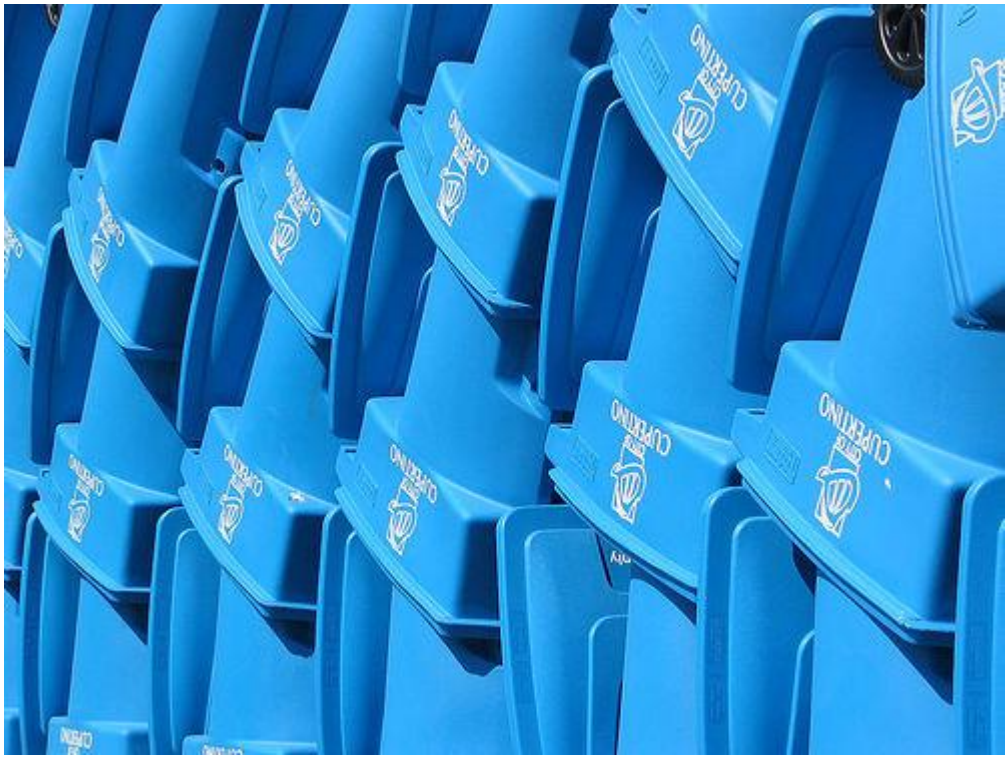


NIR spectrophotometric technology expands your ability to identify and sort resins and are playing a critical part in plastics recycling efforts.
Image Source: Flickr user Peter Kaminski

Recycling used to be reserved for the environmentally devoted, requiring special trips to the recycling station where we carefully sorted plastic from glass from paper. Today, recycling is standard operating procedure, as evidenced each Sunday night when my street becomes lined with recycling bins full of soda bottles, margarine tubs, and take-out containers. While most don't know exactly what happens to those plastics once they are trucked away, we tend to believe that it's something good – something useful and productive. At the very least, we believe that recycling actually happens.

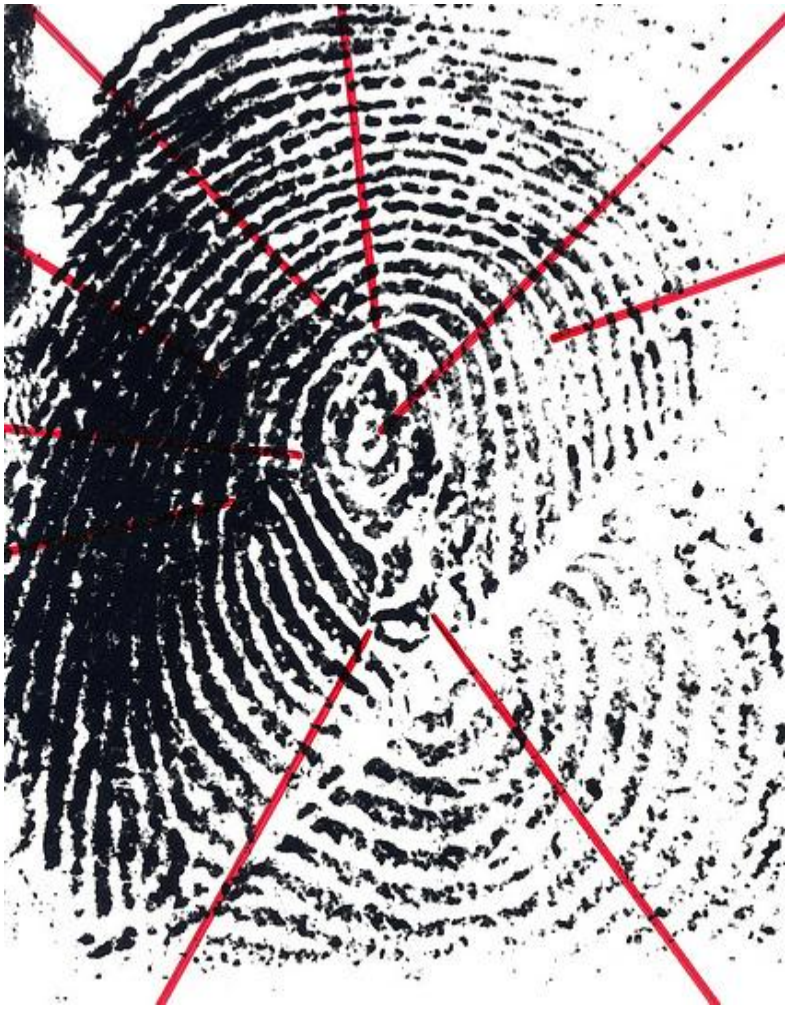
Too often, however, our efforts are in vain and the plastics we so dutifully placed on the curb end up in landfills along with the rest of our trash; out of the 33.6 million tons of plastic discarded in the United States each year, only 6.5% is recycled.[1] In fact, major companies like Coca-Cola and Walmart, who have made public commitments to increasing use of recycled plastics, are struggling to find a supply of post-consumer plastics; it simply isn't available in the quantities needed.[2]

