding a lot of leaves that are perfectly edible.

"In the studies in our plant, we discovered that 93 per cent of the discards were good," says Alexander. "That was a huge amount of food waste."

Global suppliers of optical sorters are challenged to meet Ippolito's more exacting needs because they are in the business of increasing processing speed in industrial settings. Alexander was determined to find a made-in-Canada solution. Lucky for him, about an hour's drive away in Waterloo is a world-class company called P&P Optica. Through a fortunate confluence of meetings with P&P Optica at Conestoga College Institute of Food Processing Technology, Alexander started a pilot project two years ago.

P&P Optica has a 20-year track record enabling world-class life sciences and environmental research. In 2014, its researchers pivoted to agriculture. With federal funding from Growing Forward 2, the company patented a hyperspectral imaging technology that sees the chemistry of food.

"This is a process that measures absorbed and reflected light to analyze the chemical makeup of a specific food product," explains Kevin Turnbull, vice president of sales, P&P Optica.

Simply put, PPO Smart Imaging shines light across the electromagnetic spectrum and identifies chemical differences that identify foreign materials such as twigs, metal or paper. But more than that, data collected at super speeds, indicate the quality of leafy material.

This is where physics and chemistry meet. Remember that plants are made of chlorophyll to convert sunlight into energy. In fact, there are two types of chlorophyll – A and B – that absorb light energy. The engineers at P&P Optica have harnessed that knowledge with their hyperspectral imaging, developing algorithms that can distinguish between chlorophyll A and B. In fact, they can look at other health-related chemicals such as flavonoids.

Beyond the benefits of identifying foreign objects and reducing food waste, this technology moves the food chain to an "aha" moment. Once software experts can compare chemical signals – a plant's respiration rate for example – then that information can be monetized into identifying plants that will have longer shelf life or better taste.

Hyperspectral imaging, like other spectral imaging, collects and processes information from across the electromagnetic spectrum. The goal of hyperspectral imaging is to obtain the spectrum for each pixel in the image of a scene, with the purpose of finding objects, identifying materials, or detecting processes.

The next step will be to create a database of plant signals whereby Ippolito field representatives will be able to communicate what spinach varieties and perhaps what field practices result in the tastiest eating experience.

As Alexander explains, hyperspectral imaging will become a management tool. Beyond grading and sorting produce at higher accuracy, the processor plans to optimize its knowledge with contracted growers. In the next five years, perhaps drones will be able to fly over fields and photograph the chemistry of the field.

"This is Star Trek technology," Alexander concludes.

Editor's note: To view a video on hyperspectral imaging, go to: http://biotalk.ca/pp-optica/