

# enzymes to catalyse YOUR ambition

LYVEN produces enzymes on an industrial scale by **Solid State Fermentation** on natural substrates (e.g. beet pulp, wheat bran...) using selected strains widely accepted in the food industry: *Aspergillus*, *Bacillus*, and *Trichoderma*...



lyven®

**Amylases**  
**Proteases**  
**Pectinases**  
**Cellulases**  
**Hemicellulases**

For their development on such solid media, micro-organisms naturally have to produce a wide range of enzymes to access vital nutrients needed for their growth.

The Company has developed unique concept of industrial fermentors which produce enzymes from selected strains.

# catalyse your ambition

**Yield**  
**Productivity**  
**Clarification**  
**Filtration rate**  
**Flavour**  
**Colour**

## Enzymes: Biological catalysts

Enzymes are proteins able to catalyse biochemical reactions in a highly specific way.

Most natural biological processes are enzyme regulated. For example, enzyme pepsin present in our stomach is essential to digest food into small molecules that are vital for our organism.

The activity and stability of enzymes are mainly influenced by temperature and pH but sometimes also by redox potential and concentration of specific ionic species like calcium, magnesium, phosphate, chloride...

Therefore application conditions for any enzyme has to be defined precisely in order to reach maximal efficiency.



beet pulp and wheat bran  
substrates for the SSF processes.



### Green toll manufacturing

Besides enzymes, many metabolites (e.g. peptides, organic acids, nucleotides, cofactors... that may be interesting potential taste enhancers, flavourings, anti oxidants...) may be synthesized during a Solid State Fermentation.

The project OSIRIS, initiated in 2008 and supported by OSEO, aims at stimulating technological breakthroughs in Solid State Fermentation processes.

Consequently our R&D team and facilities are open to discuss possible developments of toll manufacturing processes based on Solid State Fermentation with you in order to produce innovative ingredients for various applications, including non food applications.



OSEO is a public organisation that aims at three occupations:

- helping innovation
- guaranteeing banks and investors
- partnering for financing



**a wide spectrum of enzymatic activities  
based on Solid State Fermentation**

# food enzymes for

## Baking



Enzymes are useful tools at each transformation step from cereals to the final consumer:

- ◆ **At the mill:**  
flour correction  
to increase  
baking potential,
- ◆ **In the bakery:**  
process improvement e.g.  
controlled dough rheology,  
absence of stickiness,  
oven spring, tolerance  
versus proofing time,  
yield,
- ◆ **Quality of baked goods:**
  - . loaf volume,
  - . texture, fresh keeping,
  - . regular size,
  - . crispiness,
  - . colour

## Brewing/ Distilling



Cereals may be transformed under more hydrated conditions like in brewing and distilling. Enzymes are useful processing aids that can work *synergistically with malt*:

- ◆ **Amylases** to process starch and yield fermentable sugars to the brewer's yeast
- ◆ **Proteases** to hydrolyse grains' proteins into free amino nitrogen (FAN) also essential for brewer's yeast development
- ◆ **Hemicellulases** ( $\beta$ -glucanases, xylanases...) to reduce mash and wort viscosities and prevent any risk of filter fouling.

## Winemaking



**Winemaking** has gone through complex biological pathways involving enzymes from quite the beginning of human kind.

It is therefore not amazing that winemakers use enzymes to manage this ancestral transformation of grape into wine. **In practice, enzymes enable to:**

- ◆ facilitate must **clarification** and optimize **extractions** from grapes
- ◆ extract and stabilize **colour** of **red wines**
- ◆ maximize **aromatic potential** of **white wines**

## Fruit and vegetable processing



Enzymes are widely used in the fruit and vegetable processing industry as exemplified by:

- ◆ Pectinases to facilitate fruit **pressing** and juice **clarification** and **concentration**
- ◆ Pectinases to facilitate **oil extraction** e.g. from olives,
- ◆ Cell wall degrading enzymes cocktails to liquefy fruits thoroughly and improve both juice **quality** and **yield**,
- ◆ Pectin esterase for **fruit firming**,
- ◆ Starch and Non starch (e.g. arabans) degrading enzymes to **prevent haze** in juice concentrates,
- ◆ Pectinases for quick and clean **peeling** of citrus or **mulilage removal** of many kinds of beans, berries and cherries.

a wide range of enzyme concentrations adapted to each customer's need



**A wide strain collection  
A R&D team expert  
in solid state and  
submerged fermentation  
processes  
A technology hall  
where  
semi industrial tests  
are possible  
A new generation of  
biocatalysts for ethanol,  
feed,  
human nutrition,  
plant protection,  
nutrition of yeast  
and bacteria.**



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◆ GROUPE soufflet



## Osiris research and services

*A new valorisation of the agricultural resources  
via fermentative processes*

### Innovative biocatalysts for your products

Solid State Fermentation (SSF) has been applied in Japan for centuries to produce so called Koji extracts (steamed rice fermented by *Aspergillus oryzae*) but also for famous sake.

Later on this technology has been developed at industrial scale in large bioreactors mainly in Asia. Main key factors of success of this technology are the preparation of the substrate and the monitoring of temperature, moisture, air flow and stirring during the process. Also the duration of the culture is a key issue to reach optimal production of the expected metabolites.

At LYVEN, enzymes have been produced for more than 20 years by solid state fermentation of agro resources like beet pulp, wheat bran...

Besides optimisation of enzymes manufacture, OSIRIS team of scientists and engineers on bioscience and biotechnology is now able to screen strains, determine bio reactors (liquid, semi liquid, solid) and define optimal fermentation conditions in tight collaboration with you in order to develop new enzymes but also innovative new ingredients e.g. natural flavours, anti-oxidants, emulsifiers, but also any other kind of biologically active molecules....



**BIOTECHNOLOGIES  
GREEN to II manufacturing**