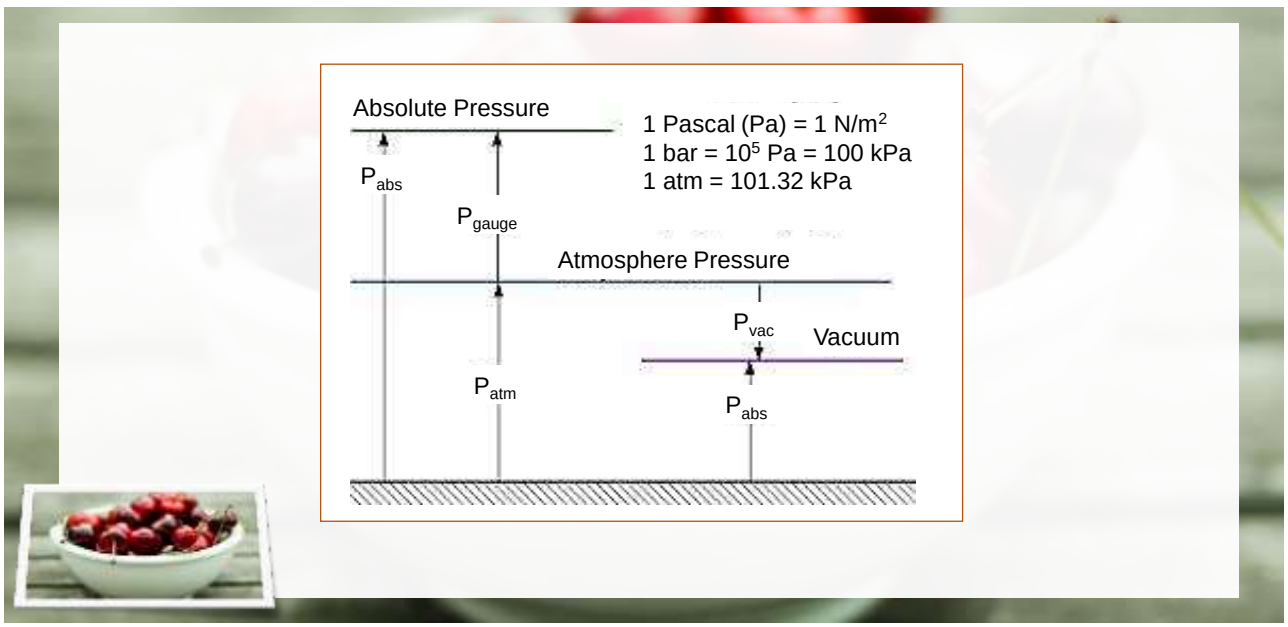
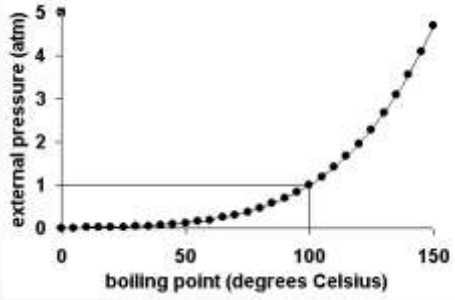
APLIKASI VAKUM UNTUK PANGAN

Pressure



Mengapa Vakum?



O_2

- Oxidation → Discolouration and rancidity
- Growth of Aerobic micro-organism → Moulds and other spoilage organism

- Degraded appearance and nutritional value
- Impared sensory qualities
- Lost freshness unpleasant taste and aroma

Product unfit for consumption

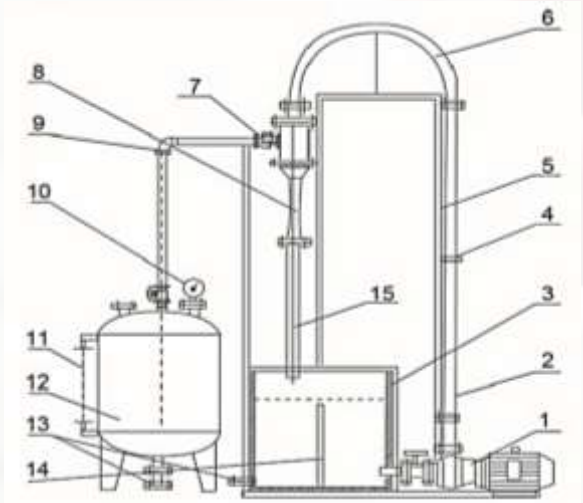
Aplikasi Vakum untuk Pangan

Vacuum generation

Pompa vakum mekanis memberikan performansi vakum yang tinggi, namun harga mahal dan memerlukan perawatan

Water Jet ejector have a low initial cost, have no moving parts, are easy to install, require little or no maintenance, and pump as well as mix liquids.

