



READING BAKERY SYSTEMS

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Is Continuous Mixing Right For Your Process?

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Introduction

As continuous mixing and other automated mixing processes continue to gain favor in the United States and abroad, a growing number of bakery operators are trying to determine which mixing system is best suited for their specific operation. If you are a bakery product or other food products producer, the information that follows can help you better understand a range of pertinent factors so you can make an informed decision concerning continuous and batch mixing. Continuous mixing is not ideally suited for every application. But neither is batch mixing. The purpose here is to help educate bakers so they can choose the best system to meet their unique needs.

The Current State of Mixing: Batch vs. Continuous

Batch processing has been the chosen technology of the bakery industry for many years. And it will no doubt continue to be a popular choice for bakeries around the world for years to come. But popular doesn't necessarily equate to practical. The fact that batch mixing is the most widely used system doesn't mean it is the best choice for your particular application.

When the U.S. industrial bakery industry first came into being, batch mixers could generally satisfy bakers' needs. But as demand for baked products grew so did the size of bakeries and ultimately, production line output. Ovens became longer and wider. But the difficulty of handling large masses of dough in a timely fashion -- and the effect that extended table time

has on the dough – created new challenges. The initial solution was to add more batch mixers. As demand continued to grow, batch mixers were made larger, but this was still not enough to handle the growing demand.

Today, it is not uncommon for a bakery operation to have several batch mixers feeding one large production line. Naturally, the larger the batch of dough, the longer it takes for the line to process it, and if the line is halted for any reason that dough could easily be lost.

Newer technologies, employing modern bulk handling and metering technologies can produce larger quantities of dough (in excess of 20,000 pounds per hour) on an as-needed basis. These “continuous dough” systems require less manpower, offer more accurate recipe control, and produce a better quality of finished product. Such systems were unheard of until 20 years ago. However, technological innovations have made it possible to accurately deliver raw materials to the mixer at rates high enough to meet the demand of the continuous mixing process. In the past 10 years, technology has advanced even further, so that today the ability to deliver accurate ingredients on a continuous process is even better.

As a result, the question whether to choose batch or continuous mixing manager is now a question worthy of careful consideration. Given the improvements in technology versus the long tradition of batch mixing in the industry and the ever-changing expectations of consumers, how do you decide which mixing technology is best for your specific process?

Disproving Misconceptions

The arguments against upgrading from batch mixing applications to continuous mixing generally center on a few commonly-held beliefs that have been proven to be misconceptions.

- Batch mixing is the only proven technology
- Continuous mixing is not suited for a large number of changeovers
- Continuous mixing is more expensive.

The validity of any of these arguments depends on your individual needs. Furthermore, embracing these principles without considering possible alternatives may lead you to overlook the inherent advantages that continuous mixing can provide.

Misconception #1: Batch mixing is a proven technology; Continuous mixing is not

Currently batch mixing is used in a much wider range of applications than continuous mixing, but that doesn't mean it's a better option. In this case, batch mixing's “proven technology” simply means it has existed many more years than continuous mixing. In fact, many of today's products were developed when batch mixing was the only available option. Many other products have been developed on batch mixers because batch mixers were available in surplus within the company.

However, the development of improved mixers, control systems, and metering devices has resulted in continuous mixing systems that are accurate, reliable, and easy to use and maintain. To further bolster this new approach, Reading Bakery Systems has developed a technical center aimed at overcoming the perceived risk of changing to a new type of mixing system. The results demonstrate the practical range of continuous mixers and have resulted in the placement of continuous mixers in many areas traditionally reserved for batch processing such as breads, cookies, and crackers

Misconception #2: Continuous mixing is not suited for changeovers

The fact is, no mixer is well suited for major changeovers. Major changeovers are changeovers that require a complete wash down before another dough can be made. This can be due to color, allergens, or other reasons. Ideally, continuous mixers need to be limited to a maximum of one or two major changeovers per day. Minor changes, however, where the second dough can push out the first dough, are well suited for continuous mixing. This is because modern metering systems allow recipes to be changed literally at the push of a button and with quick and accurate results.

