Toll compounder boosts productivity with circular fluid bed cooling

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CLIFTON, NJ Compounding Engineering Solutions (CES) cools and dries plastics faster using circular fluidized bed cooling. This supplemented traditional underwater immersion cooling after the company's success using circular fluid bed cooling on a special process for wood-plastic pellets.

The new cooling method improves run time between 20-100% in compounding various plastics such as polypropylene and engineering resins like nylons and polyesters.

CES's success with circular fluidized bed cooling started with its use on a moisture-sensitive 50% cellulose-filled plastic composite. The custom compounder selected circular fluidized bed as the only practical way to cool and dry these wood flour-plastic pellets. They can't be cut and cooled by standard water quenching techniques because moisture degrades the cellulose.

Cellulose-plastic pellets move from a pelletizer to a cyclone separator via pneumatic conveyor, and are gravity-discharged into a 60 in. (1525 mm) diameter circular vibratory cooler which reduces their temperature to 100°F (38°C) and moisture content to less than 1%. Pellets are classified into on-size, over-size and fines by a 48 in. (1225 mm) Kason VIBROSCREEN® circular vibratory separator.

Cooling Moisture-Sensitive Pellets

CES extrudes the composite on a high speed, high torque, 70-mm twin screw "megacompounder." According to CEO Arash Kiani, Ph.D., the twin screw runs at higher speed than the alternative method of a single screw following a twin screw compounder with both running slower to prevent possible ignition and/or agglomeration of pellets. Reducing to one step also eliminates one piece of equipment and potential associated problems.

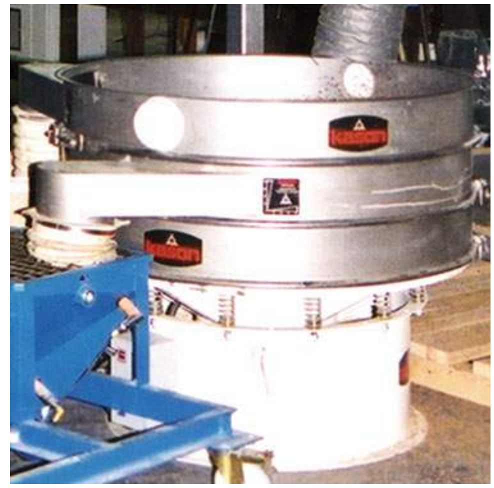
As the cellulose-plastic composite exits the megacompounder at 350°F (177°C), a hot face die cutter pelletizes it in 1/8- to 1/4 in. (3.175mm to 6.35 mm) sizes. The high heat imparted by the high speed twin screw demands rapid cooling of pellets. A 30-ft (9150 mm) long, 6 in. (150 mm) diameter pneumatic conveyor transports them into a 6-ft (1825 mm) high cyclone from which they fall into the 60 in. (1525 mm) diameter circular vibrating fluidized bed processor by Kason. The processor cools the pellets to 100°F (38°C) and dries them to less than 1% moisture. The transfer between cutting chamber and cooler takes two seconds at 4000 lb/hour (1800 kg/hour).

The free-flowing wood/plastic pellets (bulk density 40 lb/cu ft [650 kg/m3]) discharge from the fluid bed cooler into a 48 in. (1225 mm) diameter Kason VIBROSCREEN® circular vibratory separator. The screener classifies pellets into on size (1/8- to 1/4 in. [3.175-6.35mm]), over-size (larger than 1/4 in. [6.35mm]), and fines (smaller than 1/8 in. [3.175 mm]). A flexible screw conveyor carries the on-size pellets to a hopper, which drops them into a gaylord for shipment and subsequent extrusion or injection molding at customers who make products such as fence posts, decking and siding. The overs and fines are recycled back into the process.

The amount of fines the screener processes indicates to CES engineers if the hot die face cutter is generating too many fines, requiring adjustments to the cutting process.

How Circular Vibratory Cooler Operates

A blower on the circular fluidized bed cooler introduces chilled air through a 20 in. (500 mm) pipe into the bottom inlet of the fluid bed chamber to cool the pellets on a circular screen. Two eccentric weight motors and spring suspension vibrate the unit, which, together with the continuous air flow, separate and fluidize individual pellets, maximizing the surface area of material to speed the drying and cooling. The processor's vibratory motion conveys the material along a defined pathway for uniform processing on a "first in/first out" basis.


Pellets are classified into on-size, over-size and fines by a 48 in. (1225 mm) Kason VIBROSCREEN® circular vibratory separator.

Moveable for other duties

The circular fluid bed processor is compact, allowing it to fit on a caster-mounted skid with blower, hopper and controls. Mobility allows the system to cool and dry pellets at other compounding lines in the plant.

CES rejected cooling on rectangular fluidized beds or long steel belts because of their size, weight and immobility. Fred Burbank, vice president, says the fluidized bed cools and dries at least four times faster than casting the extruded pellets on a steel belt. A belt would need to stretch 150-feet (45.72m) to reduce the temperature of the cellulose-plastic pellets by 250°F (121°C). "It would occupy an impractical amount of plant space and be immovable for other jobs here," he says.

Similarly, a horizontal fluidized bed cooler of equivalent capacity would consume about twice the space of the circular fluidized bed unit, and be impractical to move for other duties. The circular unit is also inherently stronger than a rectangular design, permitting lightweight construction at less cost. Materials can be down- gauged while motors and associated components can be downsized, saving on construction costs and energy.

Cleaning is easier and faster as the circular design has no corners or crevices for material to lodge and cause contamination or to hamper cleaning.

Burbank says the circular fluidized bed's mobility has become less important since the unit will now be permanently installed. "The circular fluidized bed works so well, we are using it in most processes. It opens a large market for us."

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