



FROM VISION TO REALITY

A HOLISTIC APPROACH TO PROCESS DEVELOPMENT

BRIDGE2FOOD EUROPE 2025
JUNE 5, 2025

CHRISTIAN KLING

ANDRITZ

CHAPTER OVERVIEW



01 Introduction ANDRITZ

02 Innovation on machine level

03 From idea to process

NO CHALLENGE IS TOO BIG – A PIONEER IN LARGE-SCALE TECH SOLUTIONS WORLDWIDE



WHAT WE DO

Developing large-scale,
state-of-the-art engineering
and service solutions



Elevating customer
operations with
state-of-the-art technologies



Supporting our customers'
operations with
lifecycle services

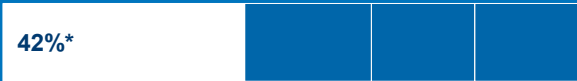


Empowering our
customers to drive the
green transition

WORLD MARKET LEADER WITH FOUR BUSINESS AREAS

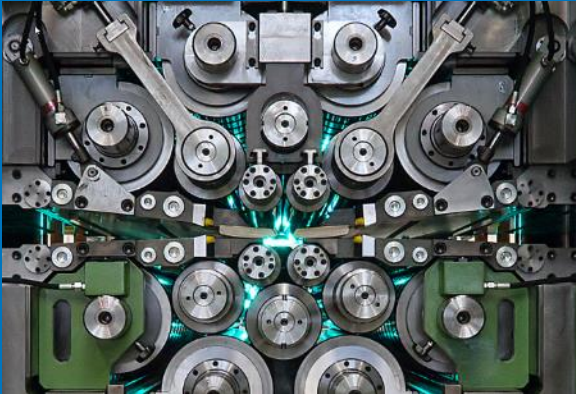


