



# 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.

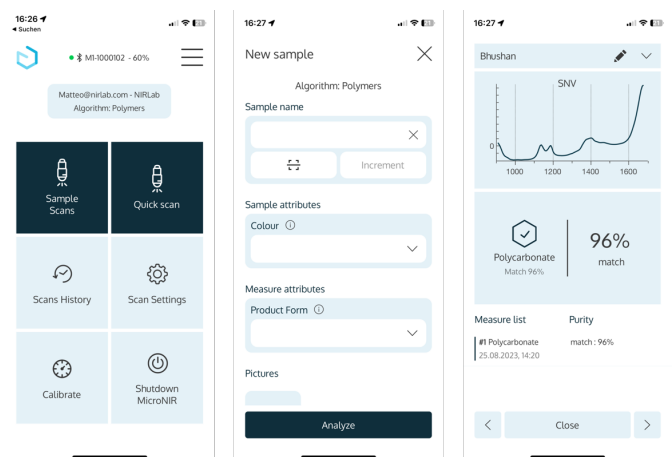


Figure 2 – NIRLAB mobile app screen, showing the results of a single scan.

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	KNM	Added by
20/03/2018	2020702_0150	PE Wooler	Match Match 99%	Benjamin Mousting (Staff)
24/03/2018	2020702_0400	PP PP-Capacitor PP-Clap-Filad	Match Match Match 99%	Benjamin Mousting (Staff)
09/03/2020	2020701_02424	PE Wooler	Match Match 99%	Benjamin Mousting (Staff)
09/03/2020	2020701_0200	PE Wooler	Match Match 99%	Benjamin Mousting (Staff)
04/03/2020	2020701_0200	PP PP-Capacitor	Match Match 99%	Benjamin Mousting (Staff)
03/03/2019	2020701_0300	Polycarbonate	Match Match 99%	Benjamin Mousting (Staff)
03/03/2019	2020701_0304	Polycarbonate	Match Match 99%	Benjamin Mousting (Staff)
02/03/2018	2020702_0400	Unknown substance	Match Match 99%	Benjamin Mousting (Staff)

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

Polymer name	Result
ABS - Flame Retardant	OK
ABS - High Impact	OK
ABS - Medium Impact	OK
ABS - Nylon Alloy	OK
ABS - Transparent	OK
Acetal Resin - Copolymer	OK
Acetal Resin - Homopolymer	OK
Acrylic	OK
Calcium Carbonate - Reinforced Polypropylene	OK
Cellulose Acetate	OK
Cellulose Acetate Butyrate	OK
Cellulose Acetate Propionate	OK
Ethylene Vinyl Acetate	OK
Ionomer	OK
Mica-Reinforced Polypropylene	OK
Modified Acrylic	OK
Nylon - Transparent	OK
Nylon - Type 6 (Homopolymer)	OK
Nylon - Type 66	OK
Nylon (Type 66 - 33% Glass)	OK
Phenylene Oxide	OK
Polyallomer	OK
Polyaryl - Ether	OK
Polybutylene	OK
Polycarbonate	OK
Polyester Elastomer	OK
Polyethylene - High Density	OK
Polyethylene - Low Density	OK
Polyethylene (Medium Density)	OK
Polymethyl Pentene	OK
Polyphenylene Sulfide	OK
Polypropylene - (Glass Filled)	OK
Polypropylene - Copolymer	OK
Polypropylene - Flame Retardant	OK
Polypropylene - Homopolymer	OK
Polystyrene - General Purpose	OK
Polystyrene - High Impact	OK
Polystyrene - Medium Impact	OK
Polysulfone	OK
Polyvinyl Chloride - Flexible	OK
Polyvinyl Chloride - Rigid	OK
Styrene - Acrylonitrile (SAN)	OK
Styrene Butadiene	OK
Styrenic Terpolymer	OK
Synthetic Elastomer	OK
Talc-Reinforced Polypropylene	OK
Thermoplastic Polyester (PBT)	OK
Thermoplastic Polyester (PETG)	OK
Thermoplastic Rubber	OK
Urethane Elastomer (Polyether)	OK

Table 1 – Polymer Identification List



N I R L A B

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Product specifications and descriptions in this document are subject to change without notice.

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