

Choosing the right system

Moisture Control

Look at the benefits before looking at the features

By Johnny Robinson, MS

Drying is a critical step in the production of dry petfood. If a dryer's moisture control is not optimized, the production potential will never be reached, energy will be wasted through over-drying and quality (i.e., shelf life, palatability) will suffer. Some petfood manufacturers still adhere to outdated, inefficient and inaccurate methods of moisture control that limit production potential, energy savings and quality assurance.

Since dryer manufacturers do not provide sophisticated moisture controls, the reasons for lack of adequate dryer control can be as simple as a lack of knowledge or complacency in a system

that "seems" to work. Informed manufacturers should not be satisfied with inferior technology but should demand that every ounce of potential production be realized, a quality product day after day and not a single BTU wasted. A high quality moisture control system will allow these goals to be realized.

Number one criterion

A number of different moisture control technologies are currently on the market, but they are not equally effective (see box). In fact, some do not work at all. Costly mistakes can easily be made if systems are not fully evaluated before they are purchased. The number one criterion when selecting a moisture control system should be a rapid return on investment (ROI). Some would argue that accuracy should be the number one criterion. There is no disagreement -this article assumes that accuracy precedes any ROI. Accuracy, however, does not always find its way to the production line. Don't assume that laboratory accuracy translates into production line accuracy.

Today's moisture control technologies provide many features (i.e., high-resolution graphics, impressive displays and on-line communications for service and support), none of which provide a return on investment.

When considering moisture control technologies, the primary focus should be on benefits, not on ancillary features. Manufacturers should ask the following relevant questions:

- Will this system allow an increase in production?
- Will it save energy?
- Will product quality improve?
- Does this system have a proven track record of providing these tangible benefits?

Following are descriptions of benefits that a quality moisture system should provide. Benefits can be broken into two categories: Tangible (directly contribute to a ROI) and intangible (indirectly contribute to a ROI).

Tangible benefits

Tangible benefits of a quality moisture control system include: Production increases, reduced energy costs and quality improvements.

Production increases

Petfood manufacturers work within a narrow moisture content range. The upper level moisture content cannot be exceeded because of shelf-life issues and the lower level cannot be exceeded because of palatability issues. It is a constant battle to stay within a specific moisture range.

In most cases, manufacturers are very conservative (on the low side). For instance, if the upper level limit is 11%, manufacturers still don't produce product with higher moisture content than 9.5%. Usually, the lack of confidence in the ability to maintain a consistent standard deviation dictates this lower, upper level limit. A good moisture control system will reduce the moisture content standard deviation and allow the average moisture content to be increased without exceeding the upper level limit (see Figure 1). This allows more water to be sold, and so increases production.

Energy savings

Energy savings can be achieved by eliminating over-drying. During a production increase as described above, unit energy consumption is reduced.

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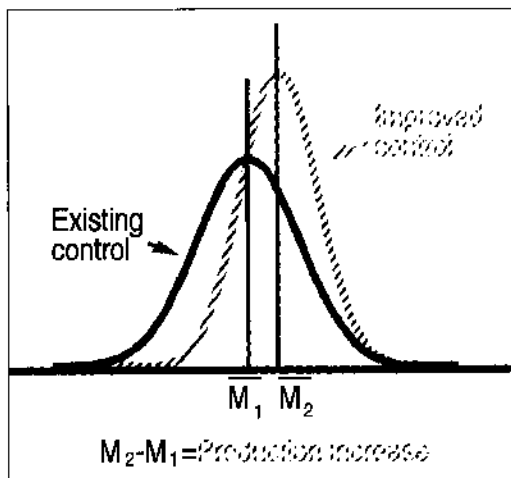


Figure 1. A good moisture control system will reduce the moisture content standard deviation and allow the average moisture content to be increased without exceeding the upper level limit.

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Good moisture control systems will also automatically adjust down burners when product flow is reduced or stopped (i.e., changing products).

Quality improvements

The ability to produce product, day-in and day-out, with a narrow moisture content distribution will significantly improve the product quality. With a consistent, on-target moisture control, color and palatability problems will decrease dramatically.

Intangible benefits

Intangible benefits of a quality moisture control system include: Optimum sensor location, automatic control, service and support and the other items described here.

