



SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)



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Unit-II Bakery Machinery & Equipments

Bulk Handling of Ingredients

Dough mixing is a process in which flour and water are mixed until gluten is developed, a result of the enhanced interaction between dispersed and hydrated gluten-forming proteins. It's quite different from batter mixing due to differences in their respective formulation specifically, the proportion between dry and liquid ingredients.

Types of mixer

There are five main types of mixer, each with advantages for particular products and applications: Vertical spindle mixers, High speed horizontal mixers, Horizontal mixers for cookie doughs, Continuous mixers and Planetary mixers.

Vertical spindle mixers

These mixers use a mobile dough tub into which the ingredients are fed and the vertical spindles are either lowered into the tub or the tub is lifted to the spindles.

Vertical spindle mixers are widely used for fermented crackers, particularly soda crackers. The dough is mixed in the tub and the tub can then be transferred to the fermentation room. After fermentation, the dough tub is brought back to the mixer for the final stage of the mixing cycle. All the ingredients are fed to the tub from a weigh hopper or manually. In a two stage mixing process for soda crackers, additional ingredients may be added before the final mix.

The mixing action is slow and thorough and generates little heat. Hard doughs may require a total mixing time of 60-90 minutes to develop the gluten sufficiently.



Horizontal High Speed Mixers

This type of mixer is very widely used for a variety of snack crackers, semi sweet doughs and short doughs.

The main dry ingredients may be fed from an automatic weigh feeding system mounted above the mixer. Water and other liquid ingredients may be metered and fed automatically. Typically small ingredients are fed to the mixer bowl in a half tilt position by hand.

The mixer bowls are stainless steel with a water jacket through which cold water is circulated. For special snack products, heated jackets may also be used to gelatinise potato starches.

The bowl tilts to discharge the mixed dough. The tilt may fully invert the mixer bowl to allow automatic discharge of dough directly to a hopper below the mixing floor for feeding the sheeter of the forming equipment.

Baker Perkins mixer capacities range from 450kg to 1100kg. Two speed machines have timers to set times at slow speed (30rpm), then high speed (60rpm). Alternative drives are variable speed.



Some hard doughs are mixed to a pre-set temperature. The mixer blade provides a vigorous extruding and shearing action to develop the gluten web and this action results in an increase in temperature. The dough temperature is monitored by a thermocouple in the wall of the mixer bowl.

The shaft-less mixer blade design gives an end to end mixing action to incorporate all ingredients evenly including those fed in small quantities. It avoids dough adhering to a central shaft, which is not fully incorporated in the dough mass on discharge. Horizontal mixers from Spooner Vicars have a helical “Sprag” mixer blade, which allows the temperature sensor to be incorporated in the centre of the dough mass.

Horizontal mixers for cookie doughs

Sigma Arm mixers have been an industry standard for mixing cookie and biscuit doughs for many years. Mixers have stainless steel construction, fully tilting bowl with water jacket for temperature control and two speed drives or variable frequency drive.

Continuous mixers

Continuous mixers have been successfully used for a wide range of cracker, biscuit and cookie doughs. They are supplied with fully automatic ingredient feed systems and usually for single purpose production lines.

The LDX Continuous Mixer combines all minor ingredients and a portion of the required flour in the first mixing stage. In this stage, special mixing elements cut the fat into the other ingredients. In the final stage, the remaining flour is added to create the final dough. This mixer is ideal for most types of cookies or any application where ingredients are blended before flour is added.

Planetary Mixers



Tonelli Planetary Mixer

The mixing bowls are mobile and ingredients may be fed remotely.

The mixer may be fitted with suitable interchangeable tools for a variety of applications, including cookies, cakes and creams. The planetary mixing system uses one or two mixing tools with a scraper. These are rotated on a pre-set planetary system to suit the product. The mixing speed of the tools and the rotation are separately driven.

The mixer has a facility to inject air into the mix to create a light, low density cake batter.

The dough may be transferred by pump or by lifting and tilting unit to feed the hopper of a depositing machine.

DOUGH DIVIDING

What is dough dividing?

After mixing, dough dividing is the next step in a bread production plant. Dough dividing implies the transformation/portioning of bulk or large masses of dough into countable or single pieces of dough that can be better handled and/or manipulated throughout the production line. Dough dividing is also the first step in the make-up stage.

It can be carried out manually or mechanically to consistently produce:

- Desired dough size
- Correct dough shape
- Set dough weight
- Dough texture for entry into the rounding step¹

How does dough dividing work?

Dough pieces are divided volumetrically. This means, the bulk mass of dough is conveyed via a screw feeder. The rotating speed of the screw or dough pump determines the rate or mass flow of dough to be divided. The volumetric processing makes dough consistency and density vital factors for an accurate operation.

