Automatic sorting of recyclable materials with NIR technology

The first near infra-red (NIR) sorting systems were used to process recyclable materials in the early 1990s. Until then, recyclable materials were only collected sporadically, and sorted more or less by hand. Now, NIR technology has found its way into almost all areas of sorting recyclable materials. Today, modern sorting systems, where e.g. paper, plastics or other recyclable materials can be sorted, cannot be run economically without near infra-red technology.

The basic principle behind NIR technology is measuring the reflectivity of an object within a wavelength range of 1.100 to 2.100 nm. In this wavelength range, materials such as plastics, paper, and textiles have their own specific characteristics. This range of wavelengths is not visible to the human eye. This is also the reason that optical sorting systems must be used.

Modern sorting systems can distinguish plastics such as PP, PS, PET, EPS, PC or PVC with ease, as well as clearly identifying cellulose-based materials such as paper, card, cardboard or wood and natural fibres. Combinations of these materials e.g. in Tetra-Pak or similar drinks containers can also be sorted. Materials which cannot be identified due to a lack of individual characteristics in this wavelength range include stone, porcelain or dark materials, which do not reflect and are therefore not measurable.

UniSort  NIR Technologies

Analytical measurement recording:

- 5,800 measuring blocks/s are measured, with two times 128 (i.e., 256) discrete wavelengths being recorded, combined and evaluated in each case. Totally, these are over 1.5 million measured data, each having an information content of 16 bits.

RTT's 64 Multiplexer opens up new, undreamt-of possibilities of applying near infrared spectroscopy (NIR). At a belt speed of approx. 2.8 m/s, all material on the belt is measured unbrokenly, i.e. without any discontinuities.

RTT's 64 Multiplexer opens up new, undreamt-of possibilities of applying near infrared
Your advantage at a glance:

- Sensor widths of 4 metres are possible (implemented on two 2 m-belts)
- Fractions of a size from 10mm upward can be easily and reliably identified
- Continuous, unbroken scanning across the entire belt width
- Precise analytical evaluation of the measured data
- Identification of constituents or additives such as flame retardants
- Air-pressure discharge window, free programmable
- Statistic analyse and documentation of the material (optional)
In order to guarantee efficient sorting using NIR sorting systems, the materials must be pre-
treated accordingly. Generally the material arrives in bales to make transport more
economical. The first step in the process is to de-bale it. Typically, NE and FE metals are then
separated from the material. It is then sieved to remove small parts which interfere with
sorting from the process. After this, the material to be feed is loaded onto an accelerating
conveyor belt via a vibrating feeder.

![Pic 1: principle of NIR sorting](image1.png)
![Pic 2: Complete sorting module with NIR Sensor, speed conveyor and material catcher hood](image2.png)

The NIR sensor is located in the last third of the conveyor, with the corresponding
transmitting and receiving unit, which is aligned at right angles to the belt as a channel. A air
nozzle bar is installed at the end of this conveyor belt to sort the detected material specifically
with a blast of compressed air. The material detected and removed is then blown over a
material splitter, thus separating it from the remaining flow of materials. The remaining
material can then be transported to another device. Any other material, e.g. PE, can also be
separated at this point.

Typical applications for NIR sorting systems include sorting of:
- Packaging
- Papers
- Waste electrical equipment
- Domestic waste
- Plastics
- Vehicle recycling

**Extract: Our Range of Product**

**UNISORT® P**
Sorting of Recyclable Fractions by NIR e.g: Beverage Cartons, PET, HDPE, PS, PP, PVC or
other kind of plastic resin

**UNISORT® PX**
NIR Sorting module with dual nozzel array, one input three output streams
Automatic sorting of recyclable materials with NIR technology

**UNISORT® C**
Color Sorting System for PET Bottles

**UNISORT® CX**
Color Sorting System for PET Bottles one input three output streams

**UNISORT® Section**
The sensor head is subdivided into two or three detecting sections and can perform different sorting functions in each of the sections, thanks to its intelligent software

**UNISORT® Multi 5**
Universal Sorting of Plastic Bottles "Five in One Solution“ Sorting by resin and color.

**UNISORT® Paper**
Sorting of recovered paper: Detect and remove Cardboards, dyed papers and other kind of nuisance material to generate De-Inking Paper

**UNISORT® Master-Slave**
New dimension in economical sorting: UniSort „Master-Slave Combination“
X - number of systems possible up to total sensor width of 4.000 mm in different widths

Application: RDF Sorting

Optical Sensing and Sorting of RDF Processing  - Field Report

Rubbish sites for untreated waste have been closed in Germany since the middle of 2005. This was a nightmare for many medium-sized waste disposal companies. Since that time there has not only been a shortage of combustion units, but disposal prices have also risen in some regions by up to 300% ad hoc. So what should be done with residual waste? The call for sensible recycling paths for sorted residue and residual waste took on a whole new dimension overnight. One interesting solution involves replacing primary energy sources like coal, gas and oil, which are becoming increasingly scarce and more expensive, with what are known as substitute fuels for energy intensive sectors like cement works and power stations or furnaces or other large industrial combustion plant. The market for substitute fuels is currently developing into a major player in the energy mix.

But also the recycling of sorted residue and residual waste is becoming ever more economical. At least 10 of the 20 new RDF processing facilities that were built in the last two years are also suitable for producing materials such as PPK, wood and special plastics. Optical sorting has become part of RDF processing where it can be used for separating troubling material like PVC or sorting out reusable material.
Application: **Polymere Sorting** **UniSort Master-Slave Solution**

Ultimate efficiency in the NIR sorting of recyclable waste

![Diagram](image)

Up to now the standard was: For each sorting point - one sensor Master - Slave means optimal use of the sensor. One sensor – 4 m sorting width. One system replaces up to four conventional systems with a working width of 1 m each.

The Multiplex NIR technology has been designed to acquire the measured object data via an optical system, the transmitting / receiving unit, and to transmit them by means of optical fibres on each channel to a near infrared (NIR) spectrometer. Standard units offer a transmission distance via optical fibres of approx. 1 metre, whereas the scanner beams of the master/slave system can be up to approx. 10 metres away.

The transmitting/receiving unit of each “slave” transmits the optical data for the measured object via optical fibre to the “master” unit. The “master” evaluates the optical data of the relevant “slave” and triggers the preset action, for example PET identified - discharge. Whether master or slave, all units can be set up both as single and double discharge units. All units are also configurable as “split” versions. This allows an endless choice of applications, ensuring maximum flexibility.

The success story of optical NIR sorting continues. Saving resources and rising raw material costs play a major role in this trend.

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