Sensor location

Where is the moisture sensor located? The sensor must be located in a position where it maximizes its ability to sense and then control moisture. Feed-back and feedforward moisture control

systems, although popular, are not as effective as moisture sensors located inside the dryer. The ability to sense moisture inside the dryer and then make adjustments in real-time, as needed, to insure consistent exiting product moisture content adds to a moisture control system's overall ability to reduce the moisture content distribution.

Easy to install and maintain

A good moisture control system will install easily and will be maintained with very little upset, if any, in production. If for any reason the moisture control system fails, will the dryer continue in a manual mode? The answer should be yes!

Non-invasive

The ideal system should also sense and control moisture with as little contact with the product as possible. The more contact a control system has with the product, the more maintenance will be required.

Correct problems

A control system must have the proven ability to handle upsets coming through the dryer. When an extruder unexpectedly starts producing half its normal production or when incoming moisture abruptly increases by a third, the control system must sense this upset and make necessary adjustments to exiting product moisture content so it will remain constant and on target. It's not enough to sense and report the problem; the problem must be corrected without operator input.

Automatic control

A good moisture control system will not replace operators but will give them confidence and more time to perform additional duties. A moisture control system that automatically senses upsets or deviations from target moisture should make the necessary adjustments to maintain a constant exiting product moisture content.

Also, when changing products, most operators are busy at or near the extruder. The control system should automatically reduce heat when no product is going through the dryer and then automatically return to set-point temperature when product begins moving through the dryer again. A control system that simply displays process variables and little else is not an automatic control system.

Short learning curve

Although the algorithms or logic behind the control system might be complicated, there is no reason that the operator interface (OI) should be difficult or cumbersome to use. A good moisture control system will be intuitive and have the necessary on-screen information for operators. It should also be able to be customized to meet particular needs and should be upgradeable as changes and expansions occur. Good systems will allow the operator to input certain process variables or functions that would normally not be found in off-the-shelf systems.

Integration with existing equipment

Manufacturers should demand that new moisture control systems utilize pre-existing control hardware. For ex-

Figure 2. The two-pass, conveyor dryer is a popular configuration in dry pet-food manufacturing. Pet-food enters the upper level on one side, travels the length of the dryer, falls to the second level and travels back to the dryer exit. The circles attached to lines represent temperature probes. The two-pass dryer is usually divided into separate heated zones (primarily utilizing natural gas). Some dryers have separate heated zones on top and bottom (three on the top and three on the bottom), while some dryers combine the upper and lower sections into single zones.

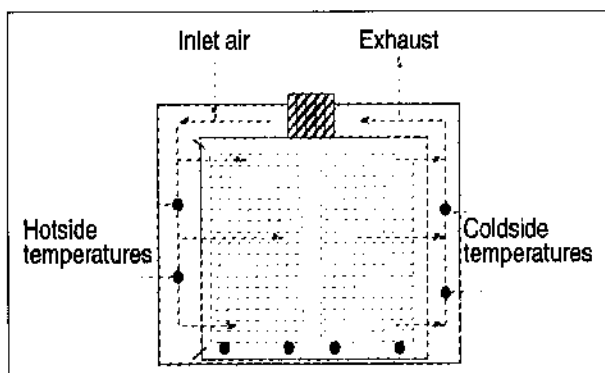
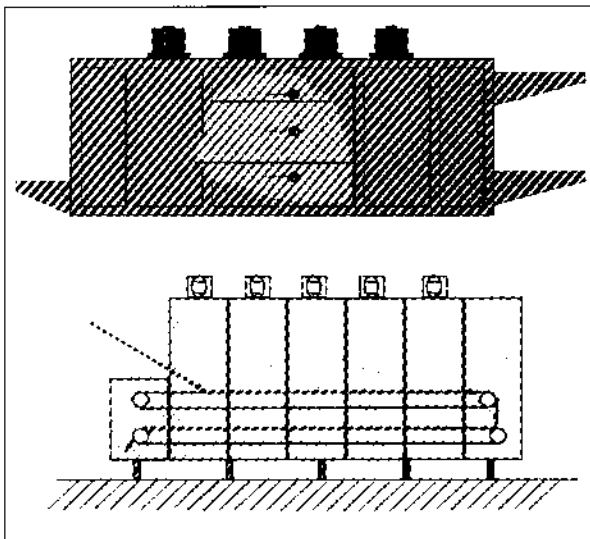


Figure 3. The batch tray dryer utilizing convective air drying (warm air passing over product) is seen in the treats industry: Jerky, rawhide, pigs ears, etc.

