PROSES PEMANGGANGAN




Tujuan Instruksional Khusus

Setelah menyelesaikan topik ini, mahasiswa diharapkan memahami definisi dan ruang lingkup proses pemanggangan (*baking*) serta aplikasinya pada produk rerotian, kriteria bahan baku, tahapan proses dan kriteria kualitas produk yang dihasilkan.

PEMANGGANGAN

Tujuan:

- perubahan karakteristik sensori (*eating qualities*),
- meningkatkan palatabilitas,
- mengawetkan (menghancurkan enzim dan mikroba, menurunkan aktivitas air)

PEMANGGANGAN

Proses yang terlibat:

- proses pindah panas
  - panas ditransfer ke bahan pangan melalui permukaan dan udara panas
- Proses pindah massa
  - air dipindahkan dari bahan pangan ke udara

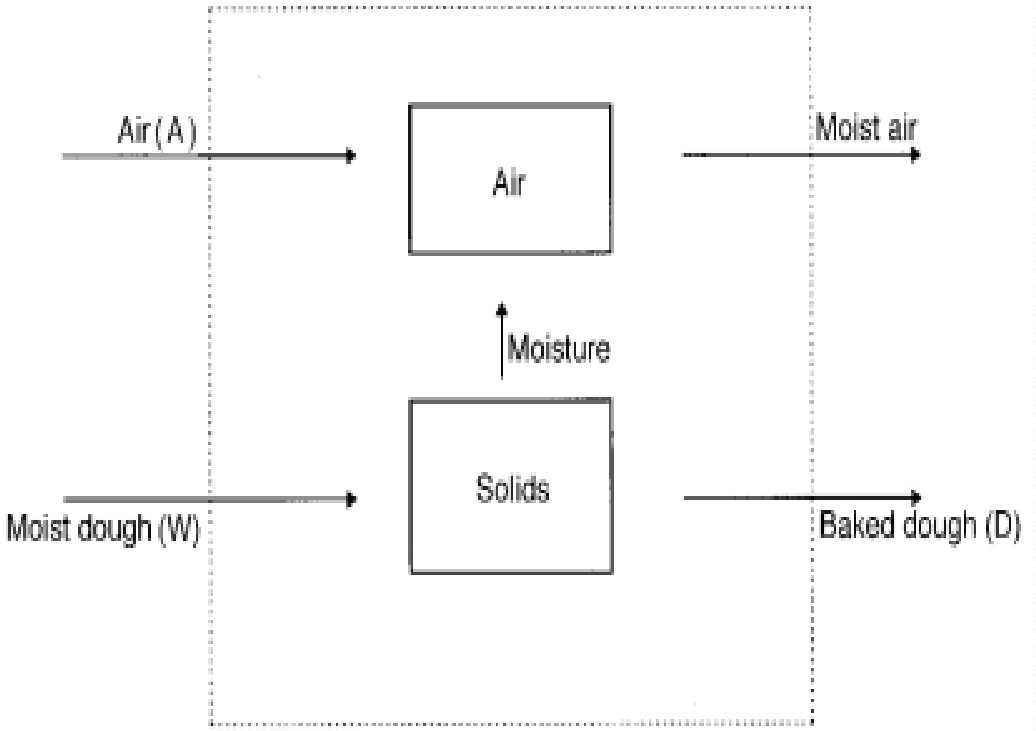
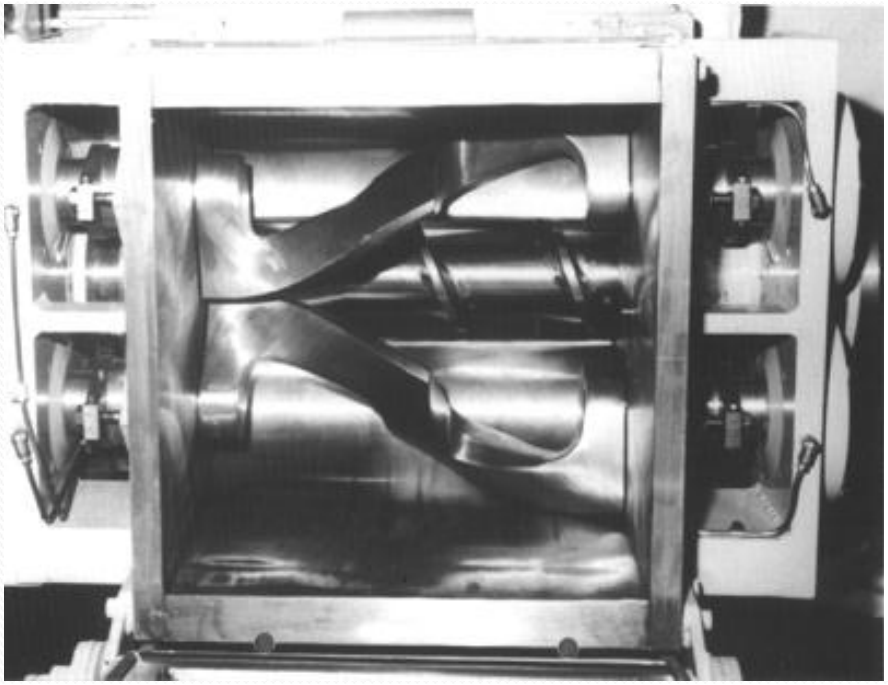


