lifebrewery

from brewery to fish feed

LIFE16
ENV/ES/000160

New Strategies for Improving the Sustainability of Breweries: Full Waste Recovery for Aquaculture Feed

azti tecnalia
Transforming Science into Business

dsanmartin@azti.es

lifebrewery.azti.es

@life_brewery

Coordinator
Coordinador

azti tecnalia

Partners
Socios

IRTA RECERCA | TECNOLOGIA AGROALIMENTÀRIES

Riera Nadeu

LKS

The Brewers of Europe

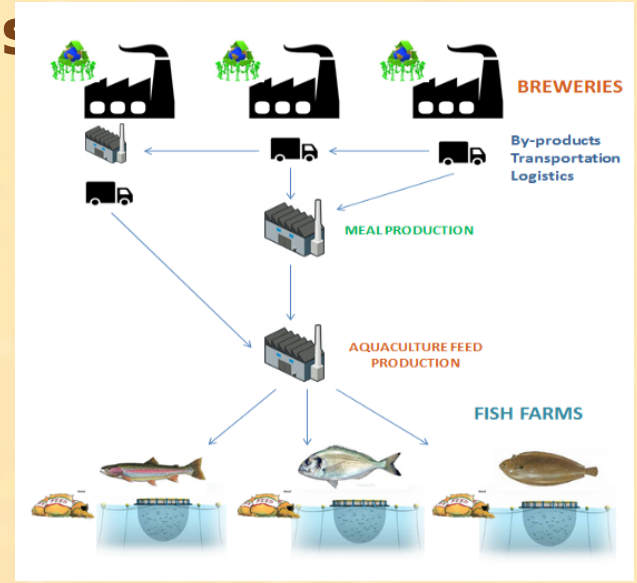
lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Objective: To **demonstrate the feasibility of** an innovative and sustainable **solution** for reusing **brewer by-products as aqua-feed ingredients through a demons**

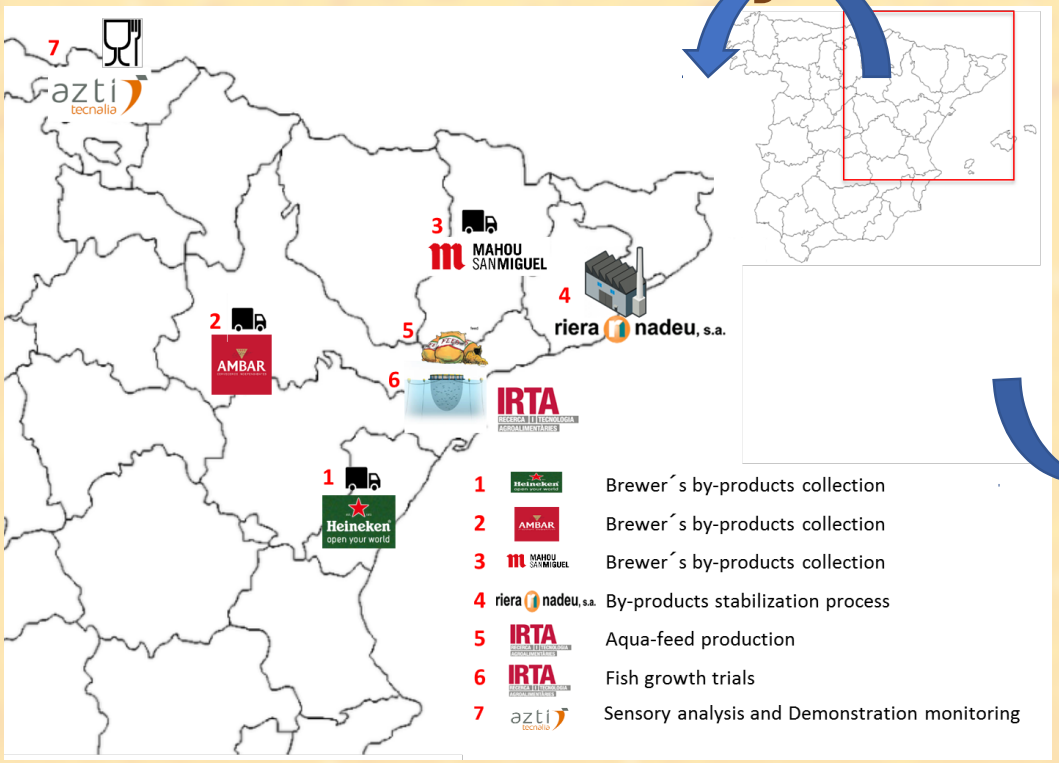
- At semi-industrial scale
- In real operational conditions
- In a real case study
- In a representative EU brewing producing region.



