



D4.5 Demonstration plant for high-value oils



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**Project Title:** Pilot plant for environmentally friendly animal by-products industries

<b>D4.5 Demonstration plant for high-value oils</b>
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**Eco-innovative demonstration projects (Collaborative project)**

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<b>Dissemination Level</b>		
<b>PU</b>	Public	<b>X</b>
<b>PP</b>	Restricted to other Programme Participants (including the Commission Services)	
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**PILOT-ABP** "Pilot plants for environmentally friendly  
animal by-products industries"

FP7-ENV.2013.6.3-2-603986

[www.pilot-abp.eu](http://www.pilot-abp.eu)



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by the European Union



# SUSTAINABLE TECHNOLOGIES

## APPLIED TO ANIMAL BY-PRODUCTS



**DEMONSTRATION PLANT  
FOR HIGH VALUE OILS**



## Introduction

In the following a brochure describing the high value oil pilot plant is shown.

### Technical specifications for first part of pