Automated Color Sorting of Recycled Glass

Material: Recycled Glass

Issue: *Color sorting is a primary step in the beneficiation of recycled glass. Historically, color sorting has been a manual operation performed at material recovery facilities (MRFs). Over the last decade automated color-sorting systems have been developed. Installation of these systems is capital intensive, and current technology requires that the cullet be prepared according to gradation and contamination specifications. This best practice discusses the procedures involved in automated color sorting. For information on manual color-sorting, the reader is referred to the* Manual Color Sorting of Recycled Glass *Best Practice*

Best Practice: Glass bottle manufacturers typically distinguish three main colors for supply of recycled glass: clear (or flint), amber (or brown), and green. Clear glass has the highest value and the lowest tolerance for contamination by other colors (See the *Testing and Sampling Protocols for Recycled Glass* Best Practice). The contamination allowance is generally about 0.5% by weight of non-clear glass. In comparison, the amber and green fractions can endure between 2 and 3% by weight contamination of foreign color glass.

Glass collection programs vary in the degree to which consumers are requested to sort by color. Drop boxes usually collect sorted colors, while curbside programs often collect a commingled stream of bottles. The variation in supply requires different types of sorting protocols by recyclers. If glass containers are not color sorted by the consumer, recyclers have two principal options: sort the glass at the point of collection, or color sort the glass at a material recovery facility (MRF).

Many MRFs include manual color sorting, a labor-intensive operation, in their processing scheme. However, manual sorting is only effective when glass particles are large enough to recognize and handle. Common manual sorting protocols assume the loss of all 2-inch minus broken glass, which totals over 40% of recycled glass in some commingled collection programs.

The degree of color sorting should depend on local market demand for each of the three colors. In some cases it may not be economically feasible to separate more than one color (usually clear due to higher market value) from a given glass fraction. Under such a scenario, the mixed color residual may be sent to alternative applications such as construction aggregate. In other cases, sorting for beneficiation of all three colors may be practical.

Automated color-sorting uses optical technology that has evolved from early designs intended to remove ceramic contaminants. The system configuration is similar to automated ceramic removal equipment, but color-sorting equipment uses a different light source. Before the automated color-sorting process begins, the equipment should be programmed for the preferred color removal. Automated systems can generally be instructed to remove any one or a combination of the three glass colors.

The resulting cullet should then be vacuumed to remove all labels, dirt, and plastic. A ceramic removal stage should also precede the automatic color-sorting equipment, as this material can generate disruptive background noise. This stage can employ a manual or automated ceramic extraction technique (See the *Removal of Ceramics From Recycled Glass* Best Practice).

Following ceramic removal, the cullet is fed into the color-sorting unit by a vibrating conveyer belt, which keeps the glass in a thin layer. As it enters the unit, the cullet passes over a plate embedded with fiber optic cables. A fast pulsing light source is projected through the glass stream to the fiber optics cables, which detect the amount of light transmitted through each particle, determining its color. Following the programmed color-removal scheme, the system detects the position of any undesirable material and directs one of a series of "air knives" to remove this material with a burst of air. Equipment of this type can process up to 5 metric tons of cullet per hour.

It should be noted that fine-sizing equipment produces a cullet powder which is too small to color sort (No. 12 mesh or finer). When used with manual or automated ceramic removal, fine sizing must follow the color-sorting stage.

Implementation: If container glass recycling is to grow, then the development of technologies to eliminate the labor-intensity of MRF operations is inevitable. Automated color-sorting technologies hold the promise for improved quality color-sorted glass with lower operating costs. Practical production-scale color-sorting equipment has been installed in the United States in only the past two years.

Benefits: The procedures discussed in this best practice will help facilitate automated color sorting of recycled glass. This information will also help end-users decide if automated systems are a practical alternative to manual color-sorting methods.

Application Sites: Glass suppliers, recycling plants.

Contact: For more information about this Best Practice, contact CWC, (206) 443-7746, e-mail info@cwc.org.

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