Start date: 01/09/2017

Finish date: 31/12/2020

Scope of the case study:



lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

1) Pre-industrial optimization of processes for obtaining brewers' by-products based ingredients

General Objectives

- Assessing the potential of **hydrolysis pre-treatment** to increase the **digestibility of by-products**

  → By comparing different prototypes with and without hydrolysis.

- Optimization of the **drying process** at semi-industrial scale for obtaining 4 meals prototypes

  1. Dried spent yeast
  2. Hydrolysed and dried spent yeast
  3. Dried spent grain
  4. Hydrolysed and dried spent grain

lifebrewery
from brewery to fish feed

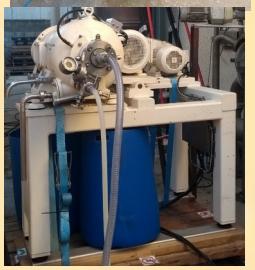
HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Optimizing and scaling-up the processing of brewers by-products

1.- Dried brewers' yeast

Moisture: 85%



1.- MECHANIC DEWATERING

Moisture: 65%

2.-BACK MIXING
Moisture: 30%

3.-FLASH DRYER

Moisture: 8%

Coordinator
Coordinador

azti tecnalia

Partners
Socios

The Brewers of Europe

IRTA RECERCA | TECNOLOGIA AGROALIMENTÀRIES

LKS

Riera Nadeu

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

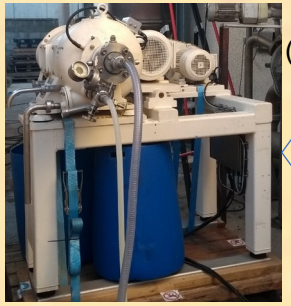
LIFE16
ENV/ES/000160

Optimizing and scaling-up the processing of brewers by-products

2.- Hydrolysed & dried brewers' yeast

Moisture 85%

1.- HYDROLYSIS
(Moisture 85%)



2.-MECHANIC DEWATERING

Liquid
(Moisture: 92 %)

→ Other applications

Solid
(Moisture: 65%)

3.-BACK MIXING
Moisture: 30%

4.-FLASH DRYER

Moisture: 8%

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Optimizing and scaling-up the processing of brewers by-products

3.- Dried brewers' spent grain

Moisture: 85%

1.-BACK MIXING
(Moisture : 50%)

2.-FLASH DRYER

Moisture: 8%

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

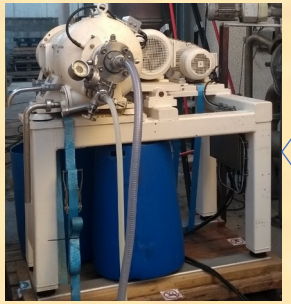
LIFE16
ENV/ES/000160

Optimizing and scaling-up the processing of brewers by-products

4.- Hydrolysed & dried brewers' spent grain

Moisture: 85%

1.- HYDROLYSIS (Moisture 90%)



2.-MECHANIC DEWATERING

Liquid (Moisture: 92 %)

Solid (Moisture: 55 %)