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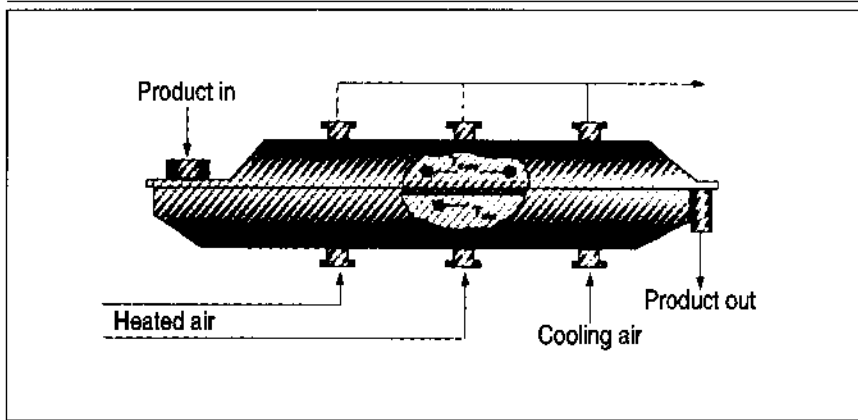


Figure 4. The continuous fluid-bed dryer is similar to conveyor dryers. Hot air flows through the product (usually a powder) in two to three heat zones (usually a cooling zone at the end). It is used for ingredients and additives drying. Kibbles and chunks too large to be fluidized.

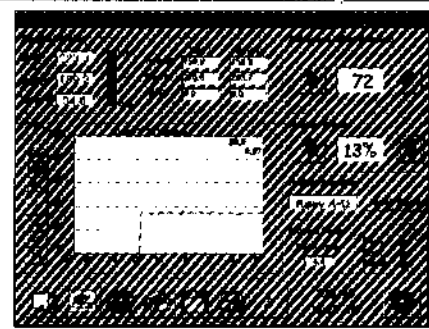


Figure 5. A typical control screen on an HMI (human machine interface) PC. Control software is Windows-based. All process variables, graphical displays and information are located on its screen. One can control the entire dryer (and moisture) from this screen.

ample, if a facility has a PLC, will the moisture control system be able to get on the data highway and utilize all the information contained there or will redundant hardware be installed?

Service and support

Finally, does the manufacturer of the moisture control system have a proven track record of repeat sales? Ask for a list of references of satisfied customers. Do they charge you every time you call for technical assistance? Do they charge for simple cosmetic changes in

the control program? Do they service what they sell in a timely manner? Production is the life's blood of petfood manufacturers—will moisture control manufacturers respond when production shuts down (24 hours a day, seven days a week)? Does the system have a modem as standard or optional equipment? These questions must be answered favorably before selecting a particular control system.

Do a test

After carefully examining the bene-

fits, many systems currently on the market will be excluded. If an impasse is reached with two or more systems, do a test. Grade each system on its ability to produce tangible benefits. Be careful to evaluate the systems with a sound protocol and determine which one lives up to the claims made about it. Most moisture control manufacturers will work with petfood manufacturers and prove their technology. Finally, it's your money, so don't settle on second best or a system destined to fail. ☐

Moisture control

Methods

Loss of weight on drying—Gravimetric methodology: gold standard for moisture determination, used to calibrate model-based methods, not practical for production line, excellent in laboratory environment.

Moisture I—Non-contact, model-based moisture control technology: measures moisture inside the dryer for real-time sensing and control. Uses temperature probes to sense moisture. Must use inside dryer. Virtually no environmental limitations.

Moisture II—Non-contact, model-based moisture control technology: measures moisture outside the dryer for feedback or feedforward control. Environmental limitations.

Moisture III—Non-contact, model-based moisture control technology: measures moisture outside the dryer (some models internal) for feedback or feedforward control. Some models have environmental limitations.

Resistance/conductivity—Contact model-based moisture control technology: measures resistance/conductivity between two plates of electrodes, usually outside the dryer for feedback or feedforward control. Environmental limitations.