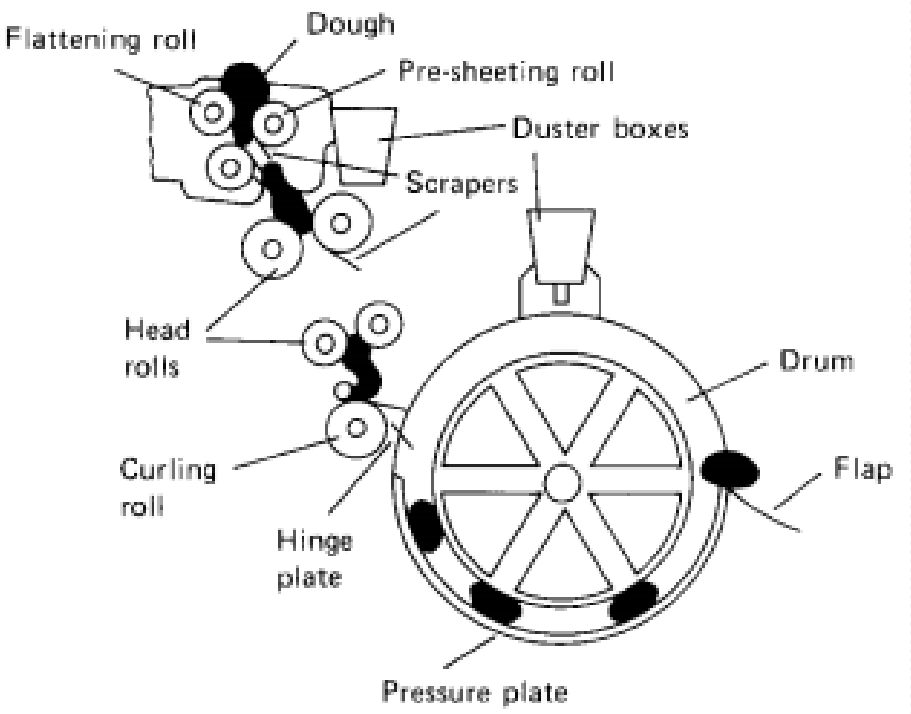
Diagram of material flow during baking in an oven (P. Fellows, 2000)