Other applications

3.-FLASH DRYER

Moisture:8%

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

2) Valorisation Scheme including all stages of the Value chain

Definition of the Valorisation scheme

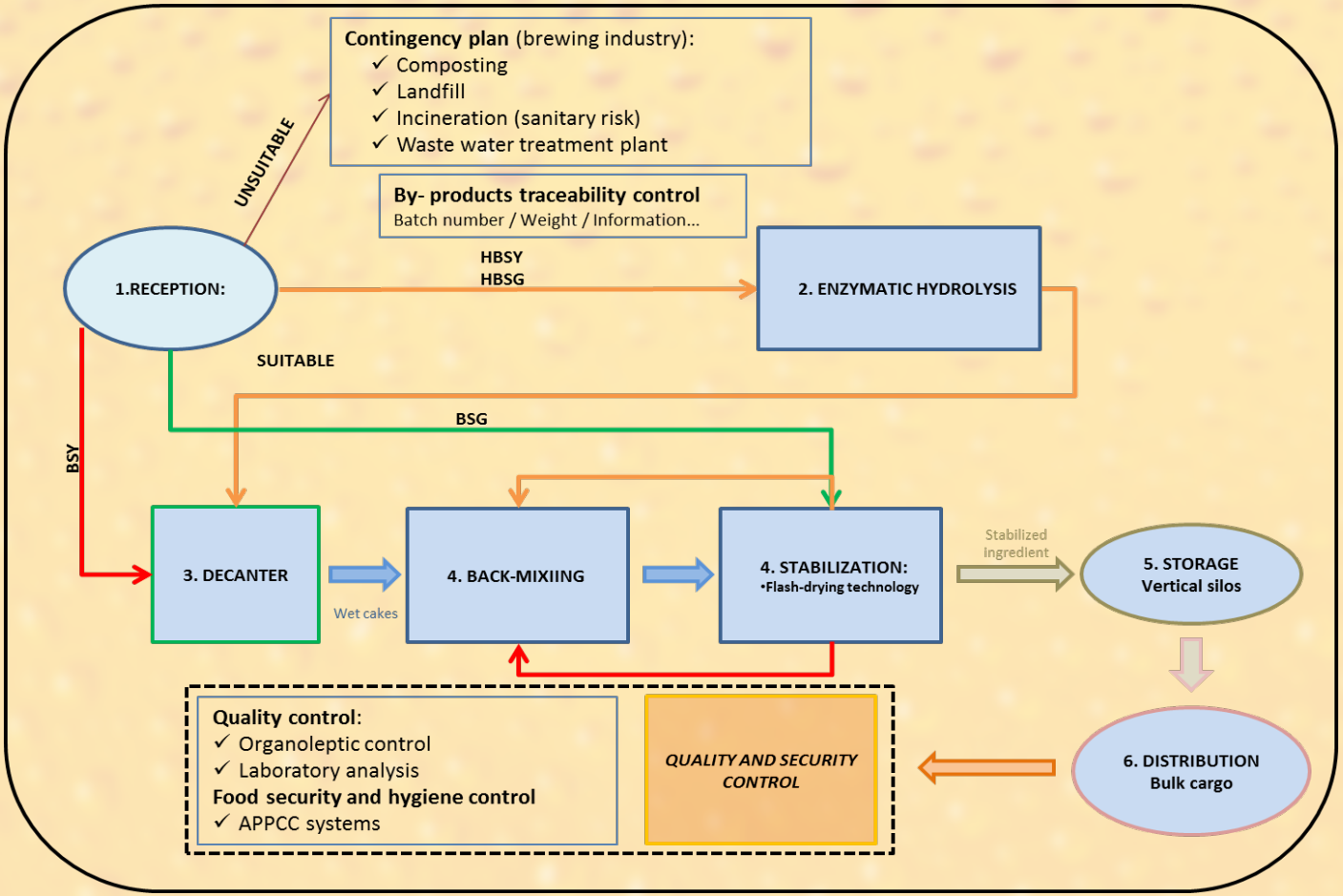
- **Valorisation scheme** for the sustainable, efficient and innovative full recovery of BSG and BY as a new raw material for aqua-feed production:
  - Including **all the stages of the Value chain**: 1) Storage in the brewery 2) Collection and transport 3) Processing 4)Aqua-feeds production.
  - Replicable to **any European scenario**
  - **Flexible** and **adaptable** to different necessities:
    1. Processing in an external plant.
    2. Processing in the breweries: different dimensioning (small, medium or large breweries).
  - Addressing all the **technical and administrative actions** required for each stage.
  - A **Protocol for the appropriate management** of by-products.
  - A **Contingency plan** for the best destination for inappropriate by-