PULP & PAPER



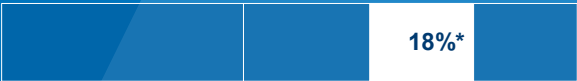
Pulp: **#1**
Paper: **#3**

METALS



Forming: **#1**
Processing: **#1-2**

HYDROPOWER



#1-2

ENVIRONMENT & ENERGY



#1-3

* share of total Group revenue 2024
global market position, estimated by ANDRITZ

CLOSE TO OUR CUSTOMERS, IN MORE THAN 80 COUNTRIES



AROUND **30,000**
EMPLOYEES WORLDWIDE



OVER **280**
LOCATIONS



OVER **80**
COUNTRIES

OUR STRATEGY: LONG-TERM PROFITABLE GROWTH

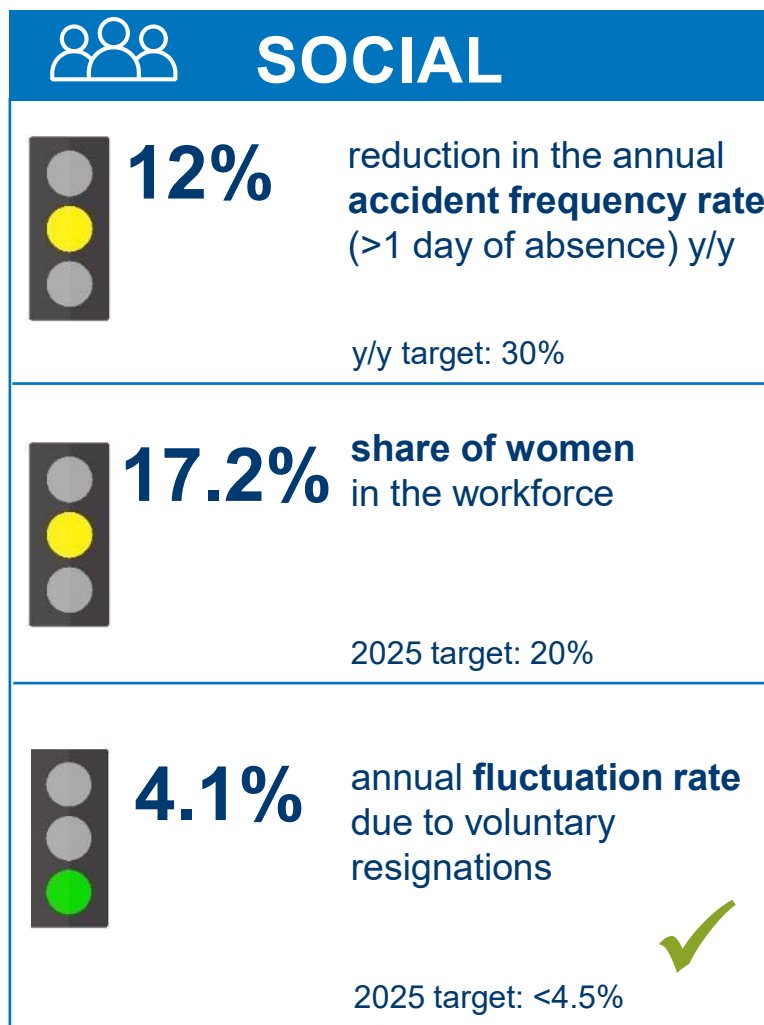
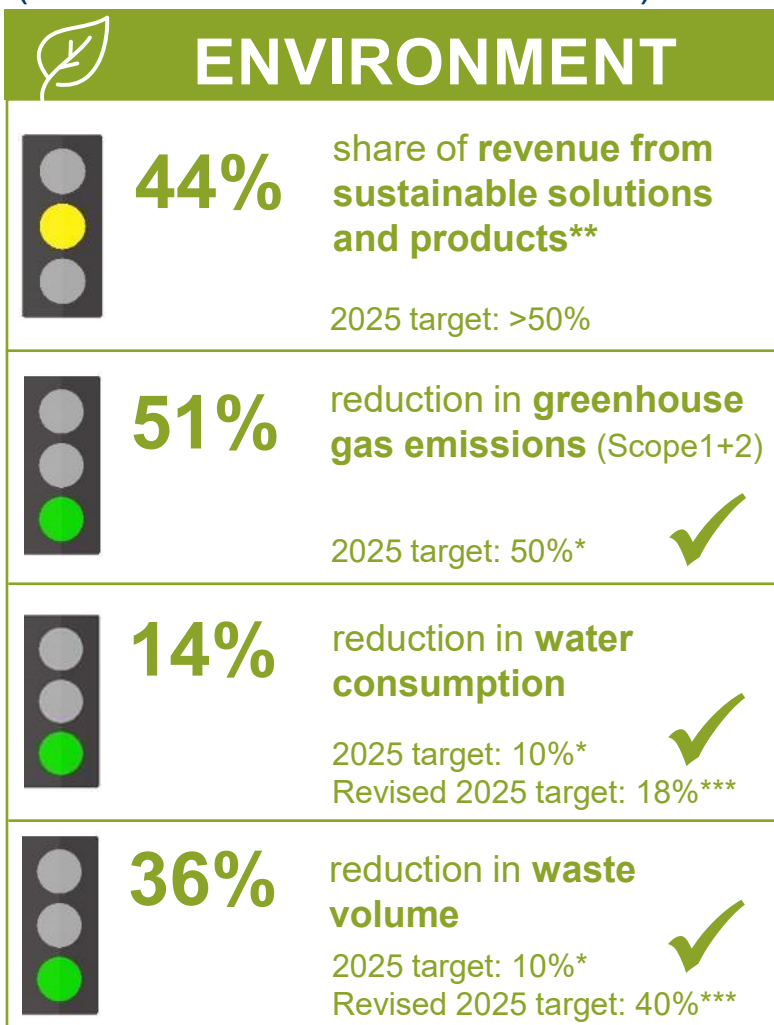


LONG-TERM PROFITABLE GROWTH

- Grow revenue
- Grow profitability
- Grow service share

ON TRACK TO MEET 2025 ESG TARGETS – MANY ALREADY ACHIEVED

(Status at the end of 2024)



