EU SecureFish

Fish and fish by-products upgrading
Alternative technologies and quality assurance:
Alternative technologies for fish preservation and processing

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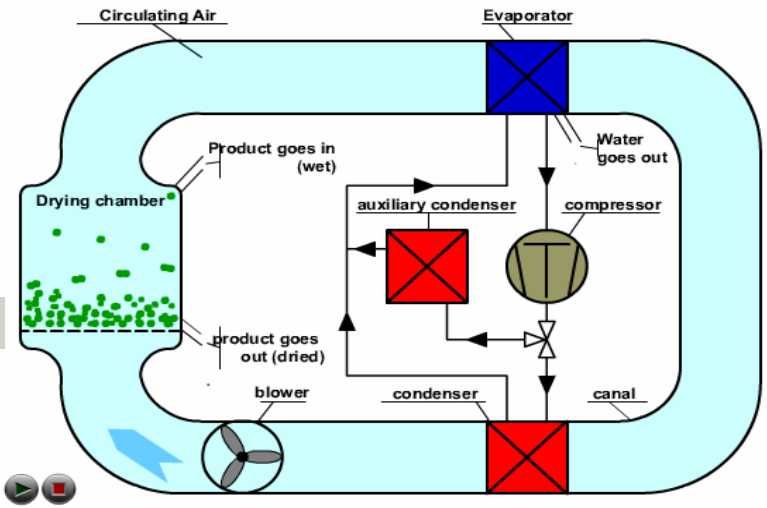
Drying of perishable food: fish

Drying: world wide used
- solar energy
- wood
- fossil energy

Simple, cheap and effective

Challenge:
World wide trade at ambient temperature (containers):
price, quality and food safety?

New boost to drying for
quality (instant) products by using
programmed mild drying/
atmospheric freeze drying (AFD)



Atmospheric Freeze Dryer concept by I. Strommen, using an heat pump

Drying Fish

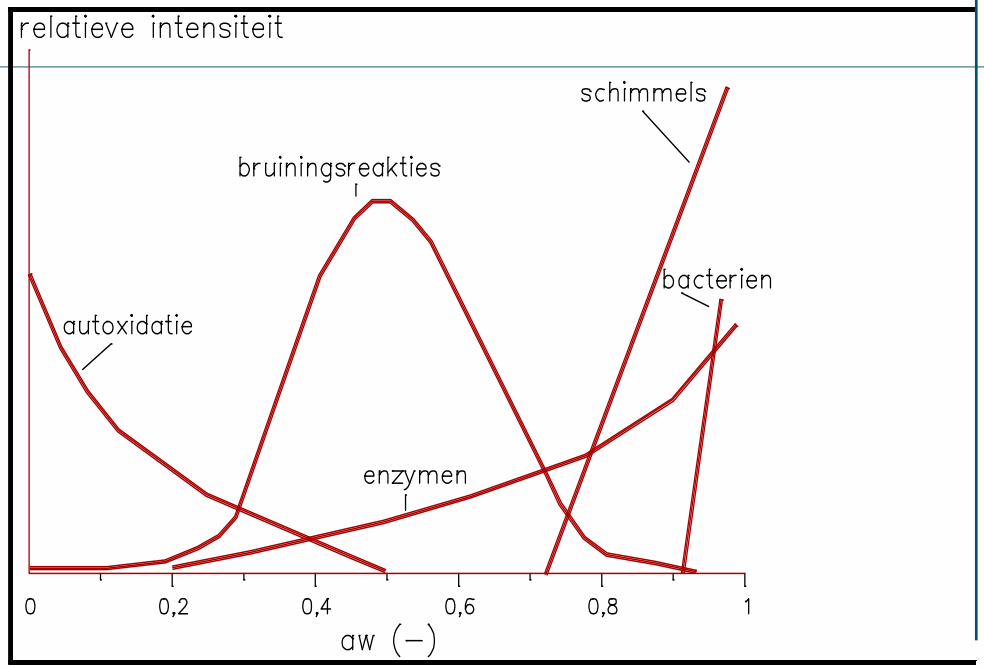
Fish: very perishable
Fish waste: even more perishable

