Use of blowers in the drying stage/packaging

In a nutshell

Summary				
Best practice is to install well-designed high-velocity small blowers at the point of use (in can/bottle-drying stages and in air-ionising rinsing systems) which can replace compressed air-based dryers.				
Target activities				
All food and beverage manufacturing	Processing of coffee	Manufacturing of olive oil	Manufacture of soft drinks	Manufacture of beer
Production of meat products	Manufacture of fruit juice	Cheese making	Manufacture of bread, biscuits and cakes	Manufacture of wine
Applicability				
This best practice is applicable to manufacturers of soft drinks that air rinse or dry cans or bottles before filling them.				
Environmental performance indicators				
• Energy use for blowing/drying per litre of product (kWh/l)				
Benchmarks of excellence				
N/A				

Description

Compressed air is an energy-carrying medium that is very versatile, flexible and safe, and which is commonly used in the soft drink industries for air tools or for more complex operations such as pneumatic controls. However, compressed air systems are very energy intensive.

Compressed air systems consist of an air compressor or a sequence of multiple compressor units followed by aftercoolers, receivers, air dryers, air storage tanks and supply lines. The system feeds a distribution system running throughout the factory to the end-use equipment.

In soft drinks manufacturing installations, the compressed air system, supplies compressed air for multiple uses/equipment in a very variable range of pressure requirements. For example, the blow-moulding process requires compressed air ranging from 15 to 43 bar depending on the type and material of the container. Some other packaging equipment such as the machine operating the pneumatic cylinders and the conveyor systems require compressed air close to 7 bar. Finally, in other steps, such as the drying of cans/bottles or rinsing bottles with ionised air, a low pressure (around 0.2 bar) and high speed air streams are required. The relative power consumption of compressed air for drying can be 20-30% of the total compressed air produced (Refresco Iberia, 2014 pers. comm.).

The efficiency of air compressors (the ratio of energy input to energy output) at the point of use can be as low as 8-10 % in many compressed air systems (NCDPPE, 2004; Carbon Trust 2012). Moreover, the delivery of compressed air involves costly systems with frequent maintenance requirements given that in soft drink industries the compressed air must be dry and lubricant-free.

Given its low energy efficiency, the use of compressed air should be restricted to the minimum volume necessary and for the shortest possible duration. Compressed air should be used in cases when significant productivity gains, safety enhancements, or labour reductions are needed (EERE, 2003).

In the soft drink industries, the drying step is carried out after bottle washing, package rinsing or after cold filling, where condensation is formed on bottles. Drying eliminates the external humidity of the bottles/cans thus preventing problems during labelling, coding, weighting and packaging. It improves the quality of ink jet coding, prevents corrosion and bacterial growth under bottle and can lids, ensures adhesion of heat-shrinkable and pressure-sensitive labels and ensures the highest packaging quality and weighting accuracy. Compressed air is normally used for these operations and depending on the case, air knives, jets and nozzles are used to provide a continuous laminar air-stream. High volumes of air at low pressure are required to dry the packages or conveyor belt systems. The air stream has no specific air quality requirements in terms of humidity or microbiological quality, so does not need to be previously filtered or dried. Compressed air systems provide unnecessarily high-pressure dry air streams (around 7 bar) resulting in high energy use.

Significant energy savings can be achieved by using well designed high-velocity blowers instead of compressed air for drying bottles and cans it is best practice to install well-designed high-velocity small blowers at the point of use (in can/bottle-drying stages and in air-ionising rinsing systems) which can replace compressed air-based dryers, producing the same amount of airflow and pressure with a much higher energy efficiency.

The primary difference between the blowers and compressors is the pressure to which they can compress air. A compressor can raise air pressure to a higher level than blowers; in fact the ratio between the discharge pressure over the suction pressure is between 1.11 and 1.20 for blowers while for compressors it is more than 1.20. Blowers are designed to provide large volumes of air at low pressures with lower power consumption (UNEP, 2006).

Blowers can easily replace in a more energy-efficient way the compressed air used for drying operations during bottling and canning in soft drink industries.

Blowers have the additional advantage that they can be fully automated and can automatically stop when the production line stops. Instead, compressed air is produced in centralised systems and the service continues even when the production line stops.

Blowers require very little maintenance and do not require long pipelines like compressed air systems, therefore avoiding the occurrence of air leaks.

Blowers can also be adapted for generating the air flow in ionised air systems. In this case, the high-speed air generated in the blower passes through an ultra-clean filter, and then into a manifold where the air becomes electrically charged.

Environmental benefits

Reduction of electricity consumption is the main environmental benefit associated with the use of high-speed air blowers instead of air compressors in the drying stage.

Energy savings of up to 87% have been reported in the case of soft drink companies which replaced compressor systems with high-speed centrifugal blower systems (Stanmech, 2014).

Energy savings can be higher when inefficient compressed air systems where leakages are present are substituted with air blowers. Air leakages in compressed air systems are difficult to control and increase with time; they can be responsible for up to 10-15% of the total energy consumption of compressed air system (Refresco Iberia 2014). Compressed air systems with long piping systems are also subject to a high energy demand (because of the pressure drop along the line) and therefore if they can be substituted with air blowers the energy savings achieved are considerable (as high as 20 to 30 % of air capacity and power), according to EERE (2003).

Finally, installation of air blowers avoids energy losses when the packaging line is shut down. The shutdown times in packaging lines are very variable, depending on the stops due to change in product formats, cleaning, line malfunction, etc.

Side effects

No environmental cross-media effects are generated by the implementation of this best practice.

Applicability

This best practice is applicable to manufacturers of soft drinks that air rinse or dry cans or bottles before filling them. The combination of blowers and heaters provides considerably faster drying times but can have severe space limitations.

Centrifugal blowers are the blower type most commonly indicated to substitute compressed air in drying operations since they have a good flow/energy consumption rate.

Normally the knives, jets and nozzles installed in the drying systems have to be replaced when air blowers are used instead of compressed air systems. These knives, jets and nozzles are specially designed to increase their performance at lower air pressures (Refresco Iberia 2014).

Economics

Generation of compressed air is one of the most energy-intensive (and therefore expensive) processes in a soft drink manufacturing plant. About 8 kW of electricity is used to generate 1 kW of compressed air.

The investment in blowers for drying or ionised air applications is higher than for compressed air systems but it often has a quick return of investment due to the significant energy savings. The cost of blowers can be very variable depending on the performance characteristics required at the point of use (e.g. air flow and maximum air pressure). Air flow can vary from 5 m^3/h -40 m^3/h and pressure from 0.01 bar to 0.2 bar.

Driving forces for implementation

The main driving force for implementation of this technique is the energy savings achieved with blower systems. Other driving forces are:

- Blowers require very little maintenance work.
- Blowers allow the packaging line to be fully automated, so that when the production line stops the blowers do too.
- Individual blowers also fit better with the air stream requirements at the point of use than compressed air system do.

Reference organisations

Literature

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