CHAPTER OVERVIEW



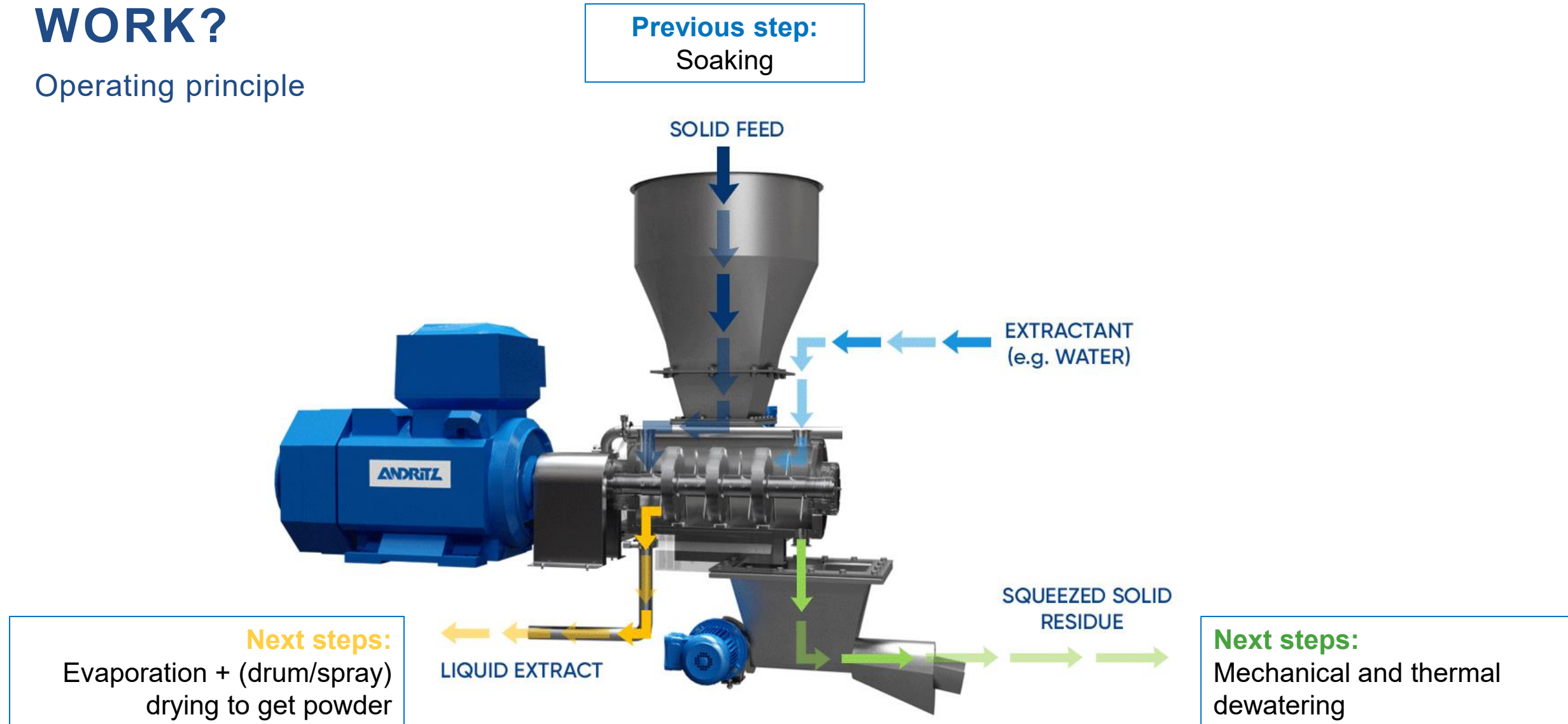
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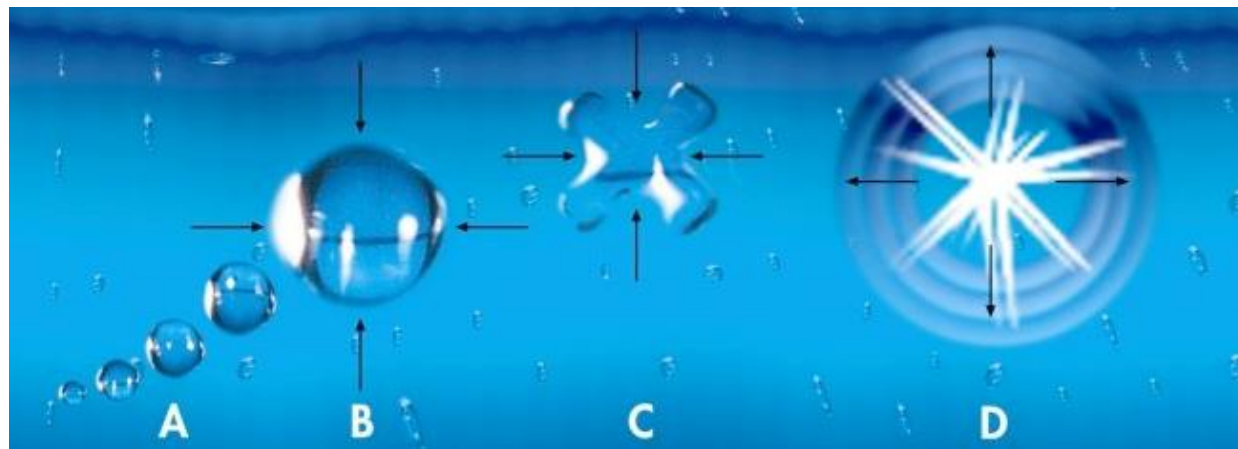
03 From idea to process

HOW DOES TURBEX WORK?

Operating principle



DISCOVER TURBEX: A DISRUPTIVE EXTRACTION PROCESS TECHNOLOGY



Phase A:
Bubble generation
and isothermal
growth

Phase B:
Maximum bubble
volume

Phase C:
Start of bubble
implosion

Phase D:
Adiabatic
implosion with
generation of
high-speed micro
jets

**Up to 20,000 K
and 10,000 bar
during implosion!**

**Bubble lifetime “from generation
to implosion”**
= 50 – 100 microseconds
~ 1000 cavitation events per
second per stator/rotor – multi-stage
also possible

HOW DOES TURBEX WORK?



