ECO-INNOVERA

Innovations for optimal use of organic side-streams and waste – IPTOSS

Annika Wilhelmson

VTT Technical Research Centre of Finland

IPTOSS

- Background
- Work plan
- Results and impact
- Partners and roles
- Volume and schedule

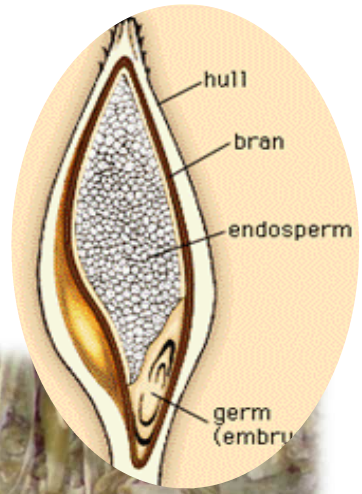
Background

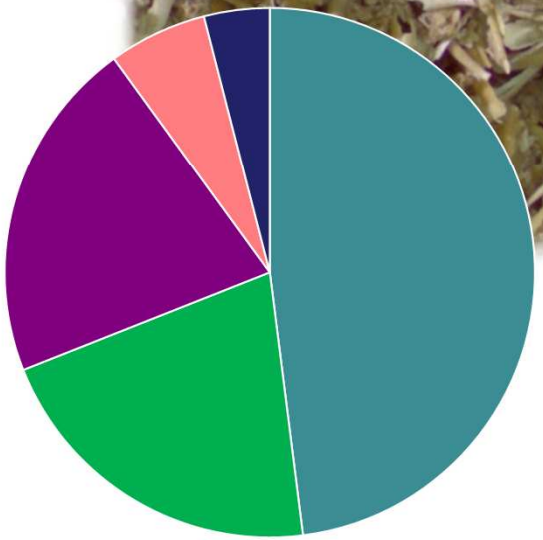
- Great attention is raised toward the exploitation of side-streams and biowastes as raw material sources for novel bio-based products

- BSG (brewer's spent grain) is a significant source of functionalised molecules (i.e. biopolymers, protein, carbohydrates) and valuable extracts for various applications

