

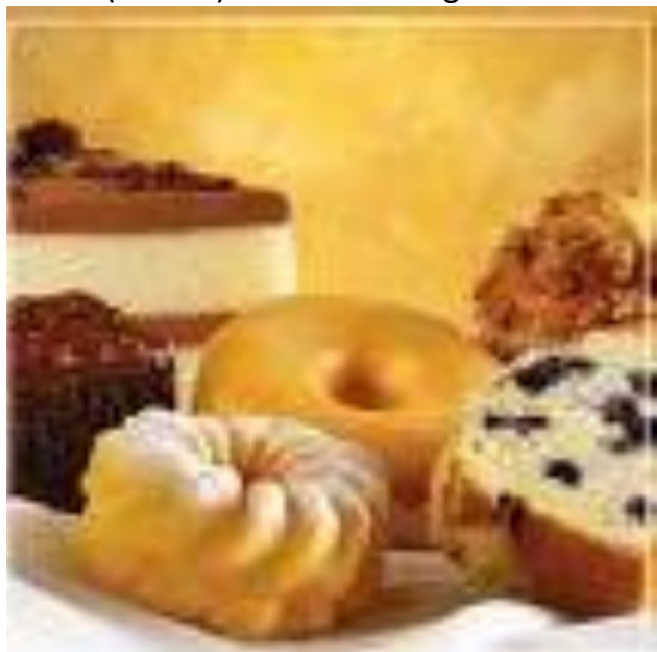
Bakery Manufacturing Processes

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This report consist of following automated manufacturing process for mass production which includes .

- Biscuit Manufacturing
- Bread Manufacturing
- Cake Manufacturing
- Wafer Biscuit Manufacturing
- Rusk (Toast) Manufacturing



Introduction

Product Range

Bakery products contain high nutritive value and are manufactured from wheat-flour,

sugar, baking powder, condensed milk, fat, salt, jelly, dry fruits, various essences and

flavoring etc. Different type of bakery products can be classified as:

Dry Bakery Products

- Biscuits: Soft biscuits, hard biscuits, cookies, crackers, fancy biscuits, cream wafer biscuits.

Moist Bakery Products

- Bread: Sweet bread, Milk bread, Masala bread, Garlic bread, Fruit bread etc.
- Buns: Fruit buns, hamburger buns, dinner rolls, crisp bread, pizza.
- Others: Cakes, pastries, doughnuts, muffins etc.

Other popular bakery products are Bagels , Waffles , Tortillas , Pretzels , Pies , Cup Cakes , Swiss Rolls , Puffs , Rusk

Popular among these and which are now highly automated for mass production is biscuits, cookies, bread, cakes and wafer biscuit. We can find these bakery products all

across globe with variants as per local taste.

Growing popularity of these products had made investor, entrepreneurs and business

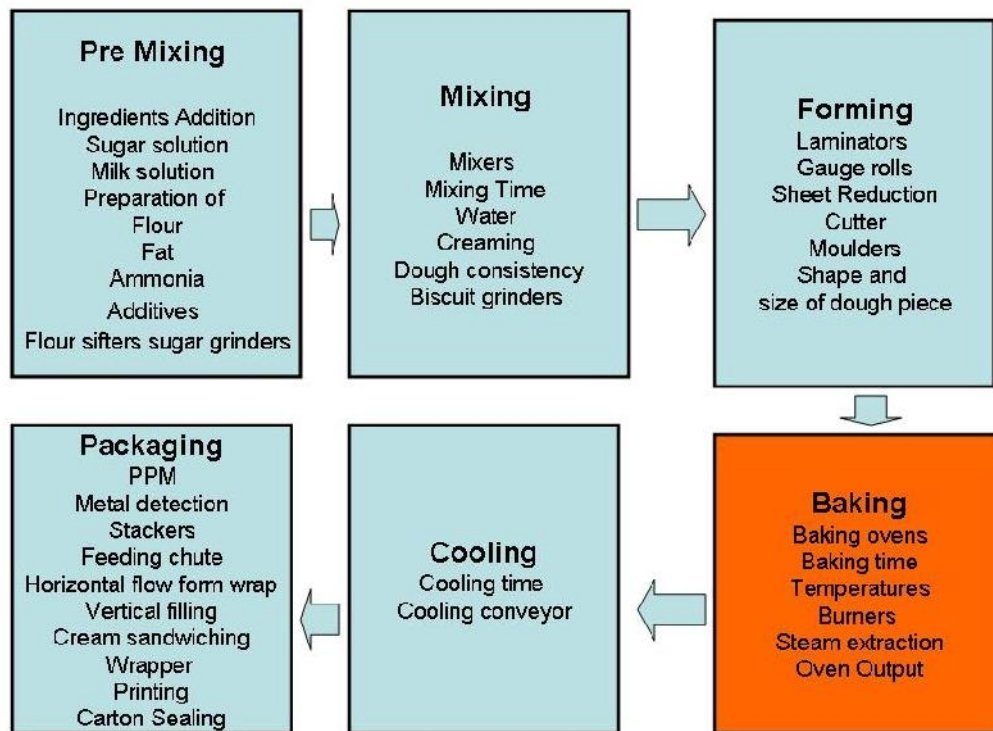
owners putting huge investments in bakery plants . This report would help people interested in bakery business to under stand the basic manufacturing principle of bakery products .