Continuous mixing systems are at their best when operating without many changes for long periods of time. In fact, most manufacturers' introduction to continuous mixing typically involves a dedicated line. Even so, there is wide latitude for how continuous mixers can be used. In reality, cleaning a continuous mixer takes no longer than a batch mixer. Today's continuous mixers include clamshell designs, which significantly reduce the cleaning time between major changeovers.

Misconception #3: Continuous Mixing is more expensive than Batch Mixing

One of the most misunderstood beliefs about continuous mixing is how pricing compares to batch mixing. The problem is that the cost of a continuous mixing "system" typically is compared to the cost of a batch "mixer." But on a mixer-to-mixer comparison, continuous mixing actually costs about the same as batch mixing.

All mixing systems (continuous and batch) require four basic steps:

- Bulk delivery of materials
- Measuring of materials into the mixer
- Mixing
- Dough discharge into a usable loaf size

Let us consider each of these areas individually, and how the two mixing systems compare to one another in the process:

Bulk delivery of materials. The delivery systems used to bring bulk materials are exactly the same for batch and continuous mixing. Generally, materials are brought from a source such as a silo or super sack un-loader to the mixing receiver by pneumatic transfer. Additions by hand are also possible in continuous mixing with the use of a ribbon blender.

It should be noted that accuracy of adding raw materials to the continuous mixer exceeds that of the batch mixer in nearly every case.

Batch vs. Continuous Comparison:

Cost of Bulk Delivery of Materials: Even

Measuring of Materials into the mixer. The cost comparison here can be difficult for the untrained eye to recognize because the bulk materials are initially metered during the "Bulk Delivery of Materials" stage. And while we readily see the cost of the dry materials feeders for

the continuous mixer, it is easy to overlook the fact that additional weighing equipment, controls, and other costs were incurred to get the “proper size” batch of ingredients to the batch mixer.

In the case of continuous mixing, sizing of batches during the Bulk Delivery stage is not necessary because all metering is done at the mixer itself. Metering directly at the mixer leads to greater automation and greater accuracy. In fact, accuracy is improved so much that often, lesser amounts of micro ingredients are required. This is due to improved metering and distribution in the continuous mixing system and can represent a significant cost savings.

Batch vs. Continuous Comparison:

Short-Term Cost of Measuring Materials: Batch Mixing is less expensive

Long-Term Cost of Measuring Material: Continuous Mixing is less expensive

Mixing. At the lowest production rates (500 to 1500 pounds per hour) mixer-to-mixer costs tend to favor batch. However, at higher rates, the cost of continuous mixers expands much more slowly than the cost of batch mixers, such that in mid-capacity systems (2000 to 6000 pounds per hour) the costs are equal. At rates above 6000 pounds per hour continuous mixers actually cost less than batch mixers.

Batch vs. Continuous Comparison:

Cost of Mixer for Low Production Rates: Batch Mixing is slightly less expensive

Cost of Mixer for High Production Rates: Continuous Mixing is less expensive and savings increase as production rate increases

Dough discharge into a usable loaf size. This is an often overlooked point for cost comparisons of batch to continuous mixing. The batch mixer makes large “batches” of dough. Because these large batches are not in a usable form, additional equipment must be purchased to resize the batches. In addition, the resizing of the dough can result in time delays in the use of the dough, additional shear due to added handling and unnecessary environmental exposure where contamination can occur. The result is additional risk, costs and variation to the product.

Continuous mixing, on the other hand, produces a continuous stream of dough that can be sliced automatically into loaves by the mixer resulting in no additional equipment and a controlled process.

Batch vs. Continuous Comparison:

