EXACT MIXING

BY READING BAKERY SYSTEMS

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Product Consistency Comparison Study: Continuous Mixing & Batch Mixing

By:

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Baked snack production lines require mixing systems that can match the throughput requirements of the forming and baking equipment. Producing a steady flow of dough production is the primary criteria for choosing the type and size mixer to supply a production line. However, despite the forming, shaping, and baking done to the dough throughout production, the quality of the final product relies heavily on the consistency of the dough supplied to the processing equipment. This is because the dough density, moisture content, and other variables impact the way production machines are able to properly process each product piece. Maintaining the exact same characteristics in the dough from the start of production through final shut down is the key to maintaining consistent and repeatable product quality.

There are two main types of mixers available for large scale production today: batch and continuous. Batch mixers enjoy wide acceptance throughout the industry as a simple and effective way to turn raw ingredients into production quality dough. Continuous mixers are a newer and more sophisticated answer to dough production and represent a less labor intensive solution.

BATCH MIXER

Ingredients are loaded into the main bowl or mixing chamber at the same time at the beginning of the mixing process. A paddle or arm is rotated through the ingredients within the bowl for a specific length of time and at a specific speed. At the end of the mixing cycle the batch of dough is collected out of the bowl and loaded into the production line.

CONTINUOUS MIXER

Ingredients are continuously metered and fed into the mixer via chutes and hoses connected to the mixing chamber. A shaft with various mixing elements attached to it runs along the length of the chamber and combines the ingredients consistently until they are discharged as dough loaves at the end of the chamber. The loaves are fed directly into the production line.

Each type has some obvious benefits, but determining which one produces a significantly more consistent dough is difficult. Simply testing the dough produced from either system without passing it through a production environment would only isolate the mixing process itself. Unfortunately, no production line would employ both mixing systems simultaneously and very few exist that have a.) switched from one system to another and b.) maintained accurate historical data for the same type of product using the same forming equipment.

However, a test was conducted at a plant where two identical production lines were making similar products using the same type of dough, but with a different mixing system at each line – one was batch mixing and the other using a continuous mixer. This test compared the weights of the product after forming, but before baking to measure the dough consistency over time. The weights were tabulated and compared against one another in the charts that follow.

Product Weight Fluctuation Test

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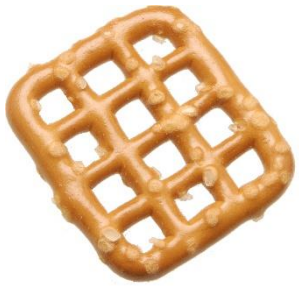
This test examined the product piece weight variation over time between two similar products produced on two very similar production lines. The purpose of this test was to determine whether there was a significant variation due to differences in the mixing process. Both production lines used the same model and size low pressure extruder to form a pretzel product. Line A used a high speed batch mixer in conjunction with a loafmaker to feed the extruder. The extruder on Line B was fed directly by a continuous mixer.

PRODUCTION LINE A: Checker Pretzel



PRODUCTION LINE B: Stick Pretzel

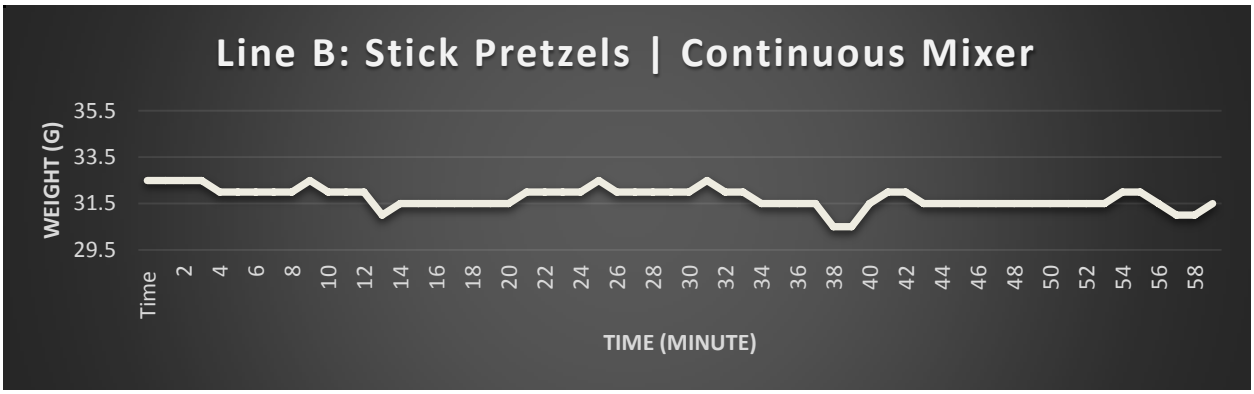
After the dough was formed into the actual pretzel pieces by the extruder and dispensed onto the proofing conveyor, samples of the product were weighed over time to determine the difference in weight fluctuation between the two mixing systems. Over the course of an hour the number of pieces of product (12 checkers and 23 sticks respectively) that should weigh 32 grams was removed from each line and the weight was recorded. The charts on the following page show the weight variation over time.

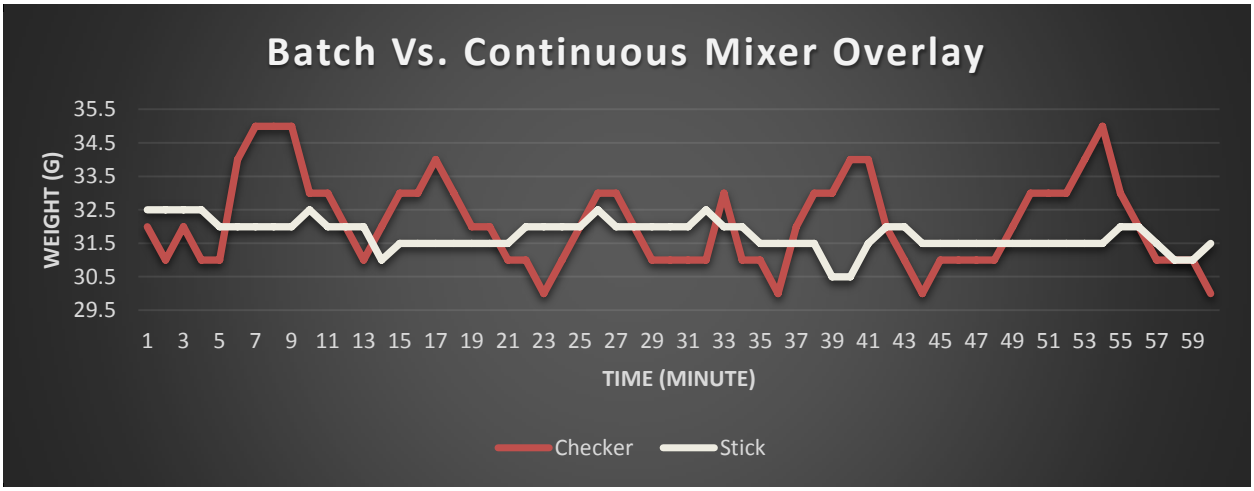
Line: A **Product:** Checker Pretzel **Mixer:** Batch **Pounds / Hour:** 1200 **Sample:** 12 pieces (32 grams) / minute **Average:** 32.12 grams **Standard Deviation:** 1.11

Line: B **Product:** Stick Pretzel
Mixer: Continuous

Pounds / Hour: 2390

Sample: 23 pieces (32 grams) / minute
Average: 31.75 grams
Standard Deviation: 0.45





Conclusion

The stick pretzel product run on the line fed by the continuous mixer shows significantly less sample weight variation over time. This can be seen in the final overlay chart showing both weight variations relative to one another. It can also be shown in measuring the standard deviation from the average weight. The continuous mixer line (.45) showed less than half the amount of variation as the batch mixer line (1.11).

This variation may seem slight when weighed at the individual piece level, but when this variation represents the variation across the width of the production baking band – and over time – it becomes clear that this can add up to large deviations for the rest of the equipment. In particular, the oven may not be able to maintain an even heat balance as it removes moisture from the product. This will impact

not only the fuel used over time, but the product quality itself since the consistency of the heat transfer will impact the type of product characteristics most often measured by consumers.

Creating dough in discrete batches will always introduce slight variation from batch to batch. While these may seem manageable they will always lead to inconsistency over time. Trying to manage quality while chasing these variables will add to the already higher – and ongoing labor cost of batch mixing. On top of the inherent variation introduced by the mixing process itself, batch mixing implies that the batch of dough will spend some amount of time waiting to be processed after being mixed. The dough will change over that period of time due to aging, environmental conditions, and the interactions of the dough ingredients. The consistent frequency of the 'peaks' in the batch mixing chart suggests when these times occurred.

Continuous mixers can represent a significantly higher initial capital investment, but over time they require much less labor to operate and clearly show a greater consistency even at significantly higher production rates.

It is in the best interest of the manufacturer to integrate components into production that actively promote consistent product characteristics. Continuous mixing represents a much more consistent solution to high capacity and high quality production.

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