

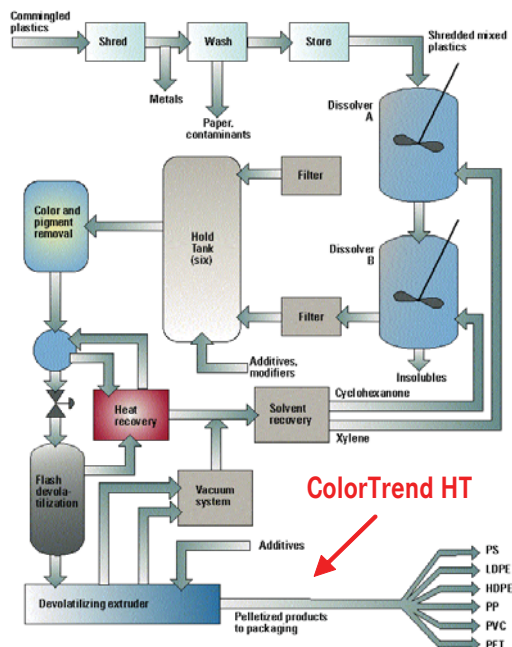
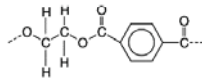
Technical Technical Note



ColorTrend® HT

How to Measure: PET Pellets

PET(E)-extruded pellets are created from Polyethylene Terephthalate, a form of thermoplastic polyester resin derived from the combination of ethylene glycol and either purified terephthalic acid or dimethyl terephthalate. These resins possess qualities which lend them well for use in a variety of applications; they have high strength and clarity, are resistant to heat, and have good moisture and gas barrier properties. Typically, these pellets are clear or translucent and are used for the production of plastic bottles and containers. Other applications include use in textiles as spinning fiber for the carpet industry, geosynthetic materials, and fiberfill. PET pellets are also widely used in the injection molding of many plastic products. The material from which they are made can be either virgin or recycled (code 1); strict requirements for quality assessment and control often exist for PET processing due to the inclusion of recycled materials in their manufacturing.



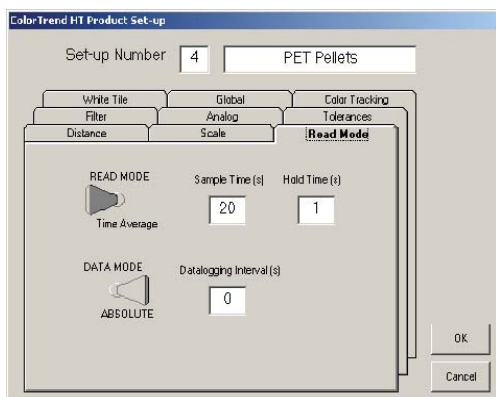
In the compounding of PET pellets, molten polymer is drawn through dies in order to form resin strands. These strands are then either advanced through a water bath for solidification and subsequently cut into specified lengths, or they can, through use of underwater pelletizers, be cut immediately upon exiting the dies. At this stage in the process, PET pellets are transported to vibrating shaker tables containing screening, such that material can be segregated by size. There are optimal size requirements for individual pellets in this application, and those that are dimensionally unsuitable are separated from acceptable product at this area. At this point in the process, the **ColorTrend HT** online color measurement instrument can be utilized in order to determine product color. Of particular importance are typically the L and b values, which signify lightness to darkness and yellowness to blueness. While specifications differ, L values must usually be greater than 73 units and b values less than 3.0. Some companies also require a values to be approximately -1.0 to -1.5 and have Yellowness Index (YI) requirements in the range of 4-16 units.

The Whiteness index can also be measured. Of concern to the manufacturer are also additive quantities used to adjust strength, clarity, and UV properties of the pellets. Changes in these often result in colorimetric changes to the product, which are detectable by the ColorTrend HT. For clear or translucent pellets, a bed depth of 0.5” is typically necessary. This can be achieved by either controlling the flow rate of pellets; placing a small sheet of plating under the sensor, so that the pellets cannot fall through at this location; or installing a small dam after the sensor, such that the pellets accumulate under the sensor and the requisite bed depth can be maintained. Ideally, the sensor should be mounted such that the viewing window is 3-4” from the product surface. The ColorTrend HT has the capability of compensating for height, so small differences in the presentation of the pellets to the sensor is not of concern, so long as the minimum bed depth of 0.5” is met.

Recommended Options

- The **Automatic Calibrator** is a beneficial and often necessary option for these systems, because the shaker tables are typically covered, often by plexiglass, in order to keep the pellets from vibrating off of the table. Thus, the sensors are not often readily accessible for calibration; in fact, some are completely enclosed in the dark. In these processes, standardization, in which a white tile is presented to the sensor, is typically configured for every two hours. An automatic calibrator allows the instrument to standardize itself at a specified interval, without intervention by plant personnel.
- **Airwipe Assembly** - PET pellets are hygroscopic and thus must be completely dried before being used in subsequent processes, such as extrusion blow molding - target moisture levels are typically 0.5%. In order to achieve this, pellets are typically dried for a period of at least 4 hours, which requires a dryer with an air temperature not exceeding 160° Celsius, that point at which the external coating of the PET pellet would be subject to melting or degradation. While moisture must be removed from PET pellets before they can be further processed, during their reclaim, moisture levels are sometimes quite high at the point of colorimetric measurement, thus condensation can accumulate on the viewing window. Use of the air wipe option helps to minimize this condition by discharging air across this sensor window.
- The **Analog Output** option is comprised of a 4 channel 4-20mA card, for which the first three channels are dedicated to the individual components of the selected color scale, and the fourth channel reports either an optional index, such as WI or YI, or height. Analog output data can be used to integrate colorimetric information with data from other key process variables. This is a popular option, because the fixed panel mount for the ColorTrend HT only allows viewing of colorimetric data at the support unit, while the Utility software, which can be used for remote display and control, does not allow simultaneous viewing of other data being collected at the process from other instruments.

Recommended Settings



Update Time of 20 seconds

The pellets are vibrating on the shaker table often at high frequency. Thus, the update time should be as long as possible to ensure the colorimetric data reported is as smooth as possible. Typically, 20 seconds is acceptable.

Filter of 0.50

0.5 should be used as a starting point for the filter setting. Changes in this process are made slowly, such that differences in values are evidenced over many minutes rather than over the course of a few readings. Thus, there should theoretically be little deviation between consecutive measurements. Use of the filter setting, which is a ratio of old data to new data per update cycle, allows smoothing of data without extending the update period.