Contoh penerapan ejektor air



1.Centrifugal pump
2. Inlet Water Pipeline
3. Water Tank
4. Pipe Clamp
5. Iron Bracket
6.The Arc Tube
7. Check Valve
8. Water Jet Vacuum Pump
9. Inlet Air Pipeline
10.Vacuum Gauge
11. Content Gauge
12. Buffer Tank
13.Exhaust Sludge Valve
14.Baffle Plate
15. Tail Pipe

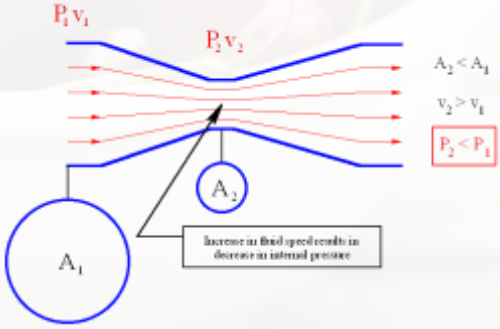
Persamaan Bernoulli

$$\frac{1}{2}\rho v^2 + \rho g z + p = Constant$$

Kinetic energy + work done by weight + work done by pressure = constant

Dari rumus bernoulli dan kontinyuitas, dapat di simpulkan bahwa

$A_2 < A_1$ ➔ $V_2 > V_1$ ➔ $p_2 < p_1$



Vakum pada proses thermal

- Vacuum frying
- Vacuum evaporation
- Vacuum distillation
- Vacuum freezing/cooling

Prinsip:

Menurunkan suhu proses pengolahan sehingga dapat meminimalisasi perubahan[2] yang merugikan, dan menghidari reaksi oksidasi

Vacuum Cooling

Vacuum ➔ reduction in the vapor pressure of water ➔ evaporation ➔ cooling effect

The method does not require any cooling medium as in other methods of precooling, (example: air in forced cooling or water in hydro cooling).

The reduction in product temperature for a unit percent weight loss can be determined by the ratio of the latent heat of vaporization and heat capacity of the produce.

Wang and Sun: Leafy vegetables containing 90% moisture : reduction of 6.5°C/1% weight loss, extension of shelf life of 2.5 days at 12°C for head lettuce, which were cooled for 20 min, sealed in polypropylene film and stored for a week at 2°C.

Vacuum drying

- Vacuum drying of food involves subjecting the food to a low pressure and a heating source.
- The vacuum allows the water to vaporize at a lower temperature than at atmospheric conditions, thus foods can be dried without exposure to high temperature.
- In addition, the low level of oxygen in the atmosphere diminishes oxidation reactions during drying.
- In general, color, texture, and flavor of vacuum-dried products are improved compared with air-dried products.
- In some cases, the product is comparable to the quality of freeze-dried foods.