Biscuit Manufacturing

Biscuit Manufacturing Flow Diagram



Biscuit manufacturing flow chart



A).Biscuit making process

MIXING: This is a process where all ingredients are put together in right proportion for dough formation. These ingredients are then fed into Mixers where mixing is done and dough is prepared for moulding/cutting .Major ingredients are flour, fat, sugar and others as per the product one would like to have. Mixing time varies from 8-12 min depending various factors . Mixing is done in two stage by preparing cream (fat and sugar) first and then mixing it with other ingredients .

MOULDING: In this section we laminate the dough into sheet, which then passes down to gauge rollers, and sheet thickness is achieved for moulder/cutter. Here we have a cutter or moulder as per the variety where one gets the shape and sizes of biscuits.Cutters for

hard dough biscuits and moulders for short dough variety

BAKING: This is the area where we pass these moulded wet biscuit into baking oven

.The biscuits are baked on desired temperature s. various type of heating are available

now days as per the convenience and cost. Different type ovens are available .

Every

product has different temp profiles . It varies from 180 deg c – 280 deg c with time

varying from 3 min to 8 min .

COOLING: These baked biscuits are then passed on to cooling conveyors for natural

cooling prior too packing .The temperatures are brought down to room temperatures

PACKING: These biscuit are then stacked and fed into packing machine for packing

Different packing material are available for packing of these biscuit in different packs

slug packs , pouch pack or family packs etc.These packs are then put into secondary

packaging like cartons to be transported to retailers.

B). Biscuit Ingredients

Following are ingredients used in biscuit manufacturing .Ingredients varies from product to product . Various type of biscuits are Glucose , Marie , Cookies , Nice , Salty & Crackers .

Biscuits are categorized into following type

By nature

Hard Dough – It's characterized by hard bite and requires cutter to cut biscuits from

laminated sheet of dough . Marie , Crackers

Short Dough – It's characterized by soft bite and requires moulder are required to shape

biscuits in dies - Cookies

By Taste

Glucose or Plain

Sweet

Salty

Semi – sweet

Others

Cream Biscuits

Enrobed Biscuits

Enriched by additives like pistachio , cashew , choc chips

Following are few major ingredients

Flour

Fat (Vegetable Shortening)

Sugar

Salt

Yeast (Cracker variety)

Sodium Bicarbonate

Ammonium Bicarbonate

SMP(Skimmed Milk Powder)

Flavors

Colors

Biscuit powder (biscuit powder generated from loose biscuits)

Sodium Meta Bi Sulphide

Soya Lecithin

Citric Acid

Liquid Glucose

Whey Powder

Maize Starch Powder .

Biscuit Manufacturing Equipments (Plants)

I have listed equipments required for biscuit plant . smaller bakeries would go for slightly different equipments .

- Bulk Handling System for Ingredient

Flour

Fat

Sugar

Liquid

- Z-Sigma type mixers/ Continuous Mixers
- Dough Tilters (or through gravity for feeding it into either
- Laminators – Vertical Or Horizontal
- Pre – sheeter or Dough Crusher (Short dough variety)
- Gauge Rollers
- Cutter or Molding Unit as per dough variety
- Relaxing web

- Swivel Panner Web
- Tunnel Oven or for smaller bakeries Rotary rack ovens with combination of dough sheeters and Depositors and cutters
- Stripper conveyors
- Cooling Conveyor
- Metal Detector
- Magnetic Stacker



- Packing Table
- Packing Machine - Horizontal Flow Wrap

Apart from basic equipments such as biscuit oven , mixers , laminators , packaging machine which are used by large biscuit manufacturers in their automated biscuit production line there are certain equipment requirement specific for certain varieties . We

can call them accessories to the main biscuit production line .These are either permanently installed on the line or can be fitted on the production line during change

overs .Varieties like Crackers , Cream , Nice , Milk and for additives like cashew , pistachio and other nuts would require these additional equipment on the biscuit production line.

To make your plant truly versatile you need to ask your biscuit plant and machinery

manufacturer to make the plant for hard dough and short dough variety or in other words

biscuit plant which can produce cutting and molding variety .