Cost of Dough Handling: Continuous Mixing is less expensive

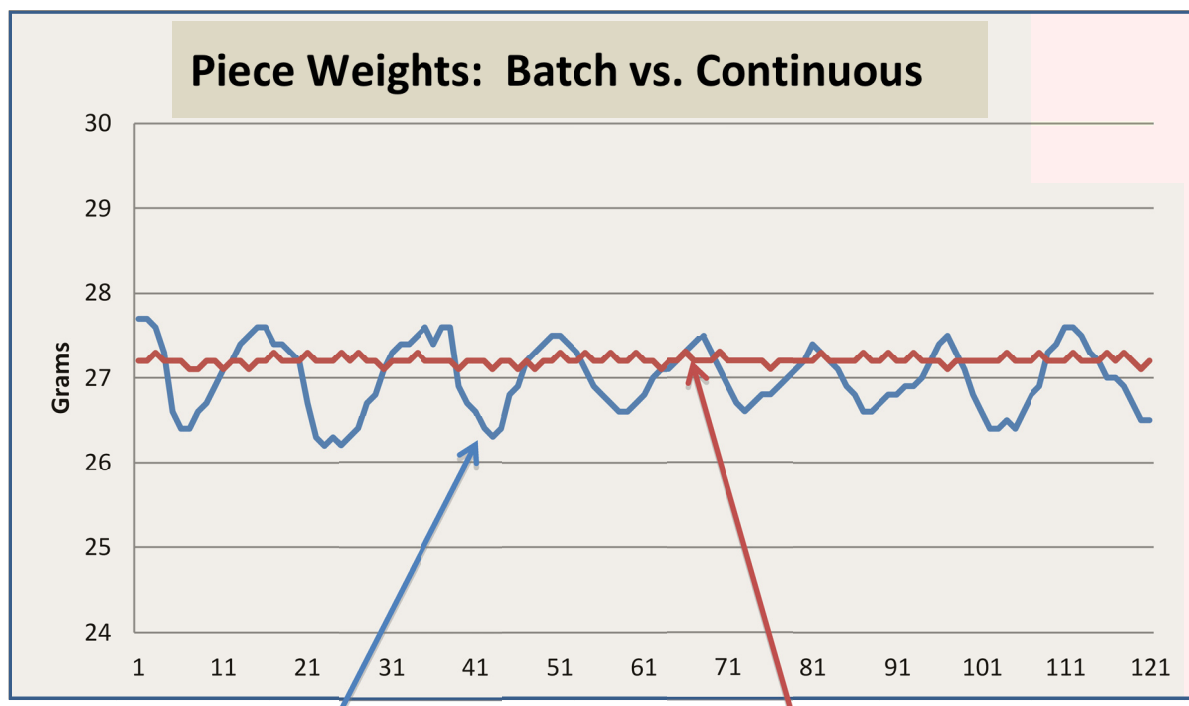
Dough discharge advantage: Strong Advantage to Continuous Mixing.

Quality and Consistency Claims: Batch vs. Continuous

While continuous mixing of dough is readily credited with operational and cost advantages, many bakery operators also select continuous mixing based on the promise of increased product consistency and quality.

A recent study looked at two side-by-side production lines -- the only difference between them was that one line was supplied by a continuous dough system, while the other line was supplied by a batch system. Both lines produced the same small snack products from low-pressure extruders. This arrangement allowed the dough consistency to be determined by measuring the piece weights. Consistent dough would extrude consistently and make consistent piece weights, while inconsistent dough would vary the flow of the dough through the extruder die resulting in varying piece weights. The trial was conducted for one hour on each line. Each weight sample consisted of 20 pieces and a sample was taken every 30 seconds.

As the chart below indicates, the continuous dough production line delivered much more consistent dough. Worth noting is that the wave curve made by the batch mixing weights mirrored the frequency rate of the batch mixing itself.



Variations in Batch Mixing Weights **Variations in Continuous Mixing Weights**

Note: 120 samples each taken over 1 hour

Important Decision Factors

While the decision to select between batch and continuous mixing may seem complicated, it really needn't be. Suitability of application, economics, and operations can be calculated and demonstrated fairly easily. The ultimate suitability of continuous mixing to a manufacturer's operations rests with three factors:

- Production Rate
- Number of Major Changeovers per week
- Technological Preference or Inclination

Production Rate: Continuous mixing is equally applicable at all rates. Continuous mixers come in all sizes, ranging from 300 to 20,000 pounds per hour. A key difference is that for continuous mixers, as the production rates required increase, the costs do not increase at the same pace. The result is larger systems cost much less per pound of dough produced. In addition, there is no increase in labor to produce at higher rates.

Batch mixing costs, on the other hand, increase directly with the production rate of the line.

Number of Major Changeovers per week: With a continuous mixing process, most changes require only that the dough from the first process be pushed out of the mixer with the new recipe. This is particularly true if the only changes are minor modifications to the recipe. However, occurrences such as color changes, which require a thorough cleaning of the mixing system, slow the daily production rate. This results in inefficiencies that make the cost of the system more difficult to justify.

