



POWER4BIO
REGIONS FOR
BIOECONOMY



POWER4BIO webinar series: Food & Feed, session 4. 4 November 2020, 9 am CET

Examples related to trends in food

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Producing food and food ingredients from biomass/side streams



Highlights relevant food trends

- Clean label
- Healthy ingredients
- Reduce food waste, recycle surplus food
- Alternative protein sources, plant based

Food trend: clean label

E-number ↔ Vegetable concentrate/powder/...

Clean label: assisted by novel conservation processes



Example:

- High Pressure Pasteurisation
- Ingredients: avocado, tomato, lemon juice, Extra Virgin Olive Oil, salt, coriander and garlic.
- 'Traditional guacamole'
- Extends shelf life up to 8x
- Once opened consume within short period

clean label + significant shelf life

- Drivers:
 - 'fresh' perception
 - clean label
 - convenience
 - allergens free
- Success condition:
 - conservation technologies
- Drawbacks/hurdles:
 - need volume (expensive technology)



Clean label ingredients: mushroom processing water to flavour



A screenshot of the Scelta Mushrooms website. The browser address bar shows "https://www.sceltamushrooms.com/en/products/sta/". The page title is "More flavour - less salt". Below the title, there is a list of benefits: "Reduce salt between 25% - 50%", "Replace MSG / AYE / I+G", "Masking bitter / metallic tastes from KCl", "Reduce cocoa", and "Reduce salt while maintaining gluten structure and overall texture". There are three tabs: "Our selection", "Specification", and "Packaging". The "Our selection" tab is active, showing a product named "STA CC". Below the product name, there is a quote: "made from the stems and blanching water of the mushroom industry". Further down, there is a description: "Scelta Taste Accelerator® is an innovative umami tool that helps balance your flavour. With our STA, which can be used in processed foods, you can cut the amount of salt, autolyzed yeast extract and replace MSG, I+G flavour enhancer." Below this, there is another list of benefits: "100% natural flavour enhancer", "Clean label", "Without losing taste and function", "Bitter masking effect", "Salt reduction up to 50%", and "Small dosage, big effect".

- Drivers:
 - consumer interest in natural flavouring, clean label, gluten-free
 - reducing costs of waste water
- Success condition:
 - separation technologies
- Drawbacks/hurdles:
 - need volume (mushroom process water + market demand)

Clean label ingredients: citrus fibre

→ ↻ 🏠 <https://www.fiberstar.net/citri-fi-natural-citrus-fiber-overview/> ☆ ⋮

Key Differentiating Features

- High water holding capacity
- Emulsification properties
- Gelling properties in low pH/high Brix conditions
- Heat and pH stable
- Freeze/thaw Stability
- Replacement for chemical or synthetic ingredients


Key Attributes

- Natural
- Plant-based
- Vegan | Vegetarian
- Non-allergenic
- Gluten-free
- Non-GMO Project Certified

Citri-Fi Functional Benefits in Food Applications

View all of Citri-Fi Food Applications [here.](https://www.fiberstar.net/citri-fi-natural-citrus-fiber-overview/)

Food Applications	Functional Benefits	Food Applications	Functional Benefits
Meats	<ul style="list-style-type: none"> • Yield Improvement • Purge Reduction • Phosphate Replacement • Juiciness 	Dairy	<ul style="list-style-type: none"> • Reduced Syneresis • Stabilization • Emulsification • Thickener
Bakery	<ul style="list-style-type: none"> • Improved Freshness over Time • Moisture Retention • Egg Reduction • Oil Reduction • Improved Gluten-free Products • Natural Emulsifier 	Frozen Foods	<ul style="list-style-type: none"> • Stabilization • Fat Reduction • Reduction in Ice Crystals
Dressings & Sauces	<ul style="list-style-type: none"> • Thickener • Emulsification 	Pet Food & Treats	<ul style="list-style-type: none"> • Strengthening • Binding • Reduced Stickiness • Improved Flowability • Texturizer



- **Drivers:**
 - consumer interest in clean label, non-allergic, gluten-free

- **Success condition:**
 - high technical qualities

- **Drawbacks/hurdles:**
 - need volume (mushroom process water + market demand)