Following equipments are

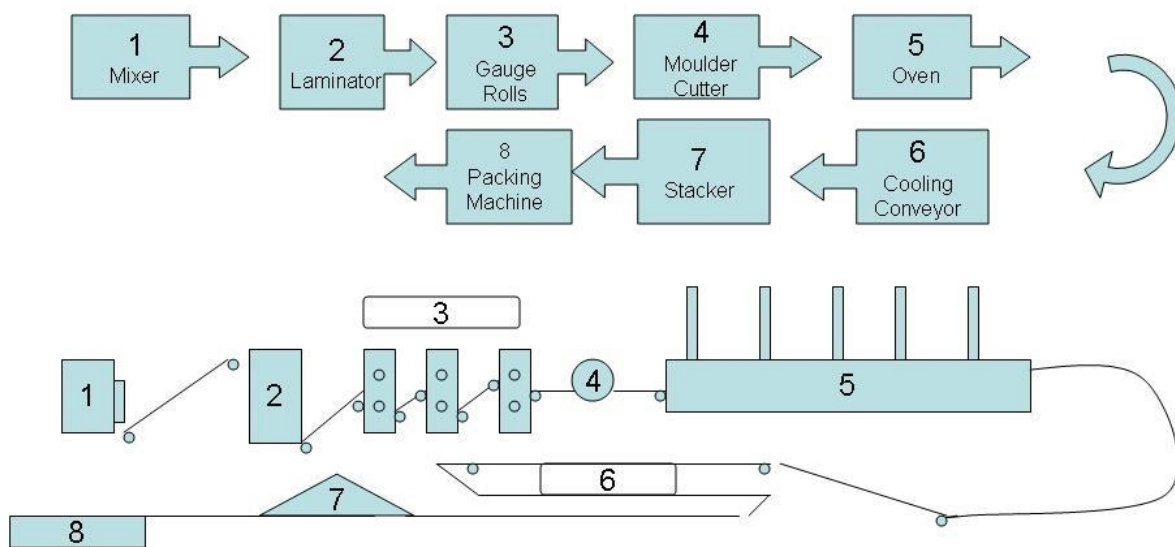
- Oil spray unit
- Milk spray unit
- Flour dusting unit
- Cashew or Nut sprinklers

- Salt Sprinklers
- Sugar Sprinklers
- Biscuit Grinders
- Sugar Grinders
- Creaming Unit
- Depositors
- Milk Storage and preparation unit
- Emulsifiers
- Tanks and vessels for Invert syrup preparation
- Planetary Mixers for cream manufacturing (Cream Biscuits)

When installing biscuit production line check for above mentioned equipments and make arrangement for them .

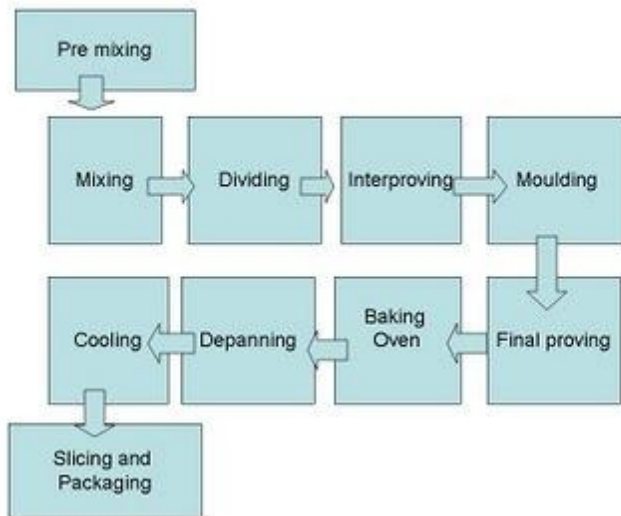
Plant layout for biscuit plant

Biscuit production line layout



Bread Manufacturing Flow diagram

Flow chart for bread manufacturing process



Stages in Bread Manufacturing

- Preparation of ingredients
- Dough mixing
- Bulk fermentation, sponge or floor time
- Dividing (scaling)
- Rounding

- Molding
- Panning
- Baking
- Cooling
- Slicing and packaging

Bread manufacturing process

Preparation of Ingredients:

- Check and obtain ingredient
- Sieve and weigh flour
- Sieve and weigh dry ingredients
- Check temperature
- Prepare water

Dough Mixing and Development:



DOUGH MIXING

This refers to the force applied mechanically or manually on flour, water and all other ingredients, allowing insoluble components of flour to hydrate, forming the structure of the dough and proper hydration of the starch, resulting a homogeneous mass.

DOUGH DEVELOPMENT

This usually refers to the phase after the dough is formed allowing protein structure to be stretched and further hydrate to develop into gluten by means of mechanical force or chemical agents or extended fermentation. The dough is developed to the optimum level sufficient for good gas retention.