More than two major recipe changes per day on average should be avoided. This is why many manufacturers target lines with the longest product runs for continuous mixing processes.

Technological Preference or Inclination: To get an idea of one's particular inclination toward technology, just look around your plant. Is the general operation of the plant based on labor or automation? Are PLC controlled processes common in the plant? Does your plant have an active preventative maintenance program? Is your ingredient inventory computer controlled? Or, would you like for your plant to function this way?

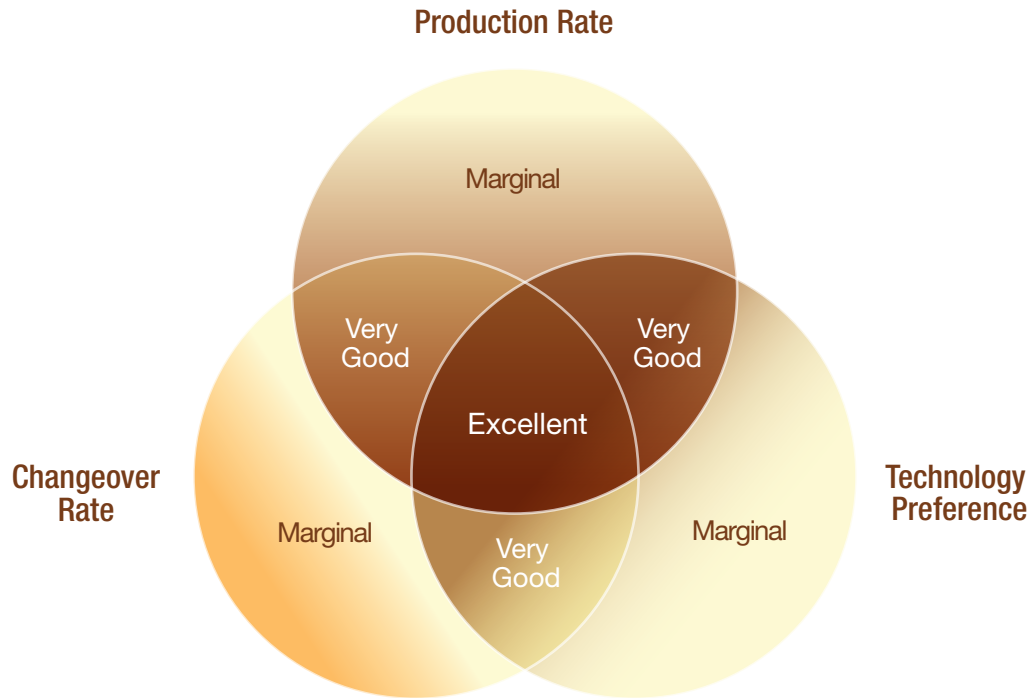
The following chart provides a handy reference guide for determining the suitability of continuous mixing for your particular operation. The chart depicts three circles. The Production Rate circle (top) shows operations ranging from low production rates to high production rates. The Technology Preference circle (lower right) depicts operations ranging from a low technology preference to a high technology preference. The Changeover Circle (lower left) indicates frequency of changeovers.

The "sweet spot" – where all three circles overlap, represents the optimum environment for a continuous mixing process: Fewer Changeovers, High Production Rate, and a High Technology Preference.

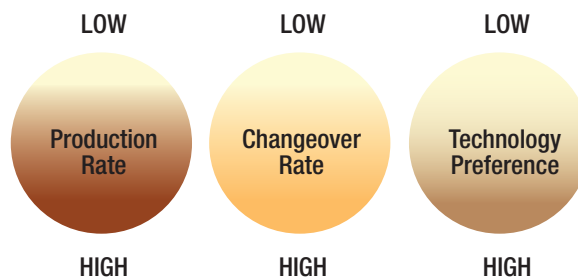
The closer your operation is to the center of the chart, the more valuable continuous mixing will be to you.

Continuous Mixing Suitability Chart

(Center of Chart Represents Maximum Suitability)



**Ideal conditions for excellent continuous mixing applications:
high production rate, low changeover rate and high technology preference**



In future articles, I will be exploring in further detail many of the issues and options that professional bakers and manufacturers should consider when planning improvements or upgrades to their existing processes.

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