Trend: healthy food ingredients & nutraceuticals



Algae

News 17 October 2014

AlgaeBiotech reports successful test to produce Omega-3 food supplement from industrial wastewater

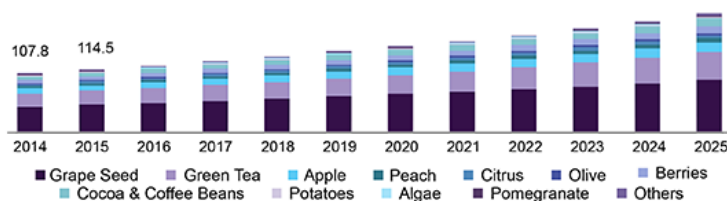


- Omega 3 fatty acids
- healthy bio-active components

AlgaeBiotech: “Producing food and supplements and cosmetics ingredients from industrial wastewater”

- Drivers:
 - co-creation of high-value products and reducing costs of waste water
- Success condition:
 - Technology development (closed production systems, adequate scale)
- Drawbacks/hurdles:
 - quality and quality management of the waste water is critical
 - Algae biorefinery is intensive process

U.S. polyphenols market size, by product, 2014 - 2025 (USD Million)



Nutraceuticals and healthy food ingredients from winery and olive residues



High oxidant level in peels and other biomaterials is natural protection for many crops' fruits

GRAP'SUD:

- natural grape colouring,
- grape polyphenols
- olive extracts
- etc.

- Drivers:
 - interest in food supplements
 - interest in natural food ingredients
- Success condition:
 - critical mass for R&D and
- Drawbacks/hurdles:
 - food supplement market: high expectations...

Healthy ingredients from fish residues



HOME ABOUT US OUR PRG

Fish residues

- fish oil
 - common use: feed
 - fish oil for food: dedicated caught fish
- proteins
 - common use: feed (fish silage, fish meal)
 - bio-functional fish protein hydrolysates are commonly derived from caught fish

New ideas: food-grade protein hydrolysate and/or oil from by-product

Drivers:

- price of nutraceuticals

Success conditions:

- traditional fish oil & meal producer has access to significant volumes of fish residues already gathered
- fish processing residues can be kept food-safe (not default for fish aimed for feed meal)

Drawback/hurdles:

- integral challenge:
 - investing in process line
 - developing applications
 - developing market
- acceptance of health claims in EU is very difficult

Exploring use of brewer's spent grain in food



- Common application: feed
- Considered new application: food ingredient
 - replaces wheat
 - increases fibre and protein content

Drivers:

- sustainable food ingredient

Success conditions:

- organizing chain from BSG supply to end-use:
 - fresh ingredient
 - dried/milled form

Drawback/hurdles:

- getting food-grade material
- drying/milling required



Utilization of brewery wastes in food industry

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ABSTRACT

Beer is the most popular low-alcohol beverage consumed in large amounts in many countries each year. The brewing industry is an important global business with huge annual revenues. It is profitable and important for the economies of many

Driver: reducing food waste

Valorising unsold products for feed or as food ingredient

Using vegetable cut-offs and rejects for food products

- residues from semi-prepared vegetables:
 - peeled carrots -> peels
 - cauliflower roses -> hearts
 - use damaged produce in processed food
 - etc..



- Drivers:
 - increasing market volumes on semi-prepared vegetable products
 - society's interest in reducing food waste
- Success condition:
 - economies of scale: centralized processing/packaging
 - entrepreneur with sustainability ambitions
- Drawbacks/hurdles:
 - business case challenging; total valorisation possible?

New bakery products from unsold bread



Food products from unsold bread:

- croutons
- cookies
- bread
- beer

The bread replaces wheat or other starch ingredient

Drivers:

- consumers' interest in sustainable food
- Success condition:
 - specialty producer: fermentation starter
 - logistic position w.r.t. unsold bread supplier
- Drawbacks/hurdles:
 - variety of bread types
 - sometimes compositional 'challenge'
 - replaces wheat in bread
 - replacement product in animal feed: wheat