Turbex generates:

- Cavitation
- High turbulence
- High shear



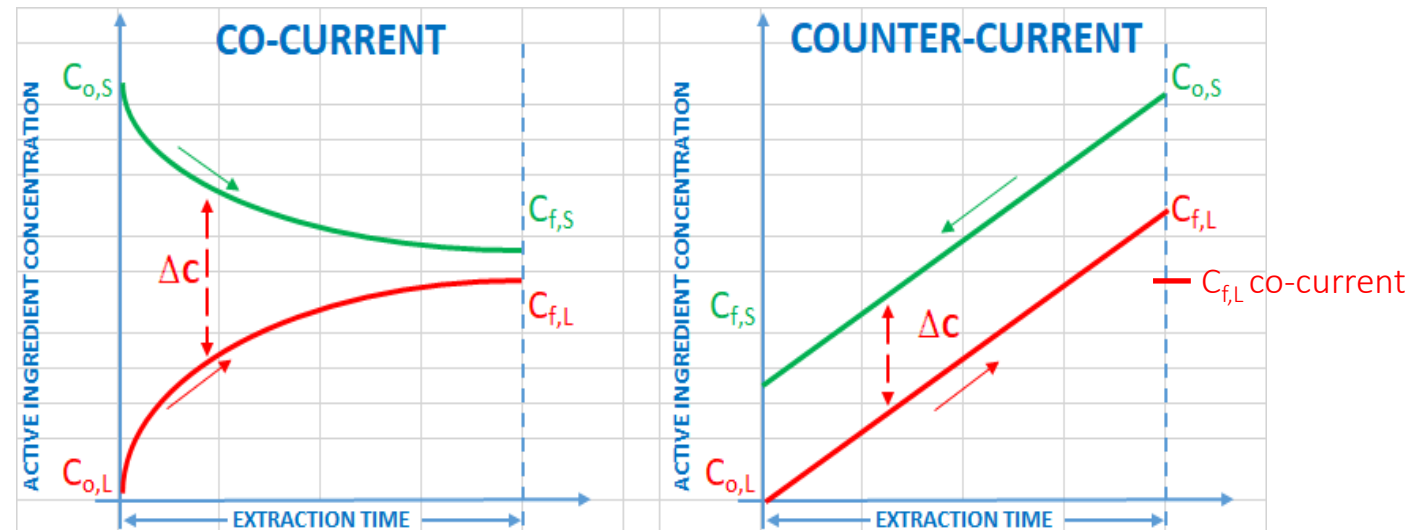
A x 100 and k x 100
vs. conventional extractors

Turbex operates in:

- Multi-stage mode
- Counter-current mode



Extraction yield
> 90–95%



Counter-current flow keeps DC (driving force) high $\rightarrow C_{f,L}$ is higher than with co-current flow

BENEFITS COMPARED TO EXISTING EXTRACTION TECHNOLOGIES




Comparison of extraction technologies for extraction of **oleuropeine from olive leaves**

	Conventional batch	Ultrasound batch	Continuous extractor	TURBEX
Operating mode	Batch process	Batch process	Continue process, countercurrent	Continue Process, countercurrent
Extraction solvent	50% water/50% ethanol	50% water/50% ethanol	50% water/50% ethanol	Water
Liquid/solid ratio	20:1	15:1	10:1	7:1
Treatment time	60–120 min	15 min	30–120 min	1 min
Treatment temperature [°C]	70	30	60–70	30
Total extraction yield	27%	34%	52%	59%
Oleuropeine yield	46%	62%	85%	99%

***Information provided by the inventor**

YOUR BENEFITS IN CHOOSING TURBEX FOR YOUR PROCESS



ONE EXTRACTION STEP ONLY

ONE EXTRACTION STEP INSTEAD OF MULTIPLE
Allowing money and solvent savings

PRODUCT QUALITY

HIGHEST QUALITY OF FUNCTIONAL INGREDIENTS, ACTIVE PRINCIPLE, AND VEGETABLE PROTEINS
due to low extraction temperature avoiding oxidation

EXTRACTION

FASTER EXTRACTION COMPARED TO CONVENTIONAL PROCESS
Due to cavitation, resulting in more product in less time

YIELD

UP TO 50% HIGHER YIELD
assisted by a counter-current process for better profitability

ENERGY SAVINGS

REDUCED ENERGY CONSUMPTION BY UP TO 30%
compared to traditional processes which in turn leads to a faster return on investment

RESULT
Sustainable high quality product production



TURBEX EXTRACTOR

FEASIBILITY TESTS / FULL SCALE TESTS



Preferred material characteristics

- Particle size < 1 mm for hard materials , < 2 mm for soft materials
- Materials should be free of any hard particles > 2 mm, because risk of damaging stator-rotor
- All particles should be able to absorb extraction solvent

Go



Marigold pellets



Birch bark, < 1 mm



BSG, dry



Ginseng panax



Abies bark < 1 mm



Spent Coffee
Ground, dry & wet



Black, Green Tea &
Yerba Mate

Usually materials that match the given dimensions qualify for a Turbex test, unless (part of) the material cannot be soaked

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ONE RELIABLE PARTNER WITH EVERYTHING YOU NEED TO SUCCEED

Our offer spans
from design, to engineering and
realization on to lifetime support
for your assets.