The dough is cut or divided into single pieces either by:

- Filling a chamber or barrel with a bulk mass of dough, and then cutting off and pushing the excess (piston dividing)
- Forcing a bulk mass of dough through an orifice at a fixed rate, and cutting protruding pieces from the end at regular intervals (extrusion and knife dividing)²

The specific weight of the dough pieces are usually set 13–15% heavier than the finished product weight to compensate for:¹

1. Fermentation losses caused by yeast metabolism
2. Baking losses due to evaporation of water and ethanol solutions
3. Losses during cooling due to evaporation of water

This is a key adjustment since the product must comply with labeling regulations and conform with in-house weight checks before being shipped to customers.

Dough dividing is essential for the production of yeast-leavened bakery products such as:

- Buns
- Rolls
- White pan bread
- Whole wheat pan bread

Dough dividers intended for high-speed or large-scale production bakeries are equipped or fitted with automatic weight-checking mechanisms to check the dough at the beginning, middle, and end of each batch, or monitoring weight in a continuous fashion.

The running speed of dough dividers can be set manually by a human-machine interface (HMI) or centrally pre-set, according to the production line speed.

Common adjustments to dough dividers include:

- Conveying speed of screw or dough pump
- Conveying speed of belt
- Cuts per minute or knife speed
- Amount of pressure in the chamber or barrel (using manometer reading)

Equipment used for dough dividing

- Rotary/extrusion dividers
- Piston dividers
- Ram and knife dividers
- Pocket dividers
- Stress-free dividers

Bulk dough conveyed by a belt, sheeted to a certain thickness, and then cut lengthwise to produce a series of long ribbons. These are then gently portioned and rounded in the same piece of equipment. Stress-free dividers reduce or minimize the mechanical stress and strain forces that dough usually withstands during dividing.



DOUGH SHEETING

What is Dough Sheeting?

In baked goods production dough sheeting is the act of flattening a dough piece. The starting dough piece can be used for either pan bread or laminated products.

- Sheeting can be done mechanically using dedicated machines, or manually.
- The most basic design for a dough sheeter consists of two stainless steel rollers between which the dough is passed for sheeting instead of rolling by hand with a rolling pin.

How it works

In breakmaking bakeries, a sheeter consists of a series of gauge rolls (usually two sets) that gradually transform a rounded dough piece into a dough disk. The dough piece is then curled and molded into a cylinder- or loaf-type piece that suits pan dimensions for final proofing.

Dough sheeting for optimum crumb grain

Dough sheeting modifies the original arrangement of polymeric gluten strands by extending or stretching them on a horizontal axis due to compression forces. Ideally, the dough piece is sheeted out as thin as required without tearing the dough, bursting gas cells, or damaging the gluten network, both key aspects for optimum gas retention during proofing and baking.¹

Besides the obvious effect on dough shape, one key purpose of sheeting is to subdivide the gas cells incorporated and trapped in the dough during mixing. Thanks to gas cells subdivision, provided proper emulsification, coalescence phenomena in the expanding dough is further limited so a finer crumb grained and blisterless product can be achieved in the baked product.

Application

Pan bread dough sheeting

After bulk dough has been divided and rounded, the dough ball enters the sheeting equipment. In high-speed bread lines, a sheeter consists of two sets of gauge rolls, a top (head) and a bottom set.

The gap between top rollers is wider than that in bottom rollers to accommodate the initially much thicker dough piece. The setting of head and bottom rolls depends on the size (scaling weight) and condition of the dough piece. Thus, a 23 ounce (650 g) dough piece will require the rolls to be set farther apart than a 18 ounce (510 g) dough piece.

Loose sheeting rolls yield thick dough sheets (disks) that will not produce a sufficient number of curls upon rolling (3 to 4 rolls are suggested for standard pan bread). In some cases, loose sheeting rolls can create blisters on the surface of the moulded dough piece.

The physical condition of the dough leaving the divider and going into the makeup stage is of vital importance for its performance during sheeting and moulding. In flourless makeup lines, a deformable, highly extensible and somewhat dry dough is essential to prevent dough from sticking to conveyor belts, rollers and pressure boards at the moulder. A properly formulated and mixed dough will be easy to round, sheet, curl and mould to produce well-shaped, uniform loaves.

Roller adjustments during sheeting

Sheeting roll set is too open (gap too wide)	Sheeting roll set is too tight (gap too narrow)
<ul style="list-style-type: none">• The dough sheets are thick and do not produce a sufficient number of curls per piece upon rolling• Dough sheets will be oval shaped with an uneven cell structure• Blisters will occur on the surface of the moulded dough piece• The finished product will have a coarse grain structure and the appearance of large holes in the crumb	<ul style="list-style-type: none">• The dough pieces may tear• Dough can become misshapen

Sheeting roller considerations in high-speed bakeries

- The condition of the rolls should be checked on a regular basis. There should be no dents or build-up of dry dough on the rollers.
- The scrapers on each set of rollers should be set to specifications by the engineering and maintenance personnel to allow the dough piece to be pulled away from the rollers without tearing. The scrapers should be kept clean and free of build-up. The equipment should be locked-out prior to removing the guards.
- Rollers are generally made of Teflon to avoid dough stick-up or build-up and to lessen the amount of dusting flour needed.