Instock: restaurants, food trucks, catering & webshop



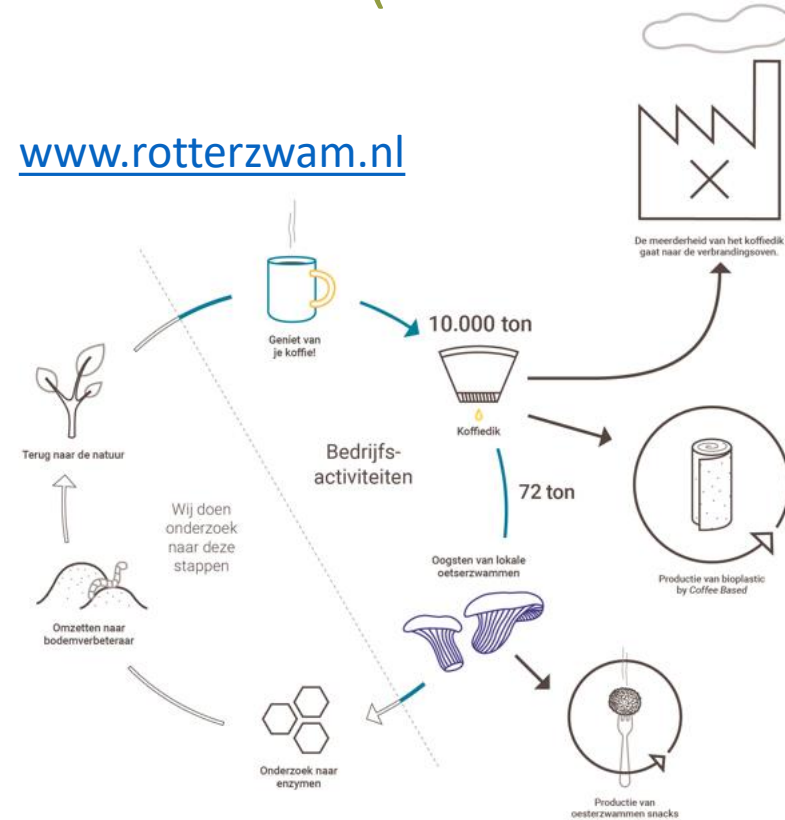
- Meals based on rescued foods
- *Pieper Bier* made from rescued potatoes
- *Bammetjes Bier* made from rescued bread
- *Boos Bier* made of rescued raspberries

Drivers:

- consumers' curiosity in sustainable food
- Success condition:
 - curiosity/fun product
 - rescue food products from large chains
 - full concept based on rescued foods
 - “circular webshop”
- Drawbacks/hurdles:
 - supply orientation, requires flexibility

Oyster mushroom production on coffee residues (Rotterzwam, GRO, ... Netherlands)

www.rotterzwam.nl



www.gro-together.com

GRO produces mushrooms on coffee residues from La Place restaurants.

The mushrooms are supplied to the restaurants.

- Drivers:
 - consumer interest in food waste valorisation
- Success condition:
 - containerized production units
 - small-scale demonstrators
 - combi with other sustainable ideas
- Drawbacks/hurdles

<https://power4bio.eu/project-material> D3.4

https://power4bio.eu/wp-content/uploads/2020/04/POWER4BIO_D3.4_Best_practices_of_bio-based_solutions.pdf

<https://bio-based-solutions.eu/#/project/89>

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Mushroom production

Pilze-Nagy Ltd, Hungary



Main inputs:

- for mushrooms production
 - straw
 - alfalfa
 - green fodder residues
 - mushroom spawn
- for biogas plant:
 - spent mushroom substrate
 - agricultural wastes

Products:

- oyster mushroom,
- oyster mushroom substrate,
- fertiliser,
- electricity

History: expanding a mushroom company to a multi-functional company

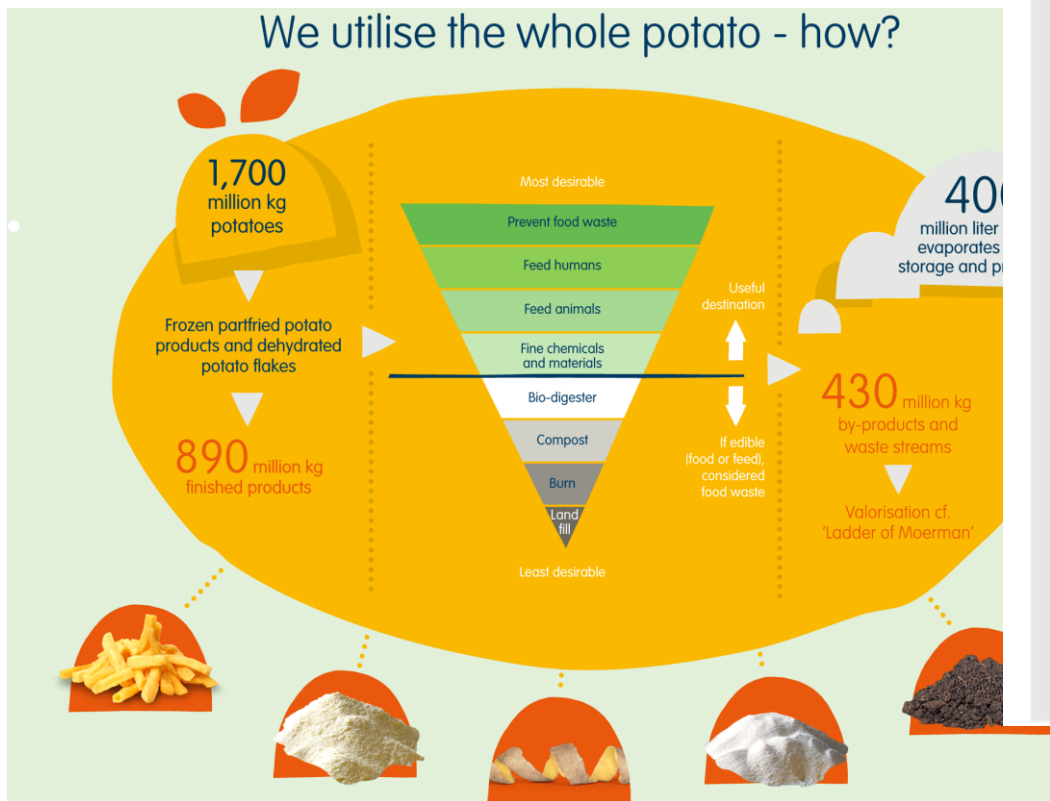
- Drivers:
 - Development funds
- Success condition:
 - proactive; o.a. participating and coordination of many domestic R&D projects
 - Continuous technology development
- Drawbacks/hurdles:

Our 2020 objective is to increase our potato utilization by 10% per tonne of consumed, finished product; to increase the valorisation of our by-products and waste streams; and to promote a more conscious consumption in our value chain, resulting in a reduced ecological footprint. This means we will need less land and fewer resources to produce the same amount of finished product.

2018 Results versus 2008 baseline

- Our potato utilisation (as produced) improved by 6.8%
- We send zero waste to landfill, and 2.7% waste is incinerated
- 97.3% of our by-products and waste streams is reused, recycled or recovered
- Customer pilot to reduce food waste resulted in only 1% fries wasted

Potato side streams to food



Driver: alternative protein sources



Alternative protein sources



Some produced on side streams from food chains

Example: native protein (Rubisco) from green vegetable residues:

- functional, colourless, native protein
- gelling and foaming properties
- can be applied in food, e.g. ice cream
- TRL 6

- Drivers animal protein replacers (in general):
 - started as new and healthy
 - now from specialty to mainstream.
- Success condition:
 - technical functionality proteins (replacing high value animal proteins)
 - texturing meat alternatives
- Drawbacks/hurdles (in general):
 - now discussions on ultra-processed food

Insects

Madebymade (Germany):

- insect breeding
- modular system (size of shipping containers)
 - > individual and efficient solutions at low planning and transporting costs
- products:
 - living, dried larvae
 - protein flours for pets
 - valuable fats
 - sustainable soil substrate

- Drivers:
 - valorizing local food processing side streams
 - interests in new proteins
- Success condition:
 - modular processing
 - awards, subsidies
- Drawbacks/hurdles:
 - still at pilot scale

Take home message

- Food trends offer good opportunities
- Some developments are based on specific properties of the side streams / residues
- Others replace (virgin) crops (intended benefit: lower costs)
- Require co-development of processes & market & market volumes

Thank you for your attention



Next session at 10 am CET

Session 5. Technical examples of regional initiatives



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