

Getting the best from recycled materials

The impact of plastic is a topic that has been recently under unprecedented pressure. It is unquestionable that one of the main challenges for the plastics industry is to reduce its environmental impact by moving towards a circular economy. For 13 years, Piovan Group has been designing and producing complete systems to promote the use of recycled materials, investing in research in order to devise processes that will ensure the responsible transformation of raw materials, sustainable production and low environmental impact, in order to move towards a circular economy.

The use of recycled material, both as re-pelletised PET and PCR flakes, is something that is already a common practice in the industry. Using recycled materials means facing different challenges all along the process from the storage to the injection moulding machine inlet, from the dosing to the feeding systems. What are the factors to be considered in processing recycled material? Piovan identifies some of the most relevant: The possible high amount of humidity especially for PET flakes, the presence of dust, difficult handling due to an irregular shape and the tendency of making bridges. Other relevant factors are the light weight, the possible presence of contaminants and the fact that the raw material is amorphous and cannot be simply dried without a preliminary process that increases the crystallinity grade.

In order to provide high reliable turn-key systems, Piovan has developed solutions making the bottle-to-bottle process stable.

Dust removal

The presence of dust can have a negative impact on the quality of the final product and affects the reliability and performance at the feeding system. To solve this problem, it is necessary to manage the dust already present in the raw material to prevent it causing any problem. The generation of additional dust is to be avoided and of course it is essential to remove the dust from the raw material. A complete range of filtering units can be provided to convey heavy dusty materials. The features of these filtering devices are:

- wide filtering surface, obtained with a kit consisting of multiple cartridges;

- device for the automatic cleaning of the cartridges by means of compressed air;
- bins for collecting the separated dust designed for an easy handling and with the possibility of disposing of the dust without stopping the system.

In many cases, recycled material has a bigger content of dust, but in addition dust can be created during the feeding phase. In order to minimise this, it is important to evaluate the sizing parameters, in order to find the right balance between air flow rate, pipe diameter, speed of the material and of the air inside the pipe.

To further adjust actual running conditions, Piovan has introduced the control system Varyo, that, combined with a frequency converter of the process blower, enables the setting of the material speed inside the pipe.

Another area of possible intervention is removing dust from the raw material. This can be done with de-dusting units. The principle of these devices is to create two contrary flows: the material falling down meets a flow of de-dusting air according to the counter-current principle.

In the case of flakes from bottle grinding, the most critical point is the handling, due to the fact that flakes are light, thin and with a tendency to create bridges. For this reason, there are some areas that require a particular care and dedicate features. One cross characteristic is the geometry of all the equipment involved, from the drying hopper to the vacuum receivers, from the blender buffer hopper to the storage bins. The most evident factor is the steeper internal

walls, but this is just what can be seen at first glance; there is more, and this makes a difference: from the specific design of the slide gates of the blenders to a different criterion in the selection of the diameters of the conveying pipes. In some cases, even the design of the static parts is not enough, and so bridge breakers and a pneumatically operated flap completes the package, helping the flow of the critical materials. No details are neglected to guarantee the reliability of the system: for example, the presence of dust can give a false reading, misleading a capacitive level sensor or very light material can float making it impossible for a mechanical sensor to detect the level.

Contaminated material

For post-consumer flakes it means that the material was a bottle and has been in contact with a beverage and a label; the bottle was then ground and washed - often with cold and warm water and with different cleaning agents. During the crystallising and drying processes, material is heated up to 160-170 °C. This can cause the evaporation of residual oils, glues, solvents and oligo-polymers. All these substances are collected by the flow of dried air and carried into the circuit. This can affect the life-cycle and performance of many components. There is, for example, the risk of obstruction of the drying air circuit or of a rapid degradation of the molecular sieves. Piovan has developed a range of fume condensers, thus providing an additional step of filtration and increasing the general reliability.

As for the design of the other entire machine, also for fume condensers, operational costs and efficiency have



been taken in account: The flow of cooling water required is managed by an automatic system. Small particles of metal can be another source of contamination, typically resulting from grinding, from blades or knives. Metal separators can be installed on the material lines during the pneumatic conveying: the dilute phase during the conveying combines with a reliable sensor mounted on the metal separator, recognising the metal parts with a minimum waste of good plastic material.

Using recycled materials means returning into the main production stream the internal scraps, non-compli-

ant or rejected final products or intrinsic production scraps i.e. from production change and start-up phases. Piovani has designed a complete package consisting of a tilter to empty the preform octabins, conveyor belt and grinder suitable for grinding preform and bottle. From the granulator the material is conveyed to a de-dusting unit and then it can be re-introduced into the process.

In the case of low percentage even a simple proportional valve can be enough to mix virgin chips and regrind before the drying step, but market demand is going in the opposite direction, for a higher and higher percentage of regrind. So it can be necessary to provide an additional step to crystallise the material, or a dedicated drying system with a special geometry to process flakes or dosing systems to manage the proportion between virgin PET, rPET, regrind as flakes, additive and masterbatch.

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