PERALATAN

I. WEIGHING, MIXING and FORMING



Z-blade mixer

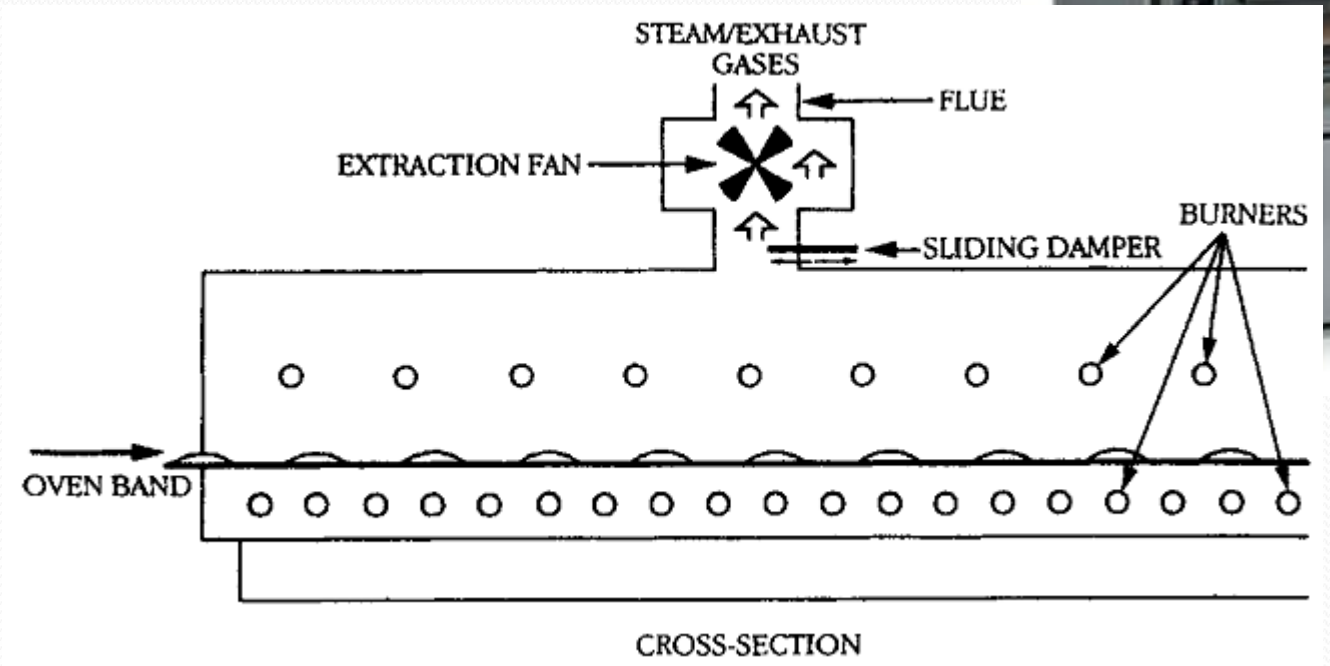


Drum moulder for bread doughs

PERALATAN

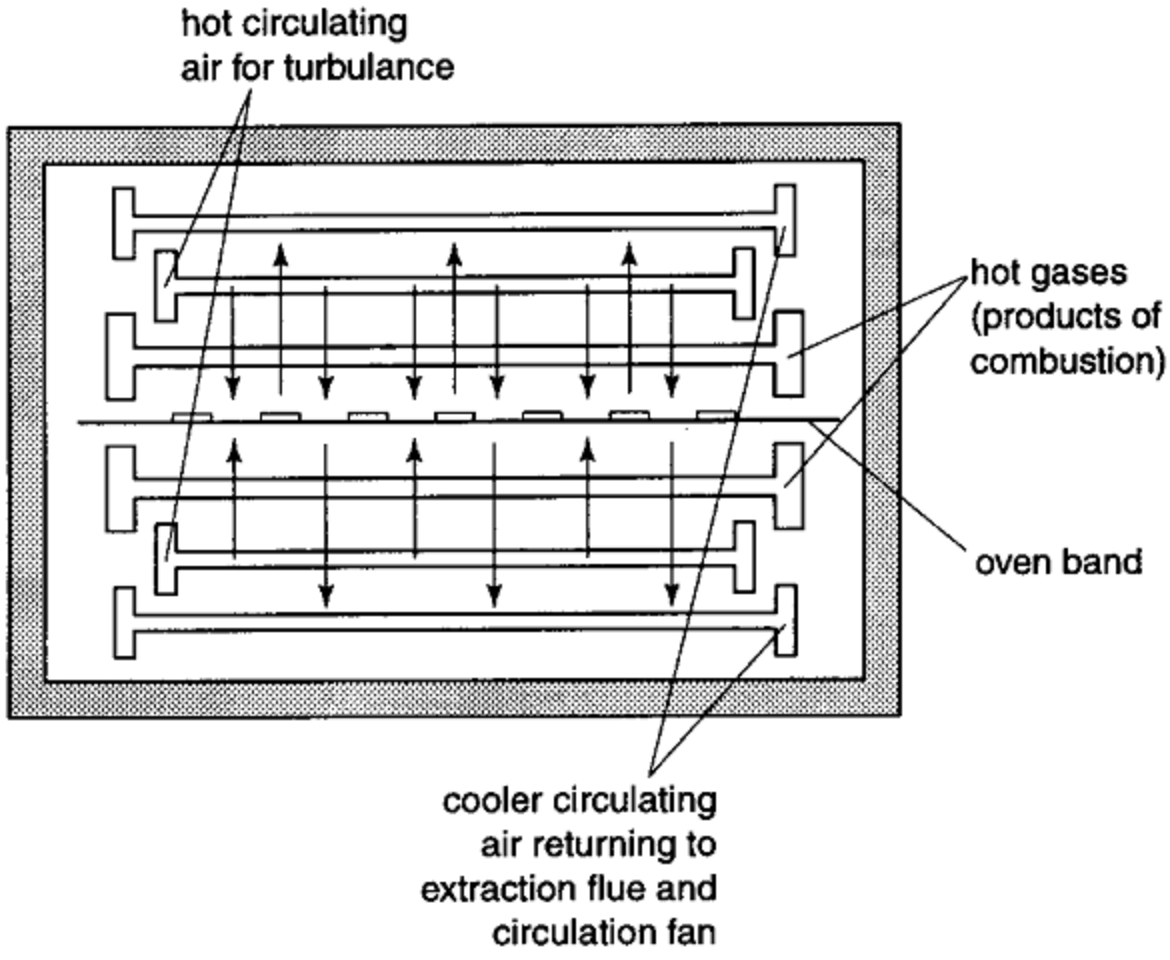
II. HEATING OVEN

1. Direct heating ovens



PERALATAN

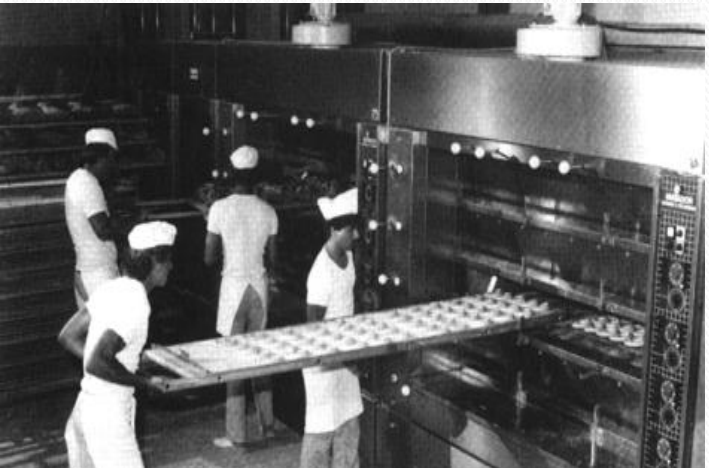
II. HEATING OVEN: Indirect heating ovens



PERALATAN

III. HEATING OVEN OPERATIONS

- batch,
- semi continuous,
- continuous



PENGARUH TERHADAP BAHAN PANGAN

- Perubahan warna, tekstur, aroma, flavour
- Kehilangan nilai nutrisi, terutama vitamin yang tidak tahan panas seperti vit C dan thiamin
- Perubahan dipengaruhi oleh suhu pemanggangan, komposisi kimia, pH bahan pangan

PEMANGGANGAN produk berbasis tepung

- **Meliputi semua tahapan proses untuk menghasilkan produk bakery**

Mixing → Dough Development → Fermentation → Oven Baking




Klasifikasi Produk

1. Produk dengan pengembang Yeast: Roti tawar dan roti manis.
2. Produk yang menggunakan pengembang kimia: Layer cakes dan biscuits yang dibuat menggunakan baking powder.
3. Produk dengan pengembang udara: angle cakes dan sponge cakes tanpa penambahan baking powder.
4. Produk setengah mengembang: Kulit Pie crusts yang mengembang dengan menggunakan steam dan gas lain selama pemanggangan