One of the primary reasons for this low recycling rate is the fact that sorting recycling post-consumer resins is often a labor-intensive process that requires more resources than many processing facilities currently have available to them. As Edward A. Bruno writes:

In order to recycle plastic into usable resins with the desired characteristics, a pure stream of resin categorized waste must be achieved. Companies that buy recycled resins want those recycled resins to have the same characteristics as virgin resins. Otherwise, it is not efficient to use recycled materials.[3]

Distinguishing between types of plastics to ensure purity has typically been done via visual inspection of plastics labeling, requiring training and man-hours to ensure resin purity and guard against contamination that renders the plastic unusable. Even when a plastics sorting labor force is

available, the condition of post-consumer plastics often makes labels illegible, as the product has been “crushed, cracked, or covered.” As such, more sophisticated resin identification and sorting methods are needed to allow for the recycling of an ever-growing amount of plastics.



Each type of plastic has unique spectral characteristics that act as fingerprints.
Image Source: Flickr user Vince Alongi

Resin Identification Via NIR Spectrophotometers

Near-infrared (NIR) spectrophotometry is increasingly becoming recognized as a reliable and economical technology to facilitate plastics identification and spur the development of automated sorting processes. Each resin type has a unique chemical composition that imbues the resin with particular spectral characteristics. These spectral qualities act as fingerprints that can be rapidly read via NIR spectrophotometers, allowing for extraordinarily accurate identification of plastics and the implementation of automated sorting systems based on this identification. By replacing **unreliable, error-prone, and time-consuming visual inspections** and manual sorting, spectral analysis via NIR technology greatly enhances sorting speed and efficiency and enables the identification of unlabeled, unknown resins, including flakes and pellets. NIR reflectance data can be analyzed even in the presence of surface contamination such as dirt and food particles, eliminating the need for consumers or processors to clean plastics prior to sorting and greatly expanding the amount of plastics eligible for recycling. Additionally, resin identification can be made **regardless of resin color**, with black plastics being the only exception.

NIR spectrophotometry allows for identification of resin type regardless of plastic color, the existence of a label, or the presence of a bottle cap.
Image Source: Flickr user Steven Depolo

Accuracy, Versatility, and Economic Feasibility

In a 2012 study published in the *International Journal of Mechanical, Aerospace, Industrial, Mechatronic and Manufacturing Engineering*, researchers took a closer look at some of the concerns some within the plastics industry have had regarding NIR spectrophotometric analysis and answer common questions regarding its practical application.[4] Specifically, they sought to answer whether or not plastic thickness, the existence of a label, and the presence of a cap interfered with accurate resin identification within an spectrophotometrically-based optoelectronic sorting system. Upon analysis of their results, the researchers discovered that none of these factors interfered with identification or sorting. Additionally, they found considerable financial advantages to replacing manual sorting practices with automated plastics sorting systems based on NIR spectral analysis:

[Sorting] plastic bottles and containers with this method would result in the considerable value added that legitimizes the costs of identification hardware and sorting system in long term. Furthermore, in other methods such as manual identification and sorting, increasing labor costs are making manual sorting economically unviable. In addition, the resulting product which is costly produced, generally only finds limited application in low-value products, due to the possibility due to the possibility of human error during the sorting operation.

The greatest benefit, however, is increasing the amount of post-consumer resins that are recycled, decreasing reliance on petroleum and **offering significant environmental protection** through decreased pollution, energy use, and destruction of fragile ecosystems.

HunterLab Technology

HunterLab has been a leader in spectrophotometric technologies for over 60 years. Our diverse range of instruments offer the plastics industry the highest level of analytical ease and accuracy whether processing post-consumer resins or **manufacturing new polymers**. The extraordinary level of accuracy and precision afforded by our spectrophotometers and software packages allows you to

move away from outdated sorting methods and step into a new era of plastics identification using the most sophisticated technologies available today. **Contact us** to learn more about our innovative products and world-class customer service supports.

1. "What Happens to All That Plastic?" January 31, 2012, http://blogs.ei.columbia.edu/2012/01/31/what-happens-to-all-that-plastic/
2. "In the Bin," April 22, 2015, http://www.economist.com/blogs/democracyinamerica/2015/04/recycling-america
3. "Automated Sorting of Plastics for Recycling," http://infohouse.p2ric.org/ref/09/08620.pdf
4. "Identification and Classification of Plastic Resins using Near Infrared Reflectance Spectroscopy," 2012, http://waset.org/publications/11237/identification-and-classification-of-plastic-resins-using-near-infrared-reflectance-spectroscopy