Food Processing Workshop

1. Drying

Material:

- Air dryer (Dehydrator)
- Drying racks
- aW-meter
- Bowl
- Water with citric acid (0,1% W/W)
- Cutting board & knife
- 2 green apples
- 1-2 Mangos

Tasks

Measure the aW-value of fresh apples and dried apples and freeze dried apples

aW-Value	
Fresh apple	
Dryed apple	
Freeze dried apples	

Methods:

Drying
Preparation: Peel the mango and slice the flesh into thin slices or strips. Wash the apples and cut in to thin slices
Preventing Browning: Briefly dip the mango and apple slices in a solution of water and citric acid (0,1 % W/W) to prevent browning.
Temperature and Time: Place the prepared mango and apple slices on the drying racks. Set the food dehydrator to a temperature between 40 and 60 °C and allow the mango to dry for about 8-12 hours and the apples for 6-10 hours. The exact drying time may vary depending on the thickness of the slices, airflow and environmental humidity
Storage: Store the dried fruits in a cool, dark place in an air tight container.
Water Activity: The optimal aW-value for dried fruits is around 0.60 to 0.70. Measure the prepared samples with the aW-meter.
The product has a shelf life between 6 and 12 month without cooling depending on the remaining water and sugar content

2. Freeze drying

Material:

- Freeze dryer
- Frozen Mangos

Tasks

Learn the principle of freeze drying

Taste some freeze dried products and describe them

Strawberries	
Color	
Smell	
Taste	
Texture	

Apple	
Color	
Smell	
Taste	
Texture	

Plum	
Color	
Smell	
Taste	
Texture	

Bell Pepper	
Color	
Smell	
Taste	
Texture	

Methods:

Freezing: The first step is to freeze the material or substance to be dried. This freezing process is essential because it solidifies the water content within the substance. Freezing is typically done at temperatures well below freezing, often around -40°C (-40°F) or lower.
Primary Drying (Sublimation): Once the material is frozen, the freeze dryer creates a vacuum in the drying chamber. Under reduced pressure, the frozen water in the substance transitions directly from a solid (ice) to a vapor (water vapor) through a process called sublimation.(-20 - -30 °C)This phase change skips the liquid phase, preventing damage to the structure and properties of the material.
Secondary Drying (Desorption): After the primary drying phase, some residual moisture may still be present in the material. To remove this remaining moisture, the freeze dryer slightly raises the temperature and continues to maintain a vacuum. (0 - 10 °C) The goal is to ensure the material is completely dry.

Throughout the process, the freeze dryer's condenser collects the water vapor that sublimates from the material, turning it back into ice. This prevents moisture from reentering the chamber and helps maintain the vacuum. Once the drying process is complete, the freeze-dried product retains its original structure, texture, and most of its nutritional value, making it suitable for long-term storage.

Freeze drying is commonly used for preserving a wide range of products, including fruits, vegetables, pharmaceuticals, and even certain biological samples, as it allows for extended shelf life without the need for refrigeration up to multiple years when packaged air tight.

3. Spray drying

Material:

- Spray dryer
- Heatable magnetic stirrer
- Beaker and stirrer
- 1 L milk 0.1 % fat

Tasks

Learn the principle of spray drying

Measure the water activity (aW-value) of fresh produced milk powder and store bought

aW-value (0.2-0.3)	
Fresh produced	
Store bought	

Methods:

Pre-heating / Evaporation: Regular milk has a dry matter content close to 10 %. Industrial scale spray dryers work with up to 30 % dry matter content. This is achieved thru pre heating and evaporating liquid to increase the dry matter. The concentrated milk then gets feed into the spray dryer at 80 °C
Temperature Drying Chamber: For skim milk powder set the inlet temperature to 180 °C in the drying chamber
Outlet Temperature: The outlet temperature is dependent on the feed amount and spray flow. Therefore when a constant spray flow is achieved the pump speed is adjusted accordingly. For a stable end product the outlet temperature shall be at least 72 °C and below 140 °C to prevent maillard reaction.
Adjusting aW-value: To adjust the desired level of drying, one can modify the suction to allow the powder to stay longer in the drying chamber