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Definition of the Valorisation scheme



lifebrewery
from brewery to fish feed

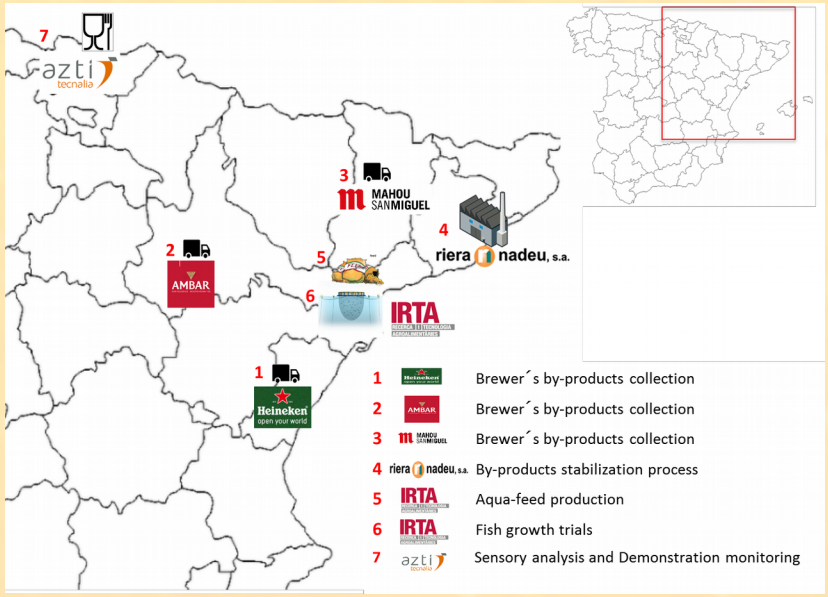
HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

3) Demonstration trial of the Valorisation Scheme

General Objectives

- Demonstrate **at a semi-industrial scale, in a representative case study in Spain and in real operation conditions** the Valorisation scheme:



lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Task B3.1 Demonstration Trial at semi-industrial scale

1. **15 tons of BSG and BY has been stored, picked-up and transported** to processing plant:
   - During 4 weeks in a radius of about 350 km.

2. **1.5 tons of different 4 ingredients has been produced**
   - Dried spent yeast / Hydrolysed and dried spent yeast
   - Dried spent grain / Hydrolysed and dried spent grain

3. **1 ton of experimental diets has been produced for Digestibility trials with fishes**
   - Gilthead sea bream & Rainbow trout
   - 2 control & 8 experimental diets (4 prototypes x 2 species); 100 kg /

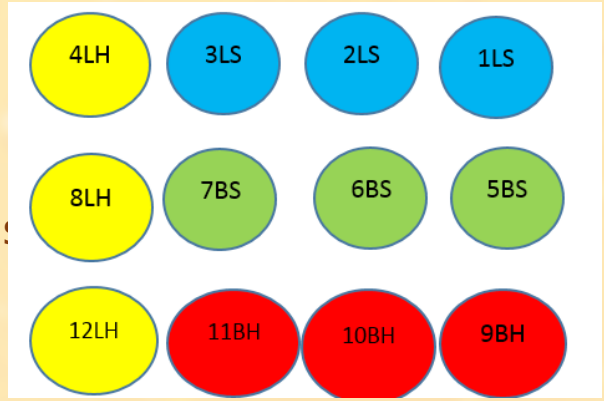
Task B3.1 Demonstration Trial at semi-industrial scale

4. Digestibility trials with fishes

→ Maximum level of inclusion

- Gilthead sea bream & Rainbow trout
- 25 fish/tank, 3 replicates
- 3 weeks feeding, feces collection and analysis
- C= control

  LS= dried yeast, LH= hydrolysed yeast,



ent gra

ed spent grain

lifebrewery
from brewery to fish feed

HERAKLION 2019
26-29 June 2019

LIFE16
ENV/ES/000160

Task B3.1 Demonstration Trial at semi-industrial scale

4. Digestibility trials with fishes

- Formula

Ingredients	Control	D-Yeast 30%	H-Yeast 30%	D- Spent grain 30%	H-Spent grain 30%
Fish meal 70 LT	60,00	40,00	42,00	50,00	50,00
Wheat starch	20,95	9,45	7,45	10,00	10,00
Dried Yeast	-	30,00		-	
Hydrolised yeast			30,00		
Dried spent grain	-	-		20,00	
Hydrolisd spent grain					20,00
Fish oil	18,00	19,50	19,50	16,50	17,00
Vit & Min Premix PV01	1,05	1,05	1,05	1,05	1,05
YTRIO	0,02	0,02	0,02	0,02	0,02