Dough Mixing & Dough Development- Objective

- Distribute all ingredients evenly
- Hydrate the ingredients
- Form and develop protein (gluten)
- Incorporate air into the dough
- Forms homogeneous dough of correct consistency

Dough Mixing Methods

LOW (SLOW) SPEED

Single and double arm mixers are most common examples. By gentle kneading, stretching & folding the dough develops. Dough produced by such mixers requires some bulk fermentation or floor-time to mature the dough.

MEDIUM SPEED

Dough is developed by mechanical force and generates more friction resulting high dough temperature. Common examples of such mixers are Spiral Mixers, Planetary Mixers and Horizontal Mixers.

HIGH SPEED

Dough development is achieved in a very short time and chemical agents are used for the purpose. Mixing time is normally 2-3 minutes. Tweedy Mixers and Indian High-Speed

mixers are typical examples.

BULK FERMENTATION– Objectives:

Straight Dough and Sponge Dough

- Biological changes in dough mass and action of fermentation over extended period.
- Form and develop protein (gluten)
- Improves dough stability
- Enhance natural flavor/aroma

Dividing, Rounding and Intermediate Proofing:

DIVIDING

Dividing the dough into desired weights or as per government regulation. Excess gas formed is expelled.

ROUNDING

Seals the dough pieces to a smooth and overall volume and also ensures consistent shape for moulding.

INTERMIDIETE PROOFING

Allows the dough piece to relax after dividing and rounding. Stimulates yeast activity to enhance conditioning of dough piece. Conditions the dough surface allowing good moulding and preventing wear and tear of the surface.

MOULDING – Objectives

- Sheet the dough piece flat
- Curl the flattened dough piece
- Seal curled dough piece
- Straight, Twisted, 4 – Piece or W- Formation shape for dough panning

PANNING – Objectives

- Desired, Convenient and consistent shape
- Means for surface during final proofing and baking
- Means for movement
- Prevents damage
- Enhance oven performance and heat transfer

FINAL PROOFING- – Objectives

- Allow dough piece to relax after moulding
- Stimulate yeast activity
- Ensures the dough piece surface to be conditioned and moist to aid oven spring

- Raise temperature of the dough piece to enhance oven performance

BAKING – Objectives

- Formation and expansion of gas
- Trapping of gas in the gluten network
- Change the properties of starch
- Change the properties of protein
- Formation of crust and browning (caramelisation)
- Achieve and set desired volume
- Develop flavor and crust characters
- Gelatinise starch and set crumb structure
- Alter properties of protein
- Stops action of yeast and enzymes
- Controls moisture content of crust and crumb
- Makes the food microbiologically stable food

DEPANNING & COOLING

- Remove baked products from oven and pan
- Cool baked products sufficiently to enable slicing and or wrapping or packaging without damaging the product
- Reduce contamination or possible microbiological spoilage

Packaging - Objectives

- Protect baked product from external contamination and damage
 - Provide suitable medium containing, handling, transport
- And use of product
- Retains moisture and aroma
 - Provide suitable method for labeling, identification, promotion and information



Bread Ingredients

Flour

Vegetable shortening

Sugar

Salt

SMP

Butter

Yeast

GMS (Glycerol Mono Strate)

Bread Improver – enzymes

Ammonium Chloride

Ascorbic Acid

Potassium Bromate

L- cystiene

Dough Conditioner

SSL

Calcium Propionate

Acetic Acid

Bread Manufacturing Equipments

Bread manufacturing requires certain specific equipments and machinery to produce

bread . Listed are equipments required for bread manufacturing in very large volumes .