- ## 4 Service and partnership
- Local support
 - Repairs and upgrades
 - Process optimization
 - Training

- ## 3 Realization
- Detailed engineering
 - Procurement services
 - Installation supervision
 - Commissioning

- ## 2 Engineering
- Scaling up in our pilot plant
 - Key equipment selection
 - 3D simulation and basic process layout
 - Process automation


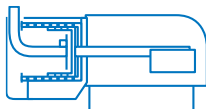
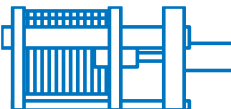

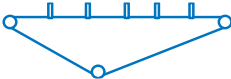
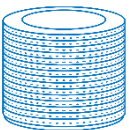


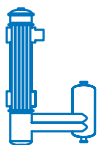
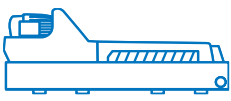
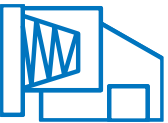
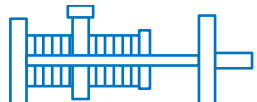

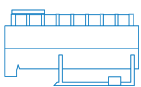
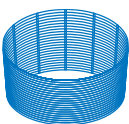


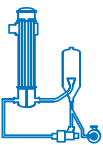
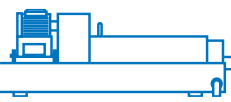






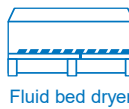


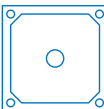
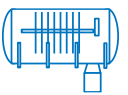


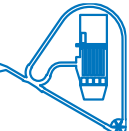

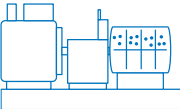




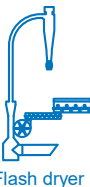



- ## 1 Design
- Project ideation and development with our process experts
 - Results: product features, yield, price, equipment parameters



TECHNOLOGY: WE OFFER EVERYTHING FROM SINGLE MACHINES TO COMPLETE SOLUTIONS

The right solution for every separation challenge



MECHANICAL SEPARATION						THERMAL SEPARATION		
DECANTER CENTRIFUGES	FILTER CENTRIFUGES	FILTER PRESSES	DISC AND DRUM FILTERS	DRAINS, PRESSES	SCREENS	CONTACT DRYERS	CONVECTIVE DRYERS	EVAPORATORS, CRYSTALLIZERS
 Decanter centrifuge A	 Pusher centrifuge	 Overhead filter press	 Dynamic crossflow filter	 Gravity belt table	 Perforated components	 Paddle dryer	 Belt dryer	 Evaporator
 Decanter centrifuge D	 Screen scroll centrifuge	 Sidebar filter press	 Tilting pan filter/UCEGO®	 Drum thickener	 Wedge wire components	 Contact drum dryer	 Drum dryer	 Evaporative crystallizer
 Decanter centrifuge F	 Horizontal peeler centrifuge	 Filter elements	 Vacuum disc filter	 Horizontal vacuum belt filter	 Screening machines	 Helix dryer	 Fluid bed dryer	 Spray dryer
EXTRACTORS	 Vertical peeler centrifuge	 Filter plates	 Hyperbaric disc filter	 Screw press	THICKENERS	 Plate dryer	 Ring dryer	 Torrefaction reactor
 Turbex extractor			 Vacuum drum filter	 Belt press	 Thickener	 Roto flash dryer	 Flash dryer	 Contact drum flaker
			 Pressure drum filter	 Heavy-duty belt press				
VARIOUS PROCESSES								
SCREENING	THICKENING	DEWATERING	FILTRATION	CLASSIFICATION	CONCENTRATION	DRYING	COOLING	SOLIDIFICATION
EXTRACTION								

FOOD INNOVATION XPERIENCE

State of the art Food Test Center in Waddinxveen (NL)

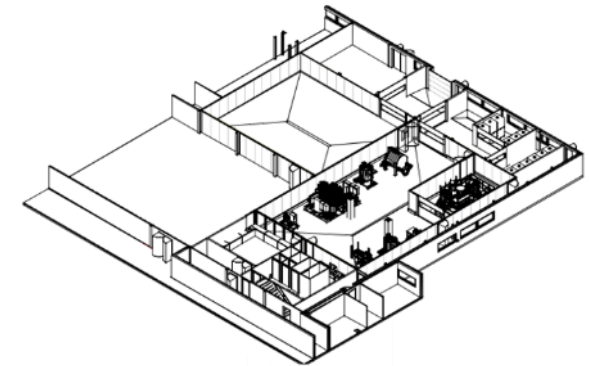


FOOD INNOVATION XPERIENCE

IMAGINE · EXPLORE · CREATE



- Food test center opened Oct 2023
- 850+ m² for trials
- Large meeting space
- Equipped lab
- ANDRITZ and other equipment
- Food grade environment
- ATEX trials possible

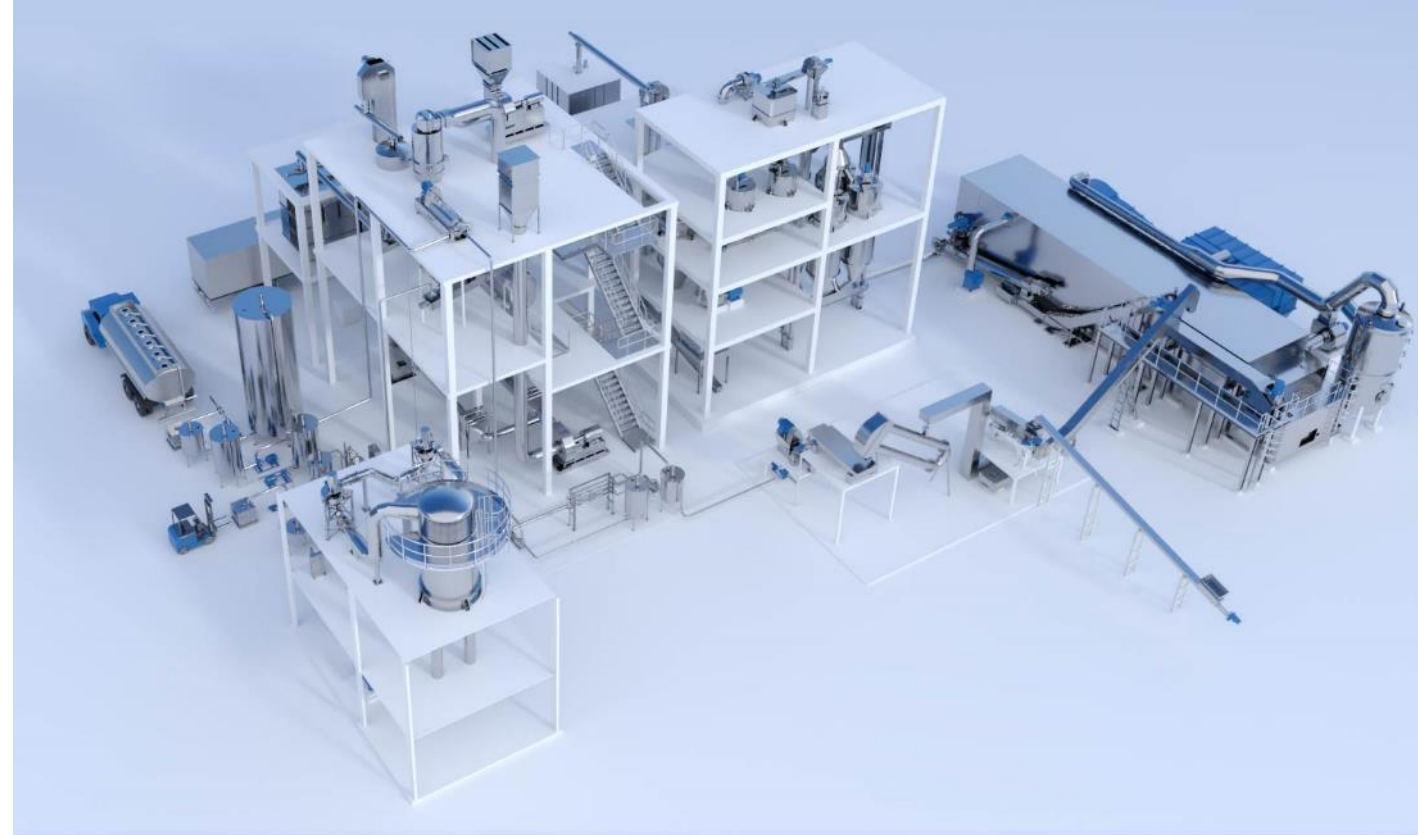


OUR AMBITION



We provide solutions to the food & feed ingredient industry – focus on proteins

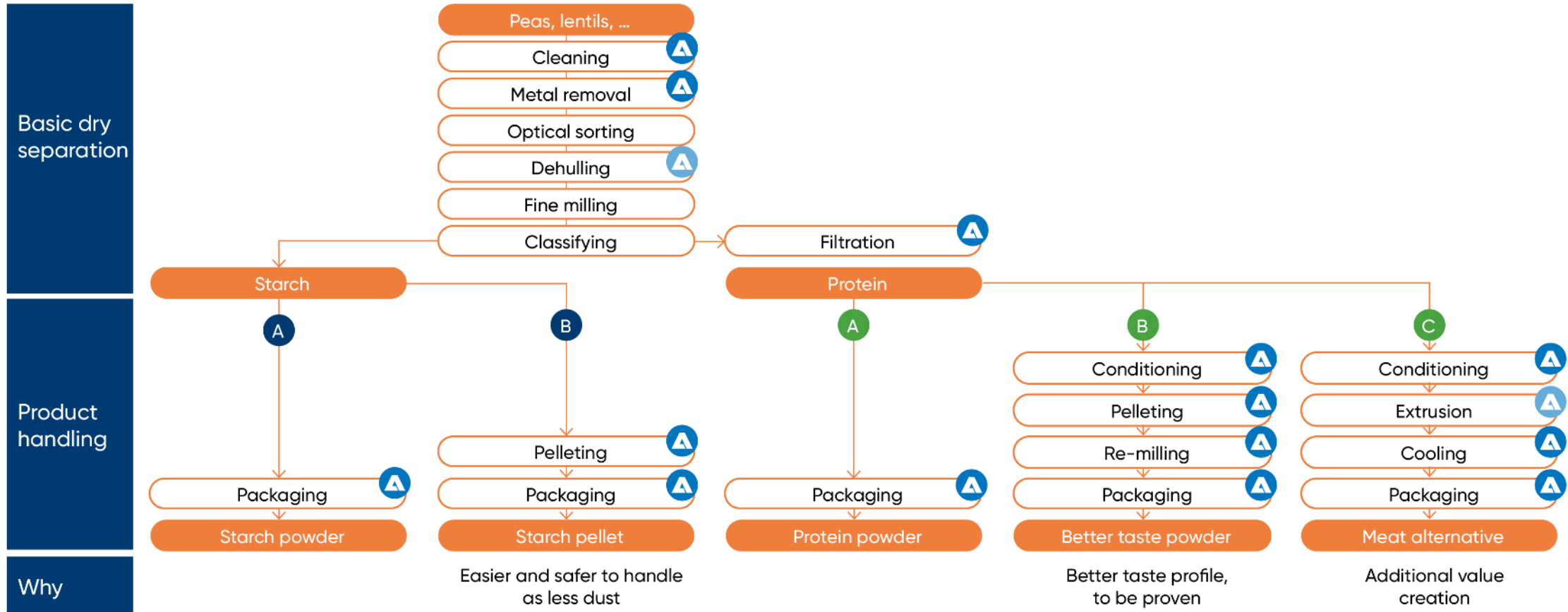
- Food activities
 - Starch
 - Sugar
 - Cereal-based baby food
- Focus on proteins
 - Plant based
 - Animal rendering
 - Insects
 - Fermentation
 - Side stream valorization



DELIVERING DRY SEPARATION



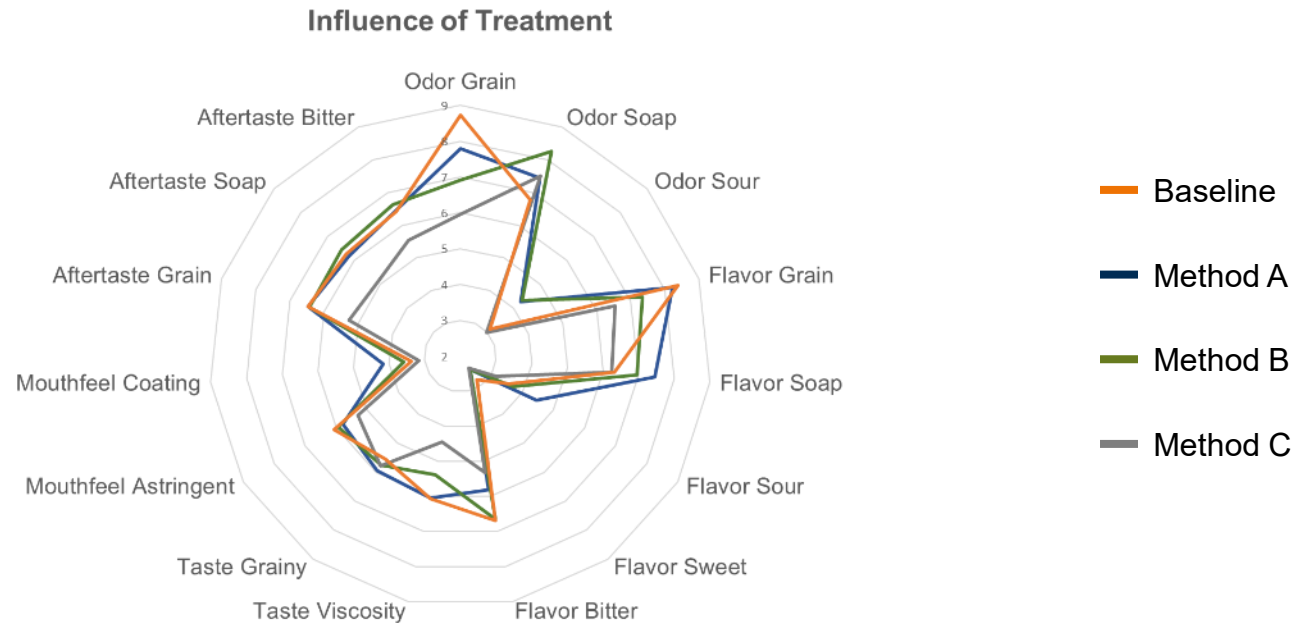
Less CAPEX, less energy & more sustainable vs. wet processes – also in meat alternatives



IMPROVING FLAVOR AND TASTE - RESULTS



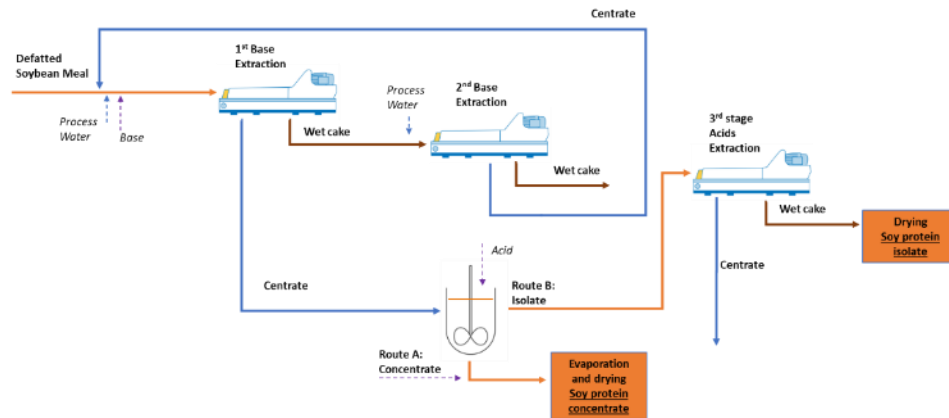
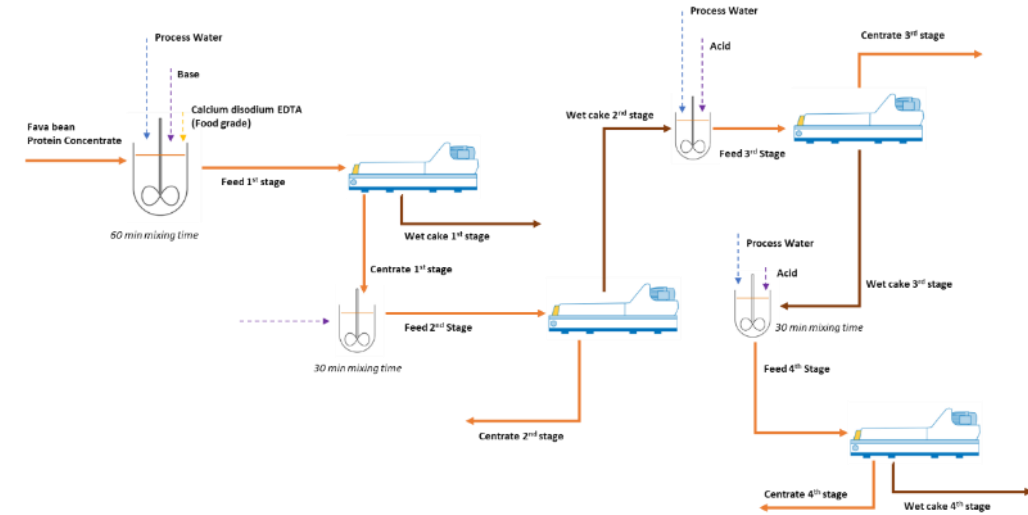
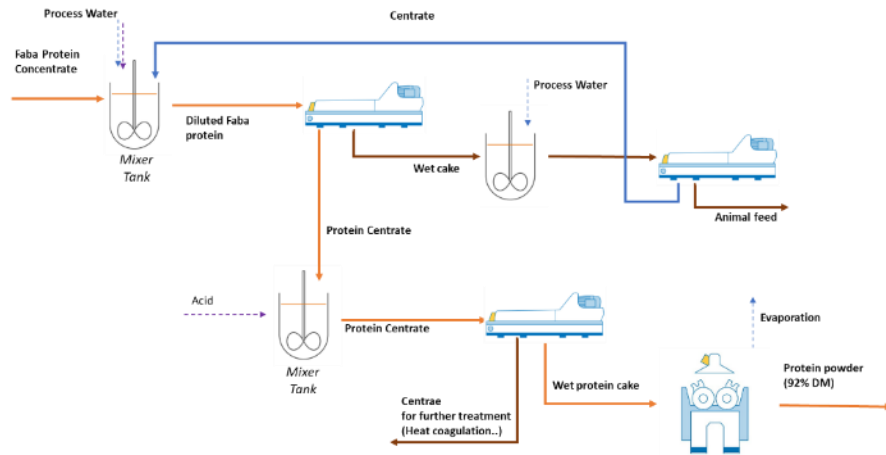
Modification of protein concentrate powder



- Varying steam, water and temperature results into different modifications, allowing to adopt to the specific raw material and desired outcome

SPECIALTY PLANT PROTEIN ISOLATES

Creating the difference



- We co-develop processes with our customers
- Product is fully adapted to their needs, allowing unique products
- Examples include pea, fava bean and soy in food and feed applications



**ANDRITZ.
FOR GROWTH
THAT MATTERS.**

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