Bahan Baku Dasar

TEPUNG TERIGU (WHEAT FLOUR)

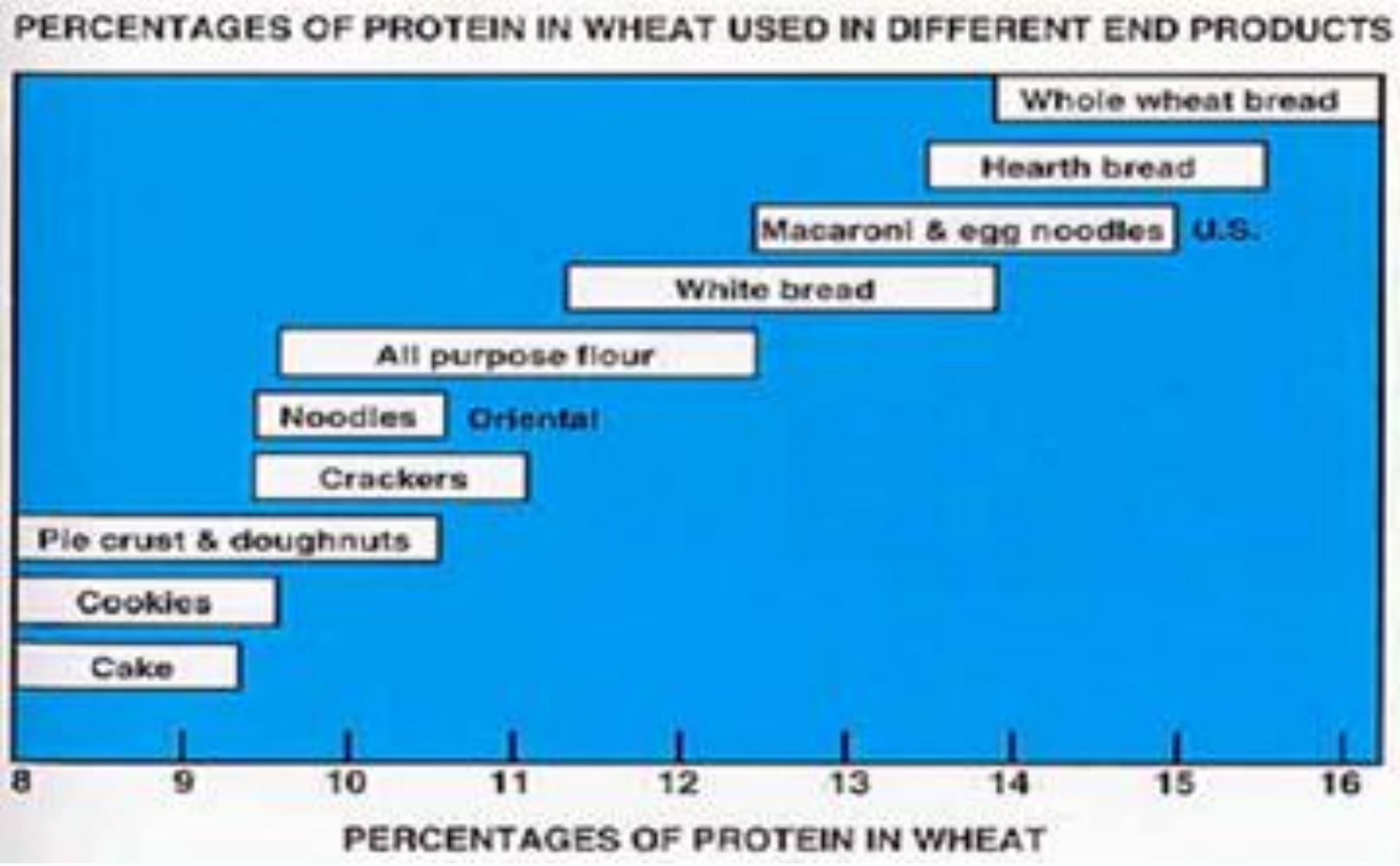
- Protein :
  - - alcohol soluble prolamin : **gliadin**
    - acid or alkali soluble : **glutelin**
      glutenin

} Gluten (elastic dough)

-Enzim amilolitik yang menghasilkan gula yang dapat difermentasi (glukosa)

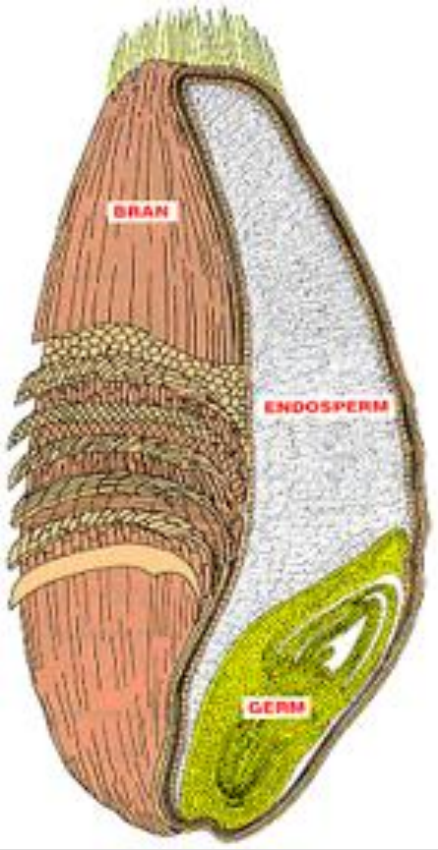
- Existing fermentable sugars

Wheat Utilization



Blending of wheats is done to achieve the best flour for an end-product use.