Premixing

Flour Handling system

Sugar Grinders

Mixing

Mixers - Spiral

Proving and Forming

Divider

Hander Up

Inter Proofer and final proofer

Moulder

Mould trays

Boilers

Baking

Ovens

Depanner

Cooling Racks

Packing

Slicer

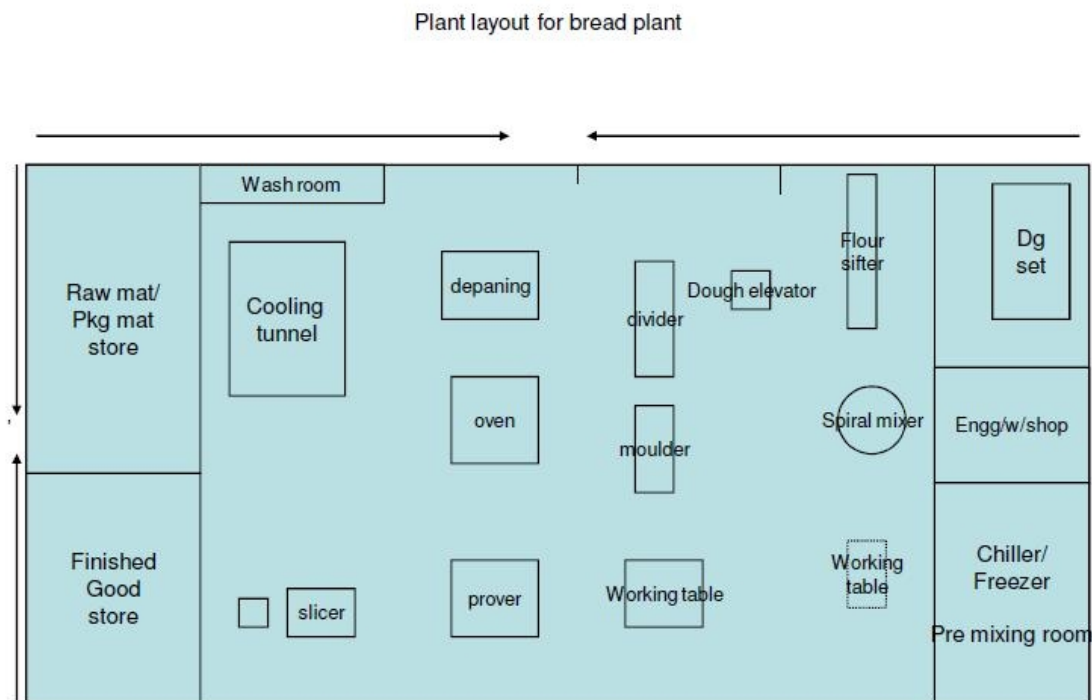
Packing Machine

Printing Machine

With other material handling equipments and utility

Plant layout for bread manufacturing

Plant layout for bread manufacturing



Plant layout for bread plant

Flour

sifter

Spiral mixer

Working

table

Dg

set

divider

Dough elevator

moulder

prover

oven

Working table

Raw mat/
Pkg mat
store
Finished
Good
store
Cooling
tunnel
slicer
depaning
,

Utility
area
Chiller/
Freezer
Pre mixing room
Engg/w/shop
Wash room

Cake Manufacturing



The process described here is for bar cakes which are sold in either as bar cakes or slice cakes

MIXING: This is a process where all ingredients are put together in right proportion for batter formation. Its like viscous paste Ingredient are then fed into Planetary Mixers

where mixing is done and batter is prepared for panning .Major ingredients are flour , fat ,sugar , eggs , emulsifiers , leavening agents and others additives as per the product

one would like to have. Mixing time 5- 10 min

PANNING : In this section we the batter into baking pans/ moulds with different sizes

as per product requirement baking papers are used on pan to prevent product to stick to

the surface of the pans , which then passes down to oven .

BAKING: This is the area where we pass these moulds into baking oven .The biscuits are

baked on desired temperature s. various type of heating are available now days as per the

convenience and cost. Different type ovens are available. Most popular ovens now days

are rotary rack ovens and contray ovens . Baking time – 20-25 min Baking temp – 165-

175 deg c

COOLING: These baked biscuits are then passed on to cooling chambers for cooling

prior to packing .The temperatures are brought down to room temperatures

DEPANNING : After baking the moulds are taken out from oven and cake slabs are extracted from moulds either manually or through depanner s.

PACKING: Baked cake slab is then taken out of and then passed to slicer. These bars

are again passed on to cake slicer for packing. These slices are then packed in horizontal

flow wrap machine .Various packing materials are used for packaging .Different packing

are available .single slice pack double slice pack sliced bar cake bar .Varieties available are fruit cut, cake milk , cake orange cake chocolate ,plum cakes etc.

Cake Ingredients

Flour

Fat (hvo)