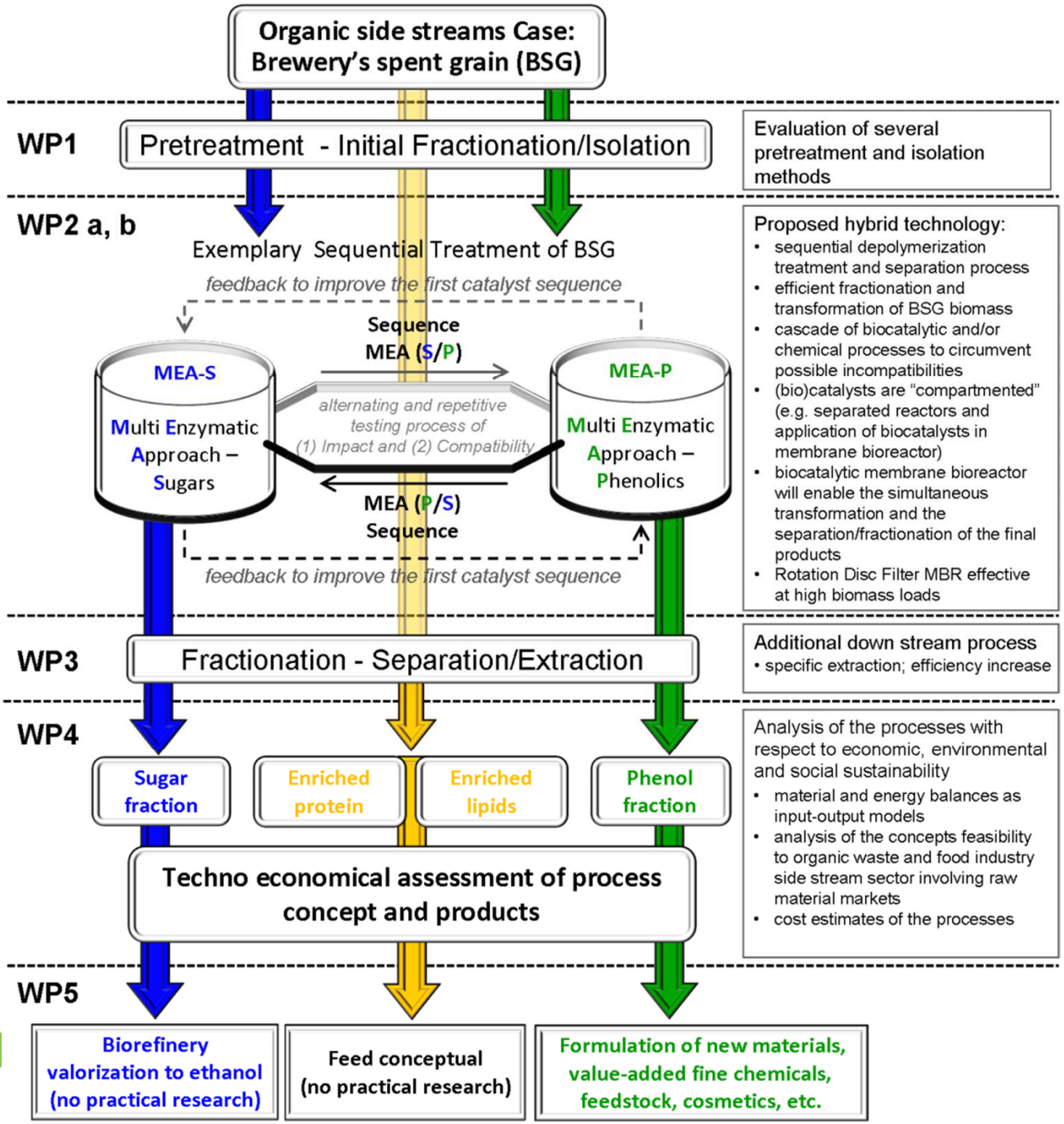
Background

- BSG contains the husks and outer layers of the barley grains
- 30 million tons of BSG is produced annually
- Current use is mainly ruminant feed with little or no profit for the breweries





Carbohydrates
Protein
Lignin
Lipids
Ash



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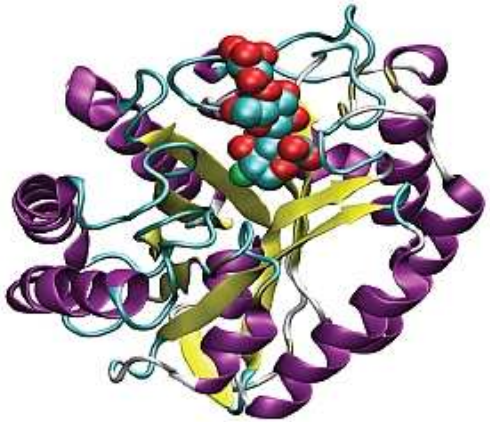
BSG fractionation

- Pre-treatments, such as milling, are required to open up the cell wall structure
- Enzymatic treatment with cellulases, hemicellulases, proteases, esterases etc.
- Chemical extractions with alkali, solvent systems etc.



What could we get from BSG?

- Composition of dry weight:
  - **22-28% hemicellulose**
  - **15-24% protein**
  - **17-25% cellulose**
  - **10% lipids**
  - **12-28% lignin**

- **Note: 70-80% water**

What could we get from BSG?

- Sugars for fermentation or chemical conversion
- Dietary fibre
- Plant protein or peptides
- Phenolic compounds with antioxidant and other bioactive properties

- **Note that BSG is a food grade material!**

Main topics of the project:

- Improving existing protocols for enzymatic BSG fractionation
- Effect of pre-treatments on subsequent fractionation
- Solubilization of protein without extensive degradation to peptides
- Decreasing water-consumption in the process

Main topics of the project:

- Recycling of enzymes by immobilization
- Decrease of enzyme inhibitory effects by continuous product removal using membrane reactors
- Chemical extractions with aqueous, organic and supercritical fluids
- Techno-economical evaluation of the studied processes

Results and Impact

- Production of high value molecules/products from organic wastes
- Include newly developed biotechnological processes into existing waste treatment pipelines
- Exploit the results into new, sustainable industrial processes and by gluing the processes into a total value chain support its diffusion into the market

Project partners

- **VTT Technical Research Centre of Finland**
  - Coordinator, fractionation of BSG, selection of enzymes
- **University of Applied Sciences Northwestern Switzerland (FHNW)**
  - Study of added-value BSG components, immobilization of nanobiocatalysts, membrane technologies
- **Bionactis Ltd, Switzerland**
  - Un- and supercritical extraction technologies
- **Roal Oy, Finland**
  - Supply and development of enzymes
- **Panimolaboratorio, Finland**
  - Supply of brewer's grain
- **ST1 Biofuels**
  - End-user of sugar fraction

Project partners

VTT

- Raija Lantto, Katariina Kemppainen, Annika Wilhelmson

FHNW

- Philippe Corvini, Gregor Hommes, Cristoph Gasser, Erik Amman

Bionactis

- Pierre Salvat

Roal

- Terhi Puranen

Panimolaboratorio

- Jorma Rasi

St1 Biofuels

- Jyri Maunuksela

Volume and schedule

- Project budget
  - VTT 440 k€
  - FHNW 370 k€
  - Bionactis 210 k€
  - SUM 1 020 k€
- Funding confirmed for Finland, soon confirmed for Switzerland
- Duration 30 months (2012-2014)