



NIRLAB

White Paper

NIRlight powered by NIRLAB for plastic recycling identification

Near Infrared Spectroscopy (NIR) is a powerful tool to identify polymers, both in production and during recycling.

Recycling of plastic materials involves the collection and reprocessing of discarded or waste plastics into new, usable products. Given that most plastics are not biodegradable, recycling initiatives aim to mitigate the environmental impact of plastic waste—particularly the estimated 8 million metric tons that enter our oceans annually. Unlike metals, which can be recycled profitably, plastic recycling faces unique challenges due to the material's bulkiness and lower value. Additionally, technical complexities arise in recycling facilities tasked with sorting and processing plastics. The NIRlight handheld device offers a robust, portable solution that enables even novice operators to rapidly identify various types of plastics in seconds.

When different types of plastics are melted together, they tend to phase-separate, like oil and water. The phase boundaries cause structural weakness in the resulting material, meaning that polymer blends are useful in only limited applications. The two most widely manufactured plastics, polypropylene, and polyethylene, behave in this way, which limits their utility for recycling. Each time plastic is recycled, additional virgin material must be added to help improve the integrity of the finished product. So, even recycled plastic has new plastic material added in. The same piece of plastic can only be recycled about 2–3 times before its quality decreases to the point where it can no longer be used.



Figure 1 – Handheld, wireless spectrometer

The NIRlight is NIRLAB's innovative, ultra-compact spectrometer. With integrated battery, button, and Bluetooth wireless communication, the NIRlight is the ideal solution for mobile material analysis in the factory or in the field. The NIRlight is the smallest fully integrated NIR spectrometer on the market and is enabled by solid state VIAVI linear variable filter (LVF) technology. With no moving parts or optical fiber and IP65/IP67 dust/water ingress ratings, it is designed for a wide range of material characterization applications. The

NIRlight is available with our new NIRLAB mobile solution for remote sample identification using an iOS or Android mobile phone. The NIRLAB Suite includes three components:

- Mobile app
- Web app
- Web based chemometric modeling package

The mobile app has a simple, intuitive interface that provides real-time scanning and identification of plastic samples.

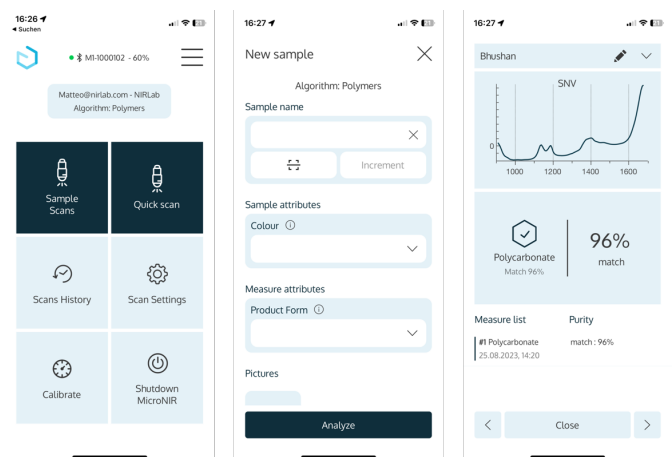


Figure 2 – NIRLAB mobile app screen, showing the results of a single scan.

The NIRLAB Mobile App connects wirelessly to the NIRlight to offer sample identification in one second with a single button press. Results are displayed on the connected mobile phone screen.

The sample name can be entered manually or using a bar code reader. A photo and geolocation ID can be attached to the scan and synced with the NIRLAB web app. All access is protected by a UserID and Password.

The Web app can also manage the NIRlight fleet. Users can be assigned to specific methods and instruments and tracked remotely.

All results collected via the mobile app can be uploaded to a secure cloud database and viewed by instrument serial number, operator, or date (Figure 3).

Date	Name	Substance	KN	Added by
20/03/2018	2020021_0150	PE Lowden	Match 99%	Bianca Moringi (User)
24/03/2018	2020024_0400	PP PP-Capacitor PP-Capacitor	Match 99% Match 99%	Bianca Moringi (User)
09/03/2018	2020079_02044	PE Lowden	Match 99%	Daniela Moringi (User)
09/03/2018	2020079_02003	PE Lowden	Match 99%	Daniela Moringi (User)
04/03/2018	2020074_02005	PP PP-Capacitor	Match 99%	Bianca Moringi (User)
03/03/2018	2020063_03000	Polipropilene	Match 99%	Bianca Moringi (User)
03/03/2018	2020063_03004	Polipropilene	Match 99%	Bianca Moringi (User)
02/03/2018	2020062_03000	Indefinita sostanza	Match 99%	Bianca Moringi (User)

Figure 3 – NIRLAB web app screen showing multiple ID results created by a user

NIR identification of plastics

NIR reflectance spectroscopy can distinguish plastic packaging and plastic waste by polymer type. NIR uses the chemical signature of polymer resins such as polyethylene, polypropylene, polystyrene, PET, PVC, Nylon (polyamide) and many others to distinguish and sort them from one another.



Figure 4 - Example of plastic waste

NIRLAB has developed an identification library algorithm to identify 50 different plastic types (Table 1), including the “big five”, PE (HD and LD), PP, PS, PET and PVC. Colored, opaque, and transparent samples can be

Benefits

- Rapid, real-time, non-destructive near-infrared material analysis
- Wireless, compact, rugged, and ergonomic design for one-hand operation
- Multifunction button for one-click data acquisition
- Internal, rechargeable Li battery with run time greater than 10 hours
- IP65 and IP67 rated for use in wet and dusty environments
- Compatible with MicroNIR sampling accessories
- NIRLAB Suite with Mobile App and Web App for iOS and Android

identified, as shown in Figure 5.



Figure 5 - Example of cataloguing for PET color samples

Distributor for Italy

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