Vacuum cooker

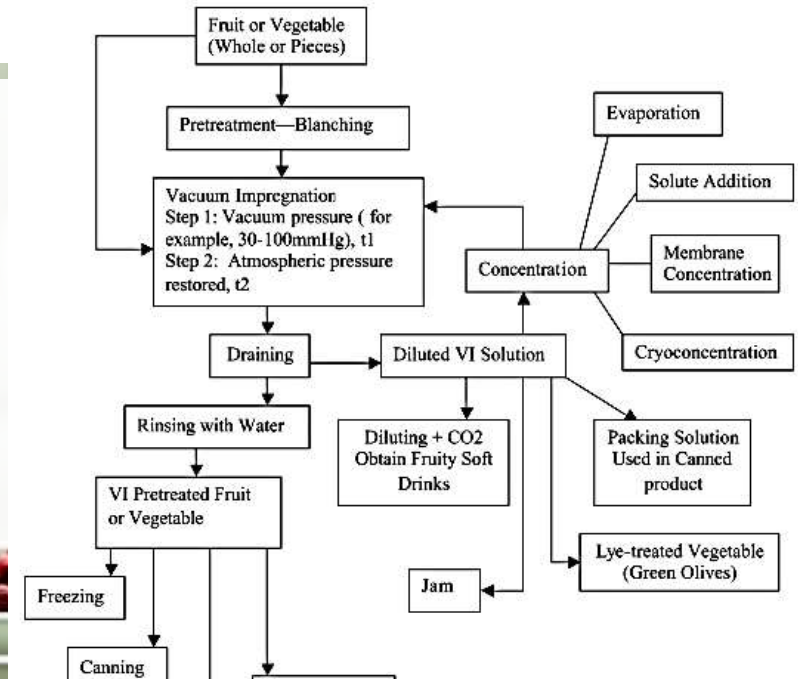
- This system is used for the production of hard candy, jelly, gum candies, and low-boiled sweets.
- The main components: cooking chamber, a stirrer inside the cooking chamber with a variable-speed drive, a vacuum pump, condensor and control system.
- The ingredients are fed into the cooking chamber manually or by dosing.
- The cooking temperature and time are controlled automatically.
- During this process, the cooked mass will be evaporated under vacuum pump.

Vacuum Impregnation

Vacuum Impregnation (VI) is a technique to introduce external liquid phase in the porous media by the action of hydrodynamic mechanism promoted by pressure change

Applications:

- pre-dehydration of fruits and vegetables,
- pre-treatment before freezing,
- modification of fortified fruits and vegetables nutrition,
- developing minimally processed fruit and vegetables to reach quality and stability enhancement, and combination with other technique through hurdle technology to extend shelf-life



Advantages

- Quality improvement due to the low processing temperature, thus minimizing heat damage and preserving sensitive nutrient, color, natural flavor and aroma
- Provides a faster osmotic process due to the combination of hydrodynamic mechanism and deformation relaxation phenomena,
- Energy saving since water is removed without heating and he partial removal of water requires less heating during the following processing steps,
- Reduce the oxidative reaction rate since oxygen concentration reduced by vacuum treatment,
- Thermal properties modification due to product composition changes

Three phenomena that involved in VI processing

- Gas outflow
- Deformation-relaxation of the solid matrix
- Liquid influx

Affect by:

- Tissue structure (pores and size distribution),
- Relaxation time of the solid matrix,
- A function of the mechanical properties of the material,
- Transport rate of Hydrodynamic Mechanism
- Viscosity of the solution
- Size and shape of the sample
- Pressure and time

Type of solutions

1. Isotonic solution: a solution containing the same solute concentration both outside and inside the cell membrane;
2. Hypotonic solution: a solution containing less solute molecules outside of the cell membrane than inside of it;
3. Hypertonic solution: a solution containing more solute molecules outside of the cell membrane than inside

Vacuum Packaging

Vacuum ➔ Discharge Oxygen

Oxygen ⇔ bacteria, lipid oxidation, moulds, spoilage, discolouration, rancidity

- VP system ➔ significant prolongation of quality shelf life at 8°C for minimally processed fruits and vegetables
- the amount of O_2 available at the start of storage: 1/3 normal amount
- the lower O_2 content ➔ stabilizes the product quality by slowing down the metabolism of the produce and the growth of spoilage microorganisms

Examples of VP Application

improve microbial quality (e.g., red bell pepper, chicory endive, sliced apple, sliced tomato)

improve sensory quality (e.g., apricot, cucumber)

Improve microbial and sensory quality (e.g., mung bean sprouts and a mixture of cut vegetables).

In some instances, no beneficial effect (mushroom, green bell pepper, and a mixture of cut fruits) or an impeded decrease in sensory quality (strawberries, alfalfa) was noticed.

With cut products (vegetables and fruits salad mixes, chicory endive, apple), VP strongly retarded enzymatic browning of the cut surfaces.

Thank You

RYN