Where's the Flour?



- **Whole grain** flour contains all grain parts
- **Refined, enriched** flours are made from the endosperm only
- **Endosperm (83% of kernel)**
  Energy for plant growth
  Carbohydrates; protein for people
- **Bran layers (14.5% of kernel)**
  Protects seed
  Fiber, B-vitamins; minerals
- **Germ (2.5% of kernel)**
  Nourishes seed
  Antioxidants, Vitamin E, B-vitamins

Learn more at: www.wheatfoods.org www.namamillers.org

Milling is Science
Flour is NOT Just Flour

- Flour is the main, and most important ingredient in baked goods.
- Millers work with bakers to produce the right flour for the baker's products, equipment, environment, and cost factors
- Flour is responsible for:
  - Structure--holding and expanding with leavening gases
  - Texture
  - Binding all ingredients
  - Flavor
  - Nutrition
- Flour cannot be exactly the same every year due to weather factors.

Wheat and Flour Type	Flour Uses	Protein	Dough Strength	Water Absorption	Mix Time	Gluten Formig
Hard Spring High Gluten Strong Patent Spring Patent	Bagels, Hearth brds Thin pizza Pizza crust Hearth bread Breads Rolls	**12-14%** 13.4-14.4% 12.8-13.2% 12.4-12.8%	High	High 60-65%	Long Mix Time 12-14 minutes	High gluten forming
Hard Winter Winter patent All purpose	Pan breads Artisan bread Sweet dough Thick crust Pizza Quick breads Cookies	**10-12%** 11-12% 10-11%	Med	Medium 50-60%	Medium Mix Time 8-12 minutes	Medium gluten forming
Soft Winter Pastry Cake	Cookies Brownies Sheet cakes High Ratio cakes; angel	**7-9%** 8-9% 7-8%	Low	Low	Short mix time	Low gluten forming

Ascorbic Acid in Flour

- High protein flour may have ascorbic acid (Vit. C) added as a maturing agent to produce better volume and crumb structure in the bread
- The Vit. C is lost in the high heat of baking
- Ascorbic acid may replace benzoyl peroxide, which is no longer used in bread flour

Bahan Baku Dasar

Air (Water)

- Melarutkan ingredient
- Membentuk konsistensi adonan
- Gelatinisasi pati
- Pengontrol suhu adonan

Bahan Baku Dasar

Yeast

- **1857**—Louis Pasteur discovers yeast is what makes dough rise : *S. Cerevisiae*.
- Fermentasi adonan untuk ⇧volume, flavor/aroma
- Cream yeast, compressed yeast (fresh yeast), active dried yeast, instant yeast (doesn't need to be hydrated or "proofed" before being mixed into flour)
- 3 factors must be present for yeast to work: sugar, warmth, and water

Bahan Baku Dasar

Shortening

- *shortness & tenderness*
- aeration
- eating quality
- keeping quality

Bahan Baku Dasar

Garam

- Meningkatkan intensitas flavor dan rasa
- Memperkuat gluten dan membuat adonan roti lebih elastis (stretchable).
- Menjaga kelembaban.
- Mengontrol pertumbuhan yeast.

Bahan Baku Dasar

Baking powder

- Meningkatkan volume
- Sodium bicarbonate or ammonium bicarbonat dan asam menghasilkan carbon dioxide ketika diberikan air dan suhu

$$3CaH_4(PO4)_2 + 8NaHCO_3 \longrightarrow Ca_3(PO4)_2 + 4Na_2HPO_4 + 8CO_2 + 8H_2O$$

Bahan baku lain

Gula

- Fermentable sugars
- Improve flavor
- Color (brown) development to the crust
- Keep moisture because sugar is hygroscopic.

