

# One Step Ahead

## Drying and Cleaning Recycled Glass in a single Process Step

*Drying and cleaning of recycled glass as well as removing the adhering labels is an important processing step in preparing for glass sorting. A new drying system combines cleaning and drying and eliminates the disadvantages of other processes.*

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Picture: John Webster

**Fig. 1: Glass collected for recycling can contain high concentration of extraneous materials, and therefore has to be cleaned, dried, and sorted.**

Reduction in the molten glass temperature when using recycled glass allows the energy costs of glass production to be reduced considerably. However, extraneous substances can cause serious damage to the melting systems, or have a negative effect on glass quality. Therefore, before the collected glass can be sorted and melted, it has to undergo various processing steps.

Preliminary sorting is frequently still done by hand, because extraneous materials such as plastic bags, plastic bottles or even mobile phones have to be removed, and there are not yet any effective ma-

chines for doing this. Coarser pieces of glass such as bottle bottoms and necks are broken up by breakers. Iron and non-ferrous metals are separated from the recycled glass by means of magnetic and eddy current separators. This leaves behind a mixture of glass, labels, corks, plastic caps and other organic contamination.

To offer an effective way of removing the organic material, it is first necessary to dry the recycled glass and pre-clean it as well as possible. Water is bound up in the organic proportion of the recycled glass above all, because the glass itself cannot hold water and only has surface moisture. Therefore, drying the recycled glass during glass preparation is to be regarded as an important processing step on the way to efficient sorting.

### Drum Dryer Basics

In drum dryers, the solid material is moved around by the rotation of the drum and by the transport effect of com-

ponents installed in the drum. Lifting paddles pick up the moist solid material from the base of the drum and drop it again after lifting, as a result of which the moist solid material comes into contact with the hot drying air. In most applications for drying, the solid material is transported with the in-flow principle, i.e. in the direction of the gas flow. The solid material is transported by what are referred to as guide paddles. This results in a combination of in-flow movement and cross-flow movement between the drying gas and the solid material.

If the solid material is transported in the counter-flow principle, i.e. opposite to the gas flow, this results in an even more efficient operating method because counter-flow drying involves less heat loss with the waste air. The moist waste air from the dryer is extracted from the dryer by a waste air fan, passed through a bag filter for separating the dust it contains, and output into the atmosphere via a flue.

### Special Advantages

Drum dryers are built for solid material throughput rates between 5 and 150 t/h. A particular advantage of drum dryers is that they are largely unaffected by changes in the input moisture level of the material to be dried; also, fluctuations in throughput rate and grain size, as well as the input of unwanted lumps or coarse items represent no problem.

Drum dryers are suitable for fine, coarse, and very coarse goods. It should be noted that it is not absolutely essential to adjust the air quantity when there is a change of products. Also, if there is a failure of the drying air, the solid material in the drum dryer can at least be transported reliably due to the rotation of the drum.

Recycled glass can be dried very efficiently in a drum dryer. This is due to the principle of operation, according to which

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all solid material particles of different grain sizes are unavoidably passed through the hot gas flow as a result of the lifting paddles.

This is important in recycled glass above all, because the grain size distribution is usually between 0 and 60 mm. Compared to a fluidised bed dryer, a drum is more suitable for broken glass because a fluidised bed dryer only operates effectively within a limited grain size range. Individual particles that are larger than 15 mm can no longer be fluidised in a fluidised bed dryer, as a result of which the positive effect on the drying performance resulting from the cross-flow principle in the fluidised bed is cancelled out.

### Drying Recycled Glass

One side effect during the drying of recycled glass in drum dryers which must not be neglected is the associated cleaning of the material by churning of the material during drying. When drying fine recycled glass less than 10 mm in particular, the



**Fig. 2: Recycled glass crushed to <math>< 10\text{ mm}</math> before cleaning and drying.**

drying process in the drum dryer achieves a very good glass quality for further processing. In the past, this fine fraction had to be separated out from the preparation process and was sent to the dump, because it could not be sorted without drying and cleaning.

Another advantage of drum dryers concerns the significantly higher drying air temperatures compared to fluidised bed dryers, as a result of which lower overall air quantities are needed for drying. Drum