Dried fish: World wide known, often salted
easy to store, easy to transport
easy to size, easy to cook
Old fashioned convenience food

Raw material for functional foods, such as hydrolysates, and other ingredients.
Dried end products, also hydrolysates

Mild drying <40°: functionality of enzymes available
Freeze drying<0°: open structure of tissue available (AFD)

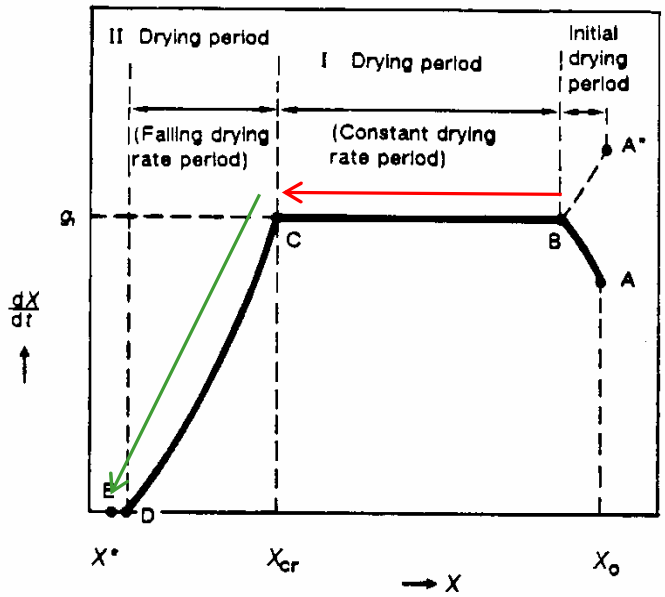
Relative rates for quality deteriorative reactions

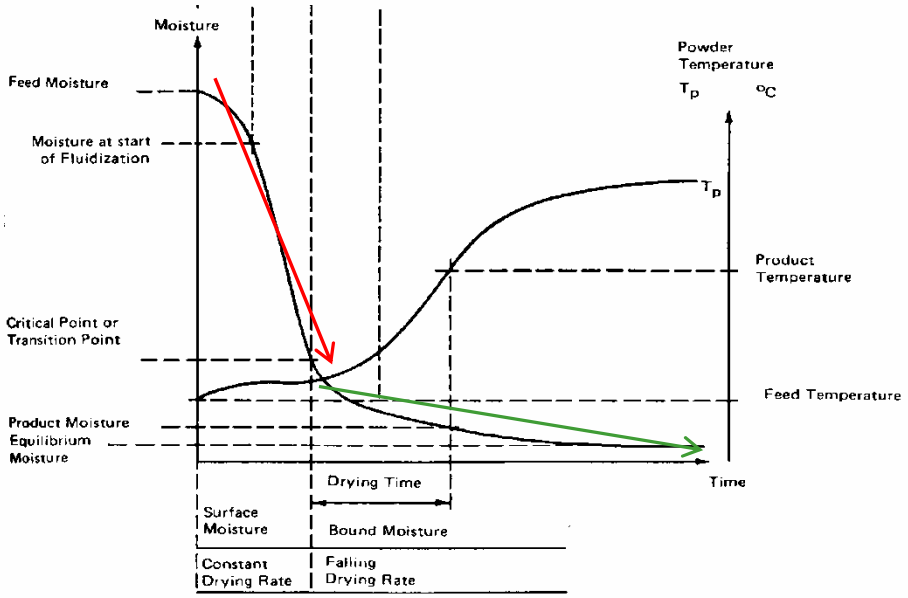


Relative intensity of growth micro organisms because of water activity Aw gives effect on:
-auto oxidation
-maillard reactions (browning)
-enzymes
-fungi
-bacteria

- availability of moisture depends on water activity Aw and determines: germination of spores, growth of micro-organisms and prevention of all kind of chemical and biochemical reactions
- microbial decay Aw > 0.7
- oxidation, non enzymatic browning & enzymatic reactions are prevailing at lower Aw

The drying process



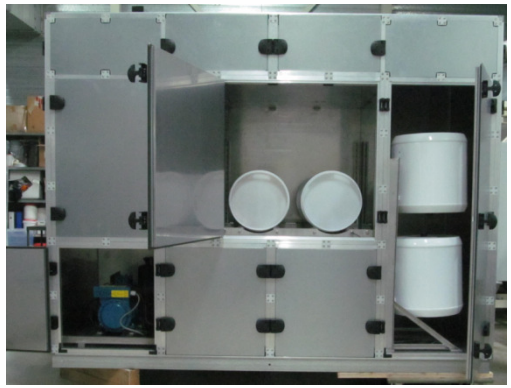


X: Humidity kg H2O/Kg material

- Constant rate: external diffusion of water in air and heat transfer to material is limiting (solar power/air speed)
  - Wet bulb temperature around 65 ºC (turbulent air)
- Falling rate: internal diffusion of water is limiting (size)
  - Material temperature can be air temperature

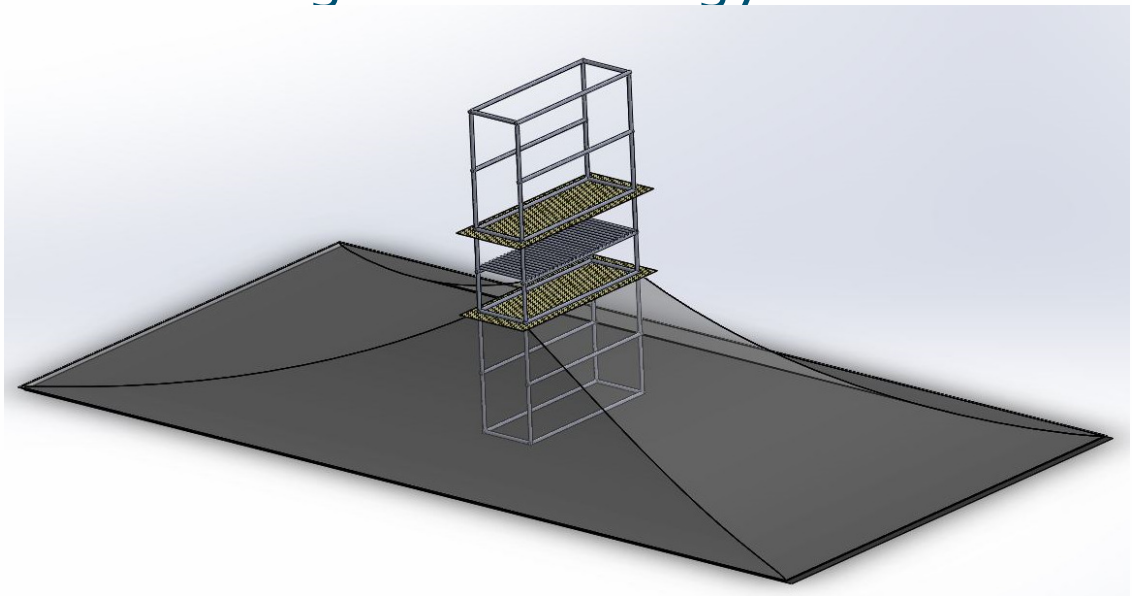
Objectives sustainable drying

- Faster drying by using more energy per kg raw material
  - -Combination of sustainable (green) energy sources: Solar/wind electricity, solar air/water heating, biomass
  - -larger solar collection surfaces
- Hygienic processing in closed dryers, according EU standards
- Better quality of dried products by
  - -faster drying giving less off-colour, less micro-organisms
  - -new drying method at lower temperature AFD, using froozen fish, giving better structure (instant hydration) and quality



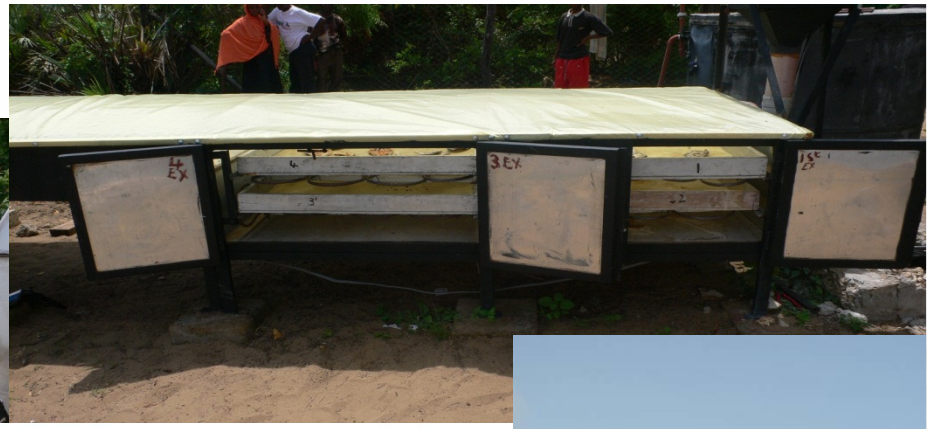
Close dryer with larger solar collector

- Small transparent polypropylene solar dryer with a tray, using a closed (hygiene) wooden frame:
  - Solar energy absorbing surface
  - Chimney for natural convection
  - Dome/Green house (see right pictures)
- The skirt 3box dryer of transparent foil of €10 with a large solar energy collector



Combination of energy sources

- Dryer for fish at Kipini (Kenya): tunnel is solar collector
- Additional water heating with standard solar water heater, pump, water tank and heating coils in the dryer part of the tunnel above the trays, also electrical heating
- Electricity by solar panels and wind mill
- 150 kg raw fish in 3 days



Also Ghana and India

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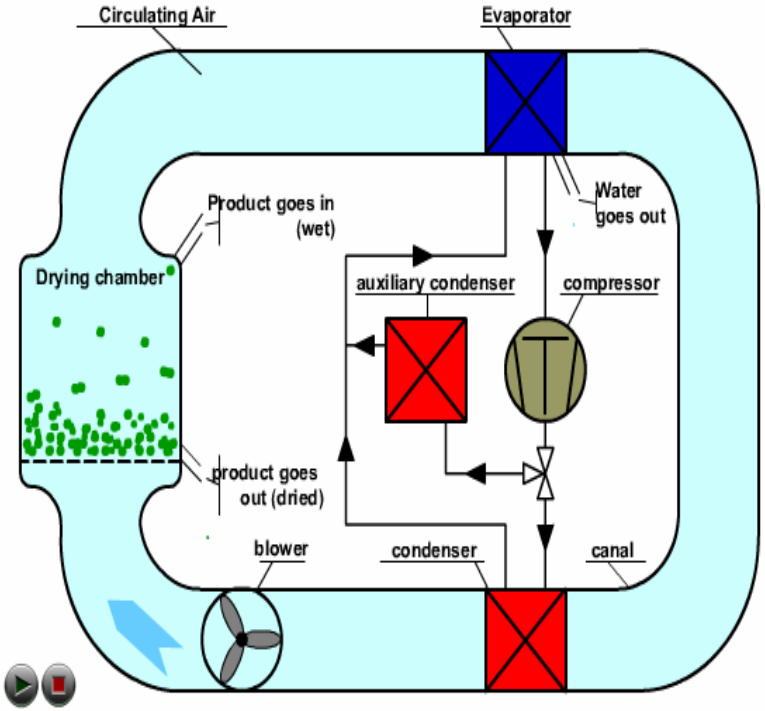
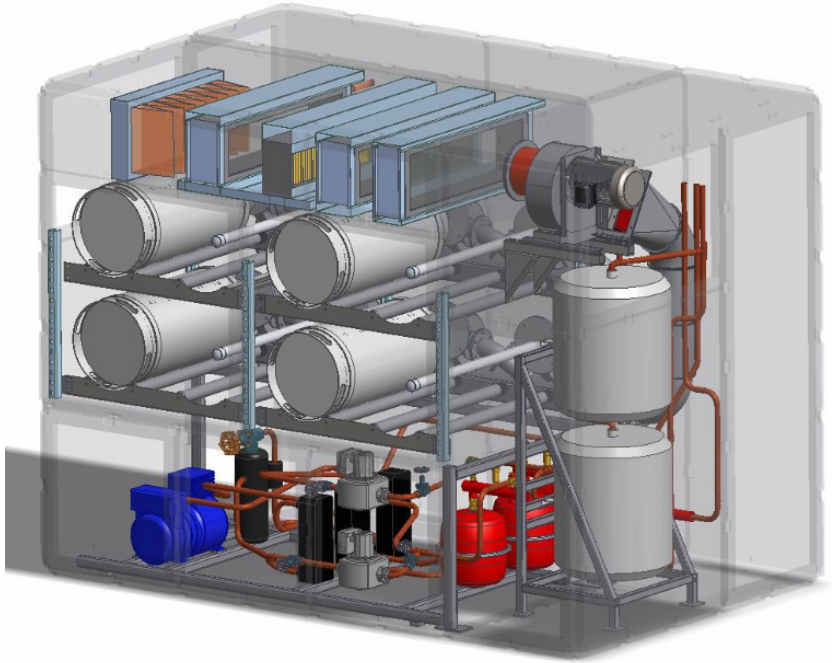
Atmospheric Freeze Drying AFD: quality