Enzim

- Amilase : fermentable carbohydrate/sugars
- Protease : act on gluten

Bahan baku lain

Mineral Yeast Foods

- Ammonium salts, phosphates & sulphates

Dough improver

- Potassium bromate & ascorbic acid

Crumb softener

- Mono / di–glycerides of fatty acids or other emulsifiers

Bahan baku lain

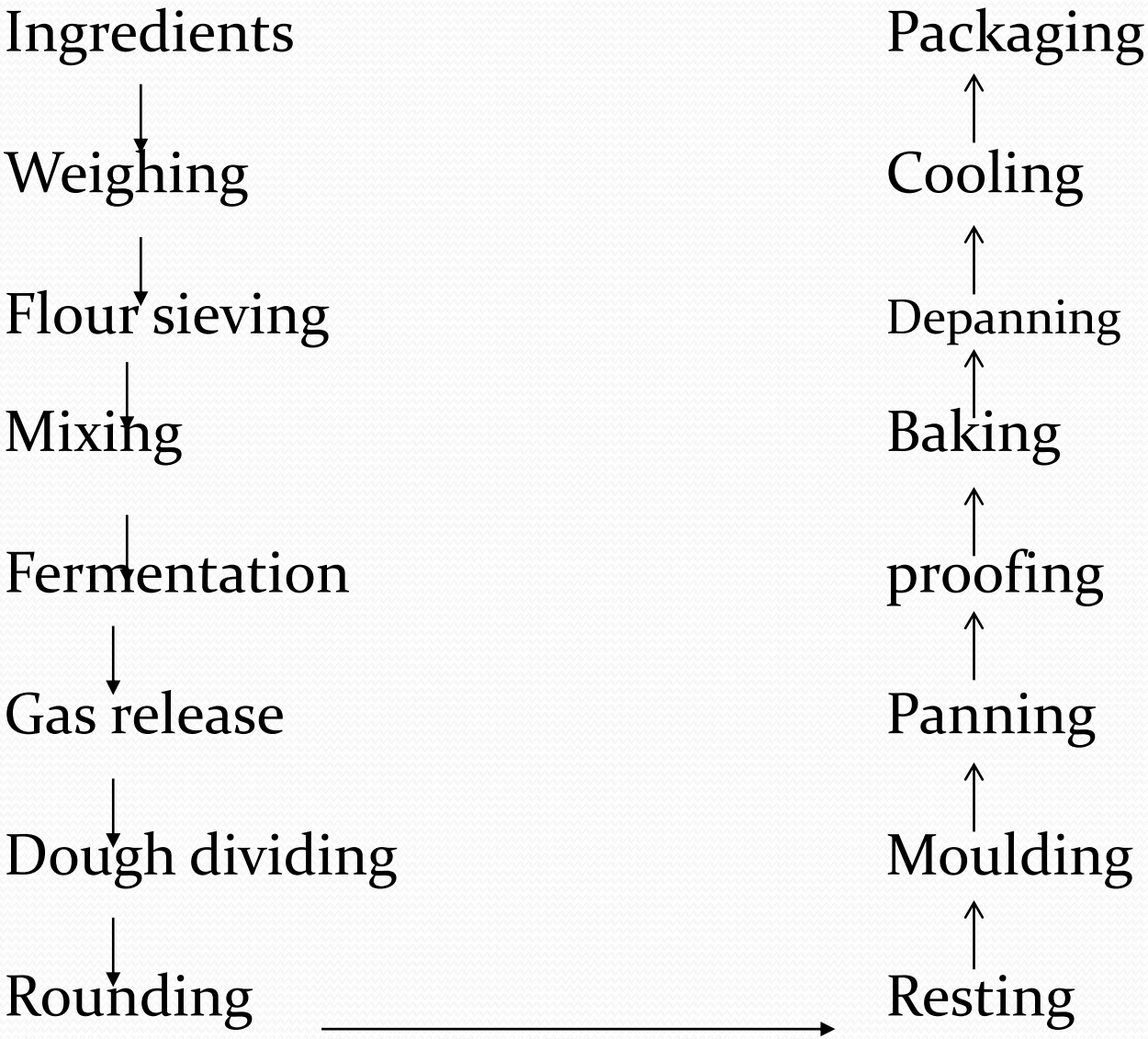
(Skim) Milk Powder

- Improve nutrition value
- Improve flavor, color and crumb

Egg

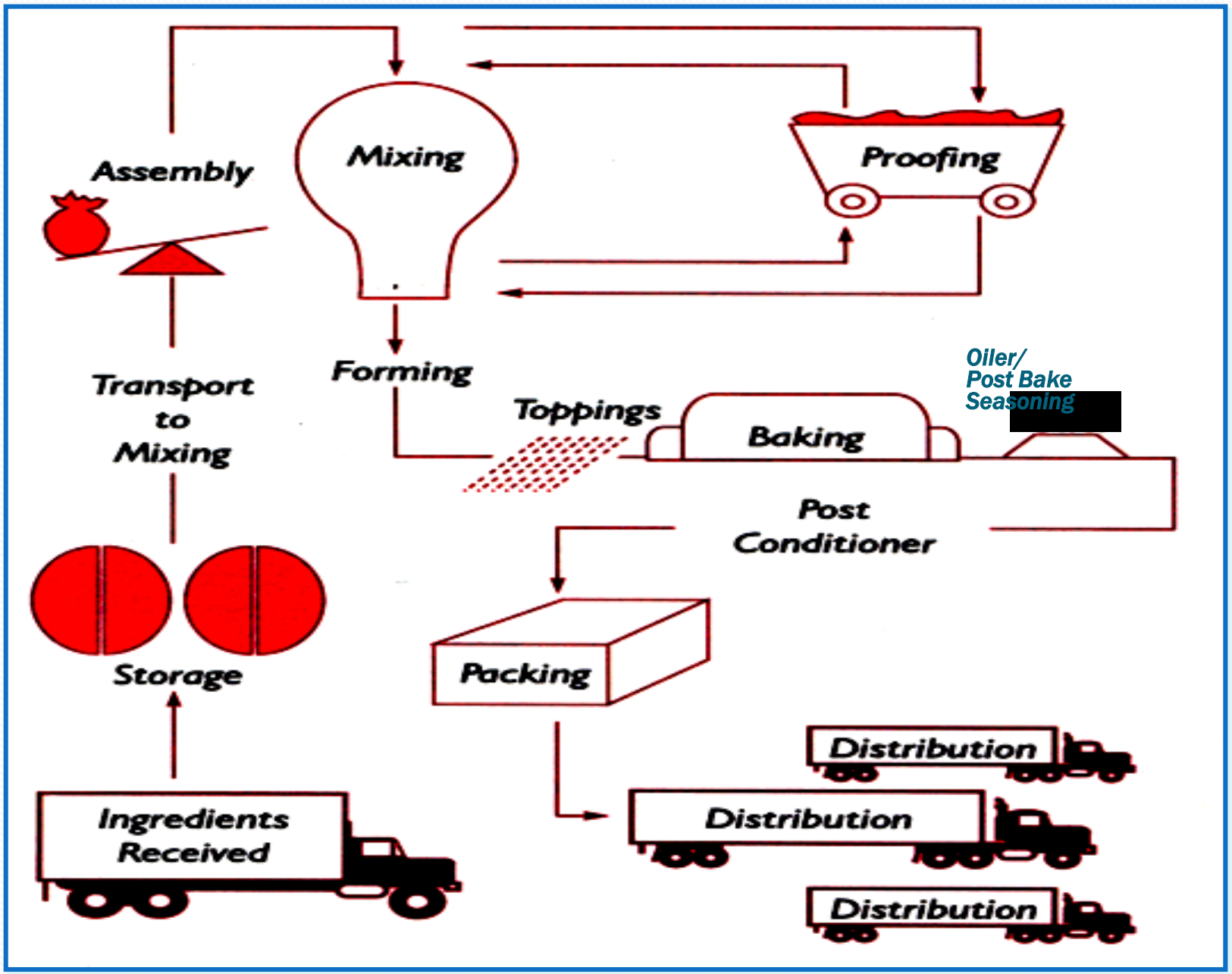
- Improve flavor, color and nutrition value
- Improve volume