Sugar

Egg

Butter

Invert Syrup

Fruit Cuts

Humectants

Invert Syrup

Emulsifiers-Margarine

Corn Flour

Sodium Bicarbonate

Salt

Preservatives – Sorbates , citric acid

Acidity Regulators –Acetic acid , tartaric acid, fumaric acid , lactic acid

Anti Oxidants – lecithin ,calcium/potassium/sodium lactate

Flavors

Colors

Cake manufacturing equipments

Planetary Mixer

Moulds

Racks

Ovens – Rotary rack oven , convey oven

Cooling Chamber

Slab Slicer

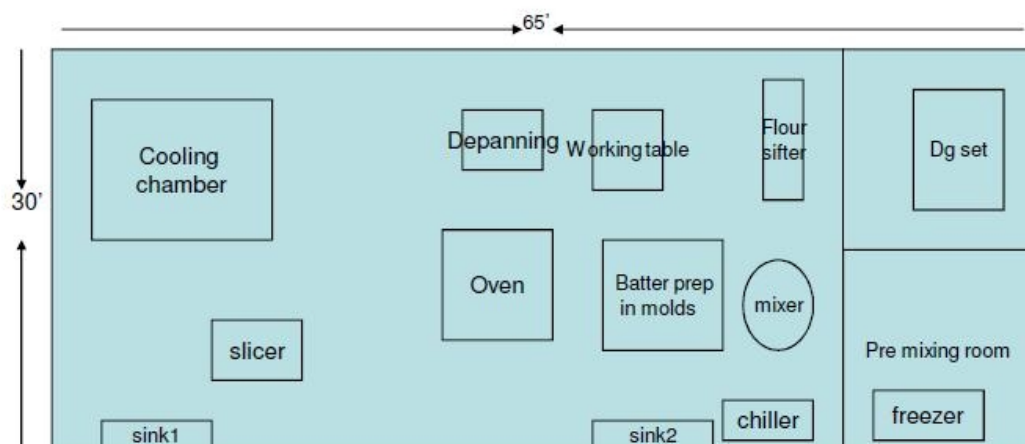
Slicers

Packing machines

Plant layout for cake manufacturing

Plant layout for cake manufacturing

Plant layout for bakery unit



Plant layout for bakery unit

30'

65'
Dg set
mixer
Flour
sifter
Oven
Depanning
slicer
Working table
Batter prep
in molds
Pre mixing room
Cooling
chamber
chiller freezer
sink1 sink2

Wafer Biscuit Manufacturing

MIXING : Batter preparation First step in wafer mixing is to prepare batter ;wheat/ flour(low gluten type)is mixed with water and other ingredient sin batter mixer to get thin batter of suitable consistency .Mixing time could be 2- 5 Minute batter is then transferred to batter storage tank from where it can be transferred to baking plate.

Cream Preparation: Creams are prepared in mixers where ingredients like flavors, colors, and whey powder and soya lecithin are added. Cream of suitable consistency is prepared.

Various types creams are popular in wafer biscuit are chocolate s , milk , caramel orange , banana , strawberry , hazelnut and others .Cream preparation could take place between 10- 12 mins. Cream then can be transferred to reservoir.

BAKING: Batter is then pumped and spread on to baking plate by help spreading nozzles. These plates then moves into baking zone of the oven. Temperature maintained

for baking these wafer baking plates is between 175 - 200 deg c. The baking time kept is

1.75 - 2.0 min. Capacity of oven can be from 50 - 100 plates. Size of plate can also vary

from 400 x300 to 300 x 200 mm and thickness is maintained between 2.5 - 3mm.

Most of

these wafer ovens are electrical oven s. These plates travel upon guide rail and electrical

power is supplied through bus bars inside the oven .Baking plates are in contact with bus

bar through carbon brushes.

CREAMING: These wafer sheets are the allowed to cool down by moving through one or

two arch's .Cooled wafer sheets are then taken to spreading machine. Cream is then

spread over wafer sheets at creaming machines Once the block of 2/3/4/5 layers of

creamed wafer is made , the block is then moved to cooling block

COOLING TOWER: Wafer sandwich blocks are then cooled to harden and creams get

set on wafer block. The cooling block is dehumidified to reduce the moisture absorption

by wafers during cooling. Temperature maintained in cooling block is between 10-15

deg c.

CUTTING AND FEEDING: Fully automated cutting is done at cutting machines

.Here

we can cut wafer blocks in different sizes. These fingers are then passed on to feed

conveyor for packing

PACKING : Horizontal flow are used to pack these fingers .These fingers are packed in

heat sealable moisture proof films for good shelf life . These packets are then packed into

cbbs and sent for dispatch.

Wafer Biscuit Ingredients



Batter preparation

Flour

Water

Soya lecithin

Sodium bicarbonate

Salt

Vegetable oil

Cream

Cream fat

Soya lecithin

Blend(milk blend , caramel , chocolate,banana , orange , hazelnut , coconut)