- Standard batch freeze dryer
  - Vacuum (17 mbar 1700 Pa)
  - Condenser/plate heating

- AFD:
  - atmospheric very dry air (favourable no oxygen) heating by mild temp. air and <<1g water/kg gas
  - frozen start material
  - Optimising drying and final product quality
  - Programmed drying in time



AFD equipment at Ebbens NL



The batch atmospheric mild freeze dryer using a heat pump to obtain a low moisture content heated air. Programmed drying time 10 -30 h, depending on conditions used and product quality needed. About 1000 kJ – 3000 kJ/kg product used.

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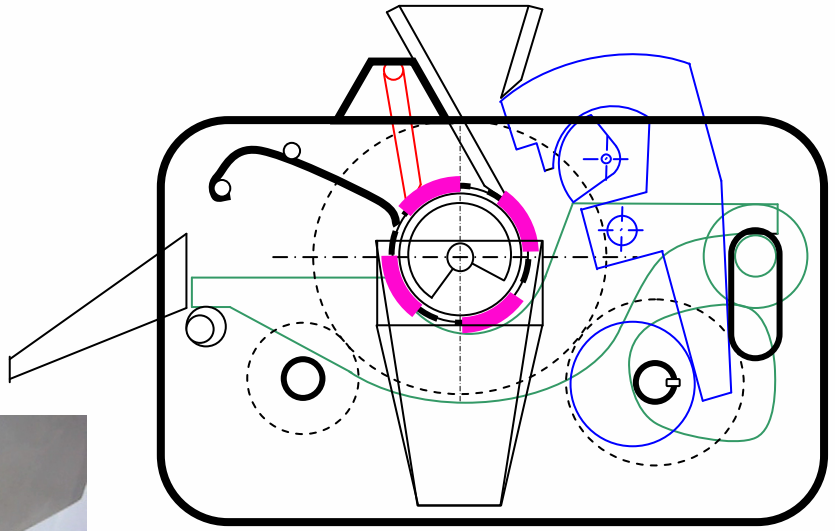
Small Scale Fish Bone Separator (SSS)

Minced meat and Surimi can isolated
from the fish waste after filletting.
At INTI in Argentina Alexandra Booman developed
a small fish meat/bones separator.

The separation of the bones from the meat is about five times better than with the better known belt separator.



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Ing. A[illegible]Booman, M.Sc.
Ing. Aurora Zugarramurdi, M. Sc.

Extrusion to form dried fish products

- Extruder: screw to mix, knead, cook and to press through a die for shaping and eventually expending, giving a first drying

- Processing fish proteins with starch

- Products:
  - Infant (school) porridge
  - Fish powder as an ingredient
  - Fish feed
    - (floating, 50% waste)
  - Snacks/crisps
  - Kroepoek or Krupuk
  - Croutons

Solar sourced electricity

- 10 kW Solar voltage systems with backup
- Namibia, Kenya and Ghana
- Also combined system in Kenya with a windmill at Kipini
- Used for extrusion but also drying or milling

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