Processing steps: for Bread



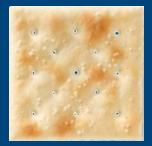
VIDEO BAKING 1

Processing Step for Biscuit (crackers)



Formulation

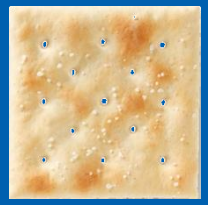
The 'Major Ingredients' used are:

		Water	Sugar	Flour	Salt
Crackers		Very High	Very Low	Strong	Low
Snacks		High	Medium	Medium	Medium
		Medium	Slightly Higher	Medium	Medium

Mixing:
Dough Types

Crackers

- **Fermented doughs (sponge + dough)**
  - Firm but extensible dough with relatively low sugar and fat
- **Chemically leavened doughs**
  - Softer & more extensible with moderate sugar and fat
- **Sweet Chemically leavened doughs**
  - Higher sugar that softens the dough but remains extensible due to high temperature that aids in developing gluten



Soda/Saltine Crackers

Butter Crackers

Graham Crackers

Video: Baking Crackers

Mixing

- **Aims** :

1. to form homogeneous dough
2. to develop gluten with optimum plasticity, elasticity & viscous flow

- **Mechanism** : blend, combine, compress, fold, strecth, push

Development of gluten matrix

(dough development)

Hydration of protein & starch

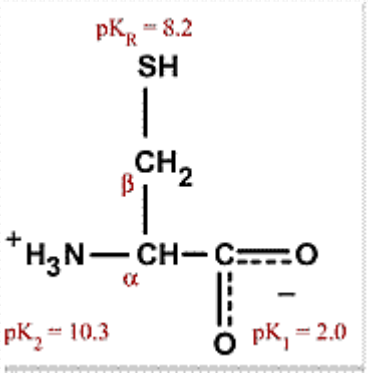
↓

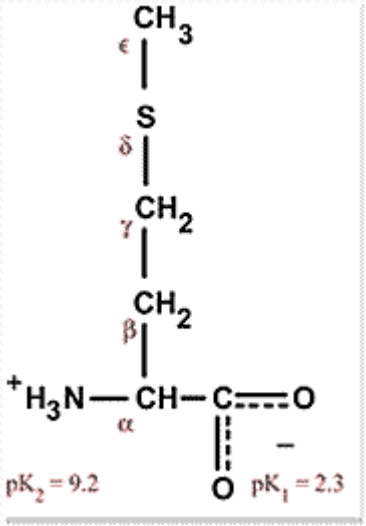
Uncoiling of protein molecules & their joining together by cross linking to form network

↓

S – S bonds involves

(mainly Cysteine, not Methionine)





Fermentation

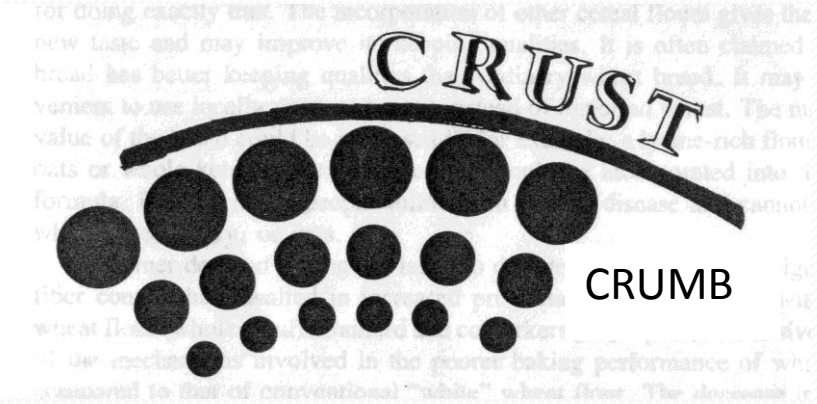
- Complex biochemical changes
- Yeast ferments sugars producing ethanol, CO_2, organic acids, etc ⟶ volume and flavour
- Development of acidity ⟶ physical changes in dough
- Temperature increases