	Control	D-Yeast 30%	H-Yeast 30%	D- Spent grain 30%	H-Spent grain 30%
Dry matter (DM, g/Kg)	978,30 ±3,09	979,20 ±2,36	976,60 ±5,46	980,50 ±5,50	978,10 ±8,50
Ash (g/Kg DM)	98,80 ±0,98	83,20 ±0,77	78,70 ±0,76	93,60 ±4,24	100,60 ±1,07
Crude protein (g/Kg DM)	419,80 ±3,39	413,30 ±0,16	418,20 ±2,49	417,70 ±3,51	392,80 ±0,70
Crude fat (g/Kg DM)	218,42 ±3,29	223,94 ±1,45	234,04 ±5,71	219,83 ±2,04	221,40 ±1,59
Carbohydrates (g/Kg DM)	215,10 ±8,42	218,50 ±16,36	197,00 ±4,22	130,20 ±9,07	166,20 ±11,46
Gross energy (MJ/Kg DM)	18,65 ±0,08	18,89 ±0,19	19,04 ±0,32	17,25 ±0,22	17,53 ±0,23

Task B3.1 Demonstration Trial at semi-industrial scale

4. Digestibility trials with fishes

- Digestibility of diets → to define the Maximum level of inclusion.

TROUT	Diet	Protein faeces			Protein diet			Av	SD
	Control	318,2	±	0,56	419,80	±	3,39	84,12	0,15
	D-Yeast 30%	295,9	±	1,28	413,30	±	1,16	78,73	2,11
	H-Yeast 30%	314,3	±	1,46	418,20	±	2,49	75,99	1,26
	D- Spent grain 30%	247,5	±	0,06	417,70	±	3,51	81,96	1,04
	H-Spent grain 30%	224,1	±	0,21	392,80	±	0,70	79,69	0,34
SEA BREAM									
	Control	198,1	±	0,40	419,80	±	3,39	90,26	0,11
	D-Yeast 30%	262,4	±	1,59	413,30	±	1,16	71,76	2,73
	H-Yeast 30%	223,1	±	2,79	418,20	±	2,49	75,01	1,27
	D- Spent grain 30%	118,2	±	3,41	417,70	±	3,51	84,01	0,54
	H-Spent grain 30%	87,8	±	0,90	392,80	±	0,70	85,22	0,31

Conclusions

1. The **Valorisation Scheme has been defined and validated along the entire value chain** for the safe reuse of brewers´ by-products as an ingredient for aquaculture: *Flexible and adaptable to different necessities*

2. The **production of the 4 prototypes of ingredients**: spent yeast and grain, hydrolysed and non-hydrolysed, **has been technically validated at semi-industrial scale**: *Innovative and energy efficient process*.

3. The results of the **Digestibility tests** of the diets **has been positive**: *Ingredients suitable for aquaculture*.

Next steps

1. 2nd **Nutritional efficiency** trials

   They will provide the necessary information to adjust the *Optimum level of inclusion of the ingredients in aquaculture feeds*.

2. A **Sensorial analysis** of the produced fishes

   It will validate the *quality of fishes*.

3. A **techno-economic and environmental study** & a **Transferability plan**

   Business model which fulfils all requirements of brewer and aquaculture sector.

New Strategies for Improving the Sustainability of Breweries: Full Waste Recovery for Aquaculture Feed

LIFE16
ENV/ES/000160

Thank you!

Any question?

azti tecnalia
Transforming Science into Business
dsanmartin@azti.es
lifebrewery.azti.es
@life_brewery

Coordinator
Coordinador
azti tecnalia

Partners
Socios
IRTA RECERCA | TECNOLOGIA AGROALIMENTÀRIES
Riera Nadeu
LKS
The Brewers of Europe