Sugar

Skimmed milk powder

EQUIPMENTS USED IN WAFER MANUFACTURING

Batter Mixer

Plasticize

Cream mixer

Wafer baking oven

Wafer spreading unit

Wafer Block coolers

Block cutting unit

Wafer Distributor

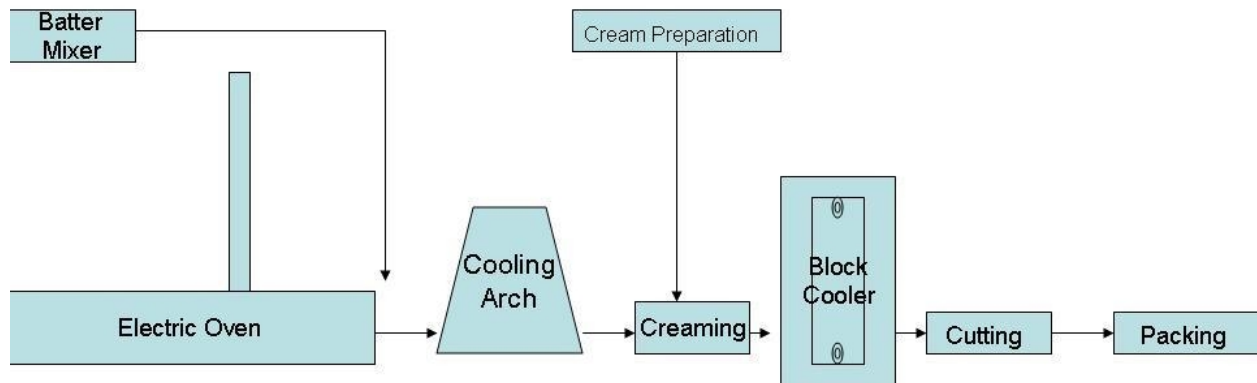
Wafer Packing machines

Plant layout and flow diagram for wafer

Biscuit

Process Flow Diagram for Wafer Biscuit Manufacturing

Mixing → Baking → Cooling → Creaming → Cooling → Cutting → Packing



Rusk Manufacturing Process



Rusk is normally a toast bread where we bake slice of bread twice hence we can say that it's an extension of bread manufacturing with difference in recipe, dimension and moisture content where in moisture is reduced to negligible extent say up to 0.8% for higher shelf life. Several varieties are manufactured such as milk, cardamom and salmonella rusk.

- Preparation of ingredients

All ingredients are weighed as per recipe and fed into mixers as per the sequence of addition . Major ingredients are flour , fat , sugar , Yeast , Invert syrup , whey powder , butter etc.

- Dough mixing

Both methods are used in dough mixing for rusk sponge method and direct feed method without any fermentation time given . In sponge method mixing is done in

two phase with addition ingredients done in two stages with fermentation time of 60

min is given in between . Mixing time varies from 10- 12 min with 10 min slow and 2

min fast in both the stages.

- Bulk fermentation, sponge time

It's part of mixing which we have discussed above . 60 min of fermentation time is given similar to bread manufacturing.

- Dividing (scaling) With Dough Tilter

Dough is then passed out to divider for cutting dough into two equal parts or even three / four pieces of equal weight depending upon the capacity of plant .Tilting device is used to add dough on hopper of divider .

- Rounding

Dough pieces are then passed out to rounding to give it a uniform spherical shape

- Molding

It goes to moulder where it's passed through cylindrical rollers to flatten and then beneath the moulder board to give a cylindrical shape as it becomes dough stick.

- Panning

Dough sticks are then placed into moulds covered with lids for proving

- Proving

Similar to bread manufacturing the moulds are kept on trays for proving for 90 mins

depending upon the baking speed and temp . Humidity and temp are maintained for

yeast activity '

- Baking

After proving where the dough gets rise due to yeast activity in prover and is ready for baking moulds are placed on trays of ovens (swing tray , rotary rack) .

Baking time varies from 25min – 30 min and temperatures ranging from 175 – 185

deg c

- Depanning

Bread is then taken out from moulds either manually or through automatic depanners . Hot breads are then kept on trolleys for cooling

- Cooling

Bread s are cooled down to room temperatures either through natural cooling or forced cooling depending on ambient the cooling time varies from 4 hrs in summer

to 8 hrs in rainy season

- Slicing

Once bread are cooled and have certain degree of stiffness on crust they are ready to be fed into slicing . Normal slice thickness size are 12mm, 14mm .

Slicers are used to cut bread loaves into slice of different size as per bread dimensions and packaging

- Toasting or baking

These are now subject to baking (toasting) . Second baking can be done in tunnel oven to get maximum output . Rotary rack ovens can also be used for second baking . Temp varies from 175 – 185 deg

- Cooling

After second baking rusk are either kept for cooling on trays or made to travel on cooling conveyor for natural cooling .

- Packaging

Rusk are then passed for automatic packing in horizontal flow wrap machines where volumes are high or packed manually in poly bags .