Baking

- CO_2 expands → raise volume
- Denaturation of proteins
- Swelling & gelatinization of starch
- Yeast & enzymes activity ceased
- Crust formed
- Develop color, texture, aroma and flavor

Baking

Baking



Penilaian mutu sensori produk roti dengan metode skoring

EKSTERNAL		INTERNAL	
Parameter	**Skor maks**	**Parameter**	**Skor maks**
Volume (ukuran produk terhadap berat adonan)	10	Warna crumb	10
Warna kulit	8	Sifat remah/grain	10
Keseragaman	4	Aroma	15
Kesimetrisan bentuk	4	Rasa	20
Karakter kulit	4	Tekstur	15
Total Skor	**30**	**Total Skor**	**70**

Storage and Spoilage

Staling : loss of aroma & flavour

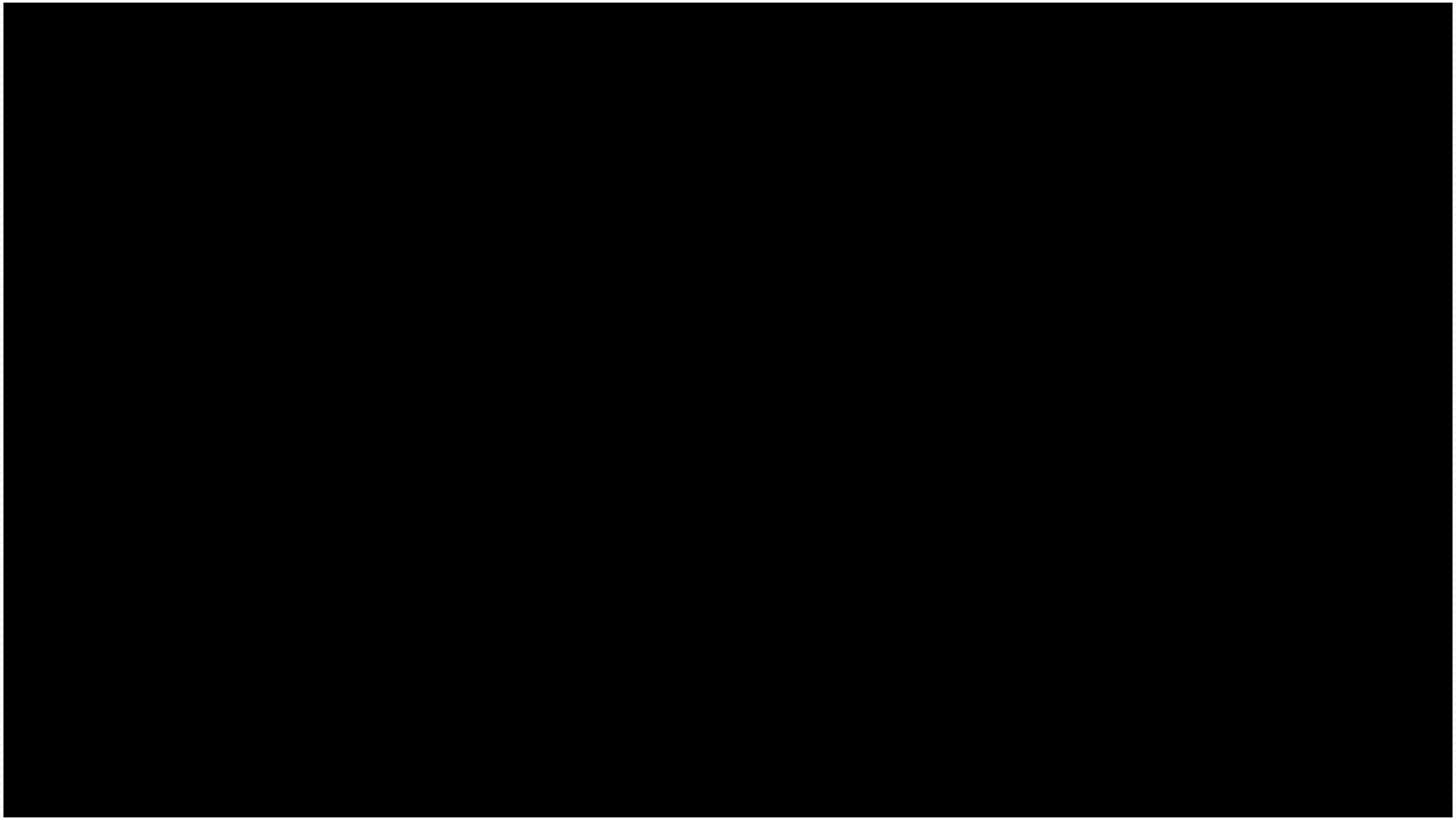
changes of texture (dry and crumbly)

Microbiology : molds, bacteria

Suggestions :

- Keep good sanitation
- Preservatives
- Crumb softener & anti – firming additives
- Appropriate packaging
- Good storage conditions

Video another baked product: French Pastry



References

- Fellows, 2000. Food Processing Technology, Principles and Practice
- Potter and Hotchkiss. Food Science.

Thank you..

Case Study

A food industry produces infant biscuits which have to be fortified with vitamins and minerals. Some vitamins are destroyed during baking. How do you produce such biscuits while fulfilling the requirement of vitamin contents ?