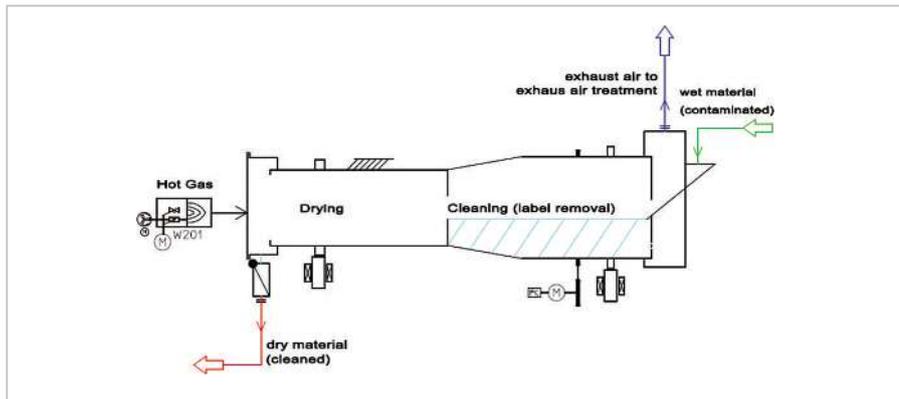


**Fig. 3: Recycled glass after cleaning and drying before the sorting process.**

dryers use only about half the quantity of air as fluidised bed dryers do.

A particular advantage of drum dryers is their lack of sensitivity to seasonal fluctuations in the moisture level of the input solid material, e.g. between dry or very rainy periods. In dry periods, it is either possible to increase the throughput rate or to adapt the amount of drying air to the reduced levels of water evaporation. Smaller fluctuations in the entry moisture level are compensated for by automati-

Pictures: Allgäuer Process Technology



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**Fig. 4: Process diagram of the cleaning drum dryer.**

cally influencing the hot gas inlet temperature (varying the burner power).

In a drum dryer, the gas burner for generating the hot gas can usually be fitted directly on the housing of the dryer. The combustion gases are mixed with a proportion of ambient air to achieve average drying air temperatures between 600 and 800 °C. This means there is no need for the expensive and complicated combustion chamber for hot gas generation, or for the corresponding piping and air supply fan.

The hot drying air is cooled down very quickly in the input area of the dryer due to contact with the moist product, thereby minimising the danger of deflagration of the organic components due to the burner flame. Nevertheless, the waste air pipe is equipped with a spark monitoring system and extinguishing device for safety's sake, in order to prevent the possibility of a fire in the waste air filter.

External hot air generators are used when there are particularly high proportions of organic material in the contaminated raw glass, or for the counter-flow principle. During the drying process, the glass is heated up to a temperature between 60 and 75 °C, and has a residual

moisture between 0.5 and 1% after drying. Most of the moisture is in the fine proportion, which means direct screening of the fine material after drying with the cut off point at about 4 mm allows the residual moisture of the good product to be reduced to below 0.3%.

## Cleaning with Drums

In certain applications such as recycled glass which has already been dried to a large extent, cleaning drums are used without a hot air throughflow, i.e. without further drying. In drums of this kind, the broken glass can remain inside for a long time leading to good label separation as well as efficient cleaning of adhering contamination. Therefore, cleaning drums for recycled glass, as they are manufactured by Allgaier, offer significant advantages compared to log washers of the various kinds delivered by other manufacturers.

In log washers the level of smashing is very high even during short holding times. In Allgaier cleaning drums on the other hand, the recycled glass is circulated without great damage to the product. The individual glass particles rub together dur-

ing the churning, resulting in the adhering labels and dirt particles being removed.

An Allgaier cleaning drum has been used successfully in the glass processing system at Viridor, UK, and was installed by Mogensen. In this system, the cleaning drum is specifically used for glass particles with adhering labels which would be misidentified as CSP material during the sorting process if it were not for the preliminary cleaning, and would thus be separated out otherwise. Following cleaning in the cleaning drum, a significant part of the valuable glass material can be recovered, and is no longer lost with the CSP waste.

## Cleaning and Drying in One

If the process steps of cleaning and label removal in the cleaning drum are combined with drying in a drum dryer, the result is a Cleaning Drum Dryer RTT which combines both useful properties for glass processing. This solution of combined cleaning without significant product damage followed by efficient drying in one apparatus has been registered as a global patent by Allgaier.

This involves the glass material to be cleaned being churned in a cleaning drum ahead of the drying drum for up to 20 minutes without significant product damage. The individual glass particles rub against each other due to the churning, at the same time as removing the adhering labels. This is deliberately done while the raw material is still damp and involves a long holding time, because numerous experiments have shown that this method achieves the best cleaning result.

Following this, the cleaned glass material moves into the drying zone of the drum, where it is dried. Drying in the drum dryer offers the advantage that the necessary amount of energy is very low and thus drying is very effective, both in the counter-flow and in-flow principles.

## Summary of Advantages

Drum dryers offer a number of advantages when it comes to processing recycled glass. To name just a few, they are suitable both for coarse and fine solids, insensitive even to very coarse or heavy solids, and achieve a high level of cleaning during the drying process. They also offer minimum complexity of air supply equipment due to direct mounting of the burner, are insensitive to changes in the solid particle size, fluctuations in moisture and throughput, and failure of the drying air, and have a low specific electric energy requirement. ■



**Fig. 5: A view inside the drum dryer during operation.**