Rusk Manufacturing Equipments

Rusk manufacturing equipments are similar to bread making except for additional oven

for second baking

- Spiral Mixers
- Dough Divider
- Hander Up (coned shaped moulder)
- Inter prover
- Molding
- Final Prover
- Baking oven or Tunnel oven /swing tray oven /rotary rack oven
- Bread Depanner
- Bread Cooling

- Bread Slicer
- Toast Oven - Tunnel oven rotary rack oven
- Product stacking
- Packing Machine
- Metal detectors
- Slice Grinders

Rusk Manufacturing Ingredients

Flour

Fat

Sugar

Salt

Yeast

Whey Powder

Butter

Invert syrup

SMP

Cardamom oil

Cardamom seeds

Ascorbic Acid

Wheat Fiber

Improver

Wheat Gluten

DMG Paste

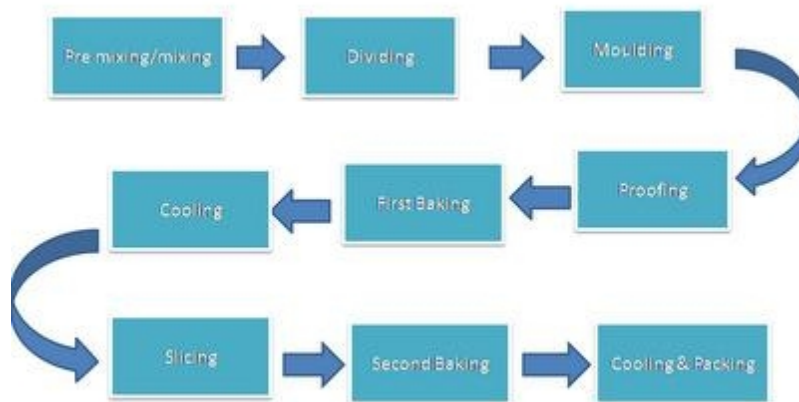
Sooji- Semolina

Water

Process diagram for rusk manufacturing



Rusk Manufacturing Process Flow Chart



Role of Ingredients in bakery manufacturing process

Various Ingredients are used in Bread and Biscuit manufacturing .Each Ingredients has specific role to play during manufacturing process . Here are few major bakery ingredient and their role

Sugar

Primary role of sugar in bread and biscuit is provide sweetness(taste) to the product

.Color to the product due to carmalisation .Color of the crust in bread loaves is due to the

sugar .Basic role of sugar is to activate the yeast to produce carbon dioxide and alcohol

during bread manufacturing .Note: When preparing for mixing yeast is separately being

put into ammonium chloride and sugar solution .

Hydrogenated Vegetable Oil -(HVO)Main function of HVO is to retain the moisture

inside the dough. Give smoothness to the bite.

Salt

It provides taste to the product.

Salt act as controlling agent against wild yeast activity .Thus controlled yeast Activity can

Provide better texture or network .

GMS (Glycerol Mono stearate)-Its act as emulsifier which binds together the oil and

water molecules and it helps bread to hold moisture .

SSL (Sodium Stearoyl lactilate)-It is also known as Smoother .It is a compound which

retains softness in bread and delays staling of bread .

SMP (Skimmed Milk Powder) Solution-Main function of Skimmed milk powder is to

give flavor to the product and sweetens the product.

Ammonium Chloride-Ammonium chloride provides Nitrogen which used to activate

yeast in presence of water and sugar.

Bread Improver-These are used for improving texture of bread and add to the flavor.

Dough Conditioner-These are used to strengthen weak flour and generally enzymes

alpha - amylase .Its added to break down the starch into sugar and alcohol. These are

prepared from fungal sources .

L - cysteine-L -cysteine acts on sulphide groups and proteins and acts as reducing agent .

It mellows the dough .

Ascorbic Acid-Ascorbic acid acts as oxidizing agent which acts upon the sulphide bonds

of amino acid (gluten) which results in stronger bonds which increases resistance and

reduces extensibility of dough.Ascorbic acid reacts slowly and for longer time and is

active even at the baking stage .

Potassium Bromate-Potassium bromate too acts as oxidizing agent the difference between ascorbic acid and potassium bromate is that it's a strong reagent its activity time

is short and reaction is strong.It also helps in increasing resistance of dough and reducing

extensibility. Note : It is interesting to know that both oxidizing and reducing agents are

used in bread. The reason to use both are that we need to get balanced property of dough.

We can make bread without L- cysteine or Ascorbic acid

Calcium propionate-Calcium propionate acts as preservative. Its main function is to

protect product from any fungal infection .Hence increases shelf life of the product. The

quantity of Calcium propionate varies with season. In rainy season quantities are increased.

Acetic Acid-Acetic acid is also used as preservative .It protects products from bacterial

infection . As it reduces the pH of the dough and turns the dough towards acidic side .Its

quantity also varies as per the season.

Yeast - Helps in dough fermentation through breakdown of sugar in presence of water

and flour . Thus releasing gas and alcohol. Gas entrapped in dough are responsible for

texture for bread .

Sodium Bicarbonate- Acts as leavening agent when reacts with acidic component in

dough releasing carbon dioxide thus getting those textures and puff.

Ammonium Bicarbonate – Similar to Sodium Bicarbonate acts as leavening agent

Whey Powder - Add Flavor of milk into baked product

Invert syrup – Better shelf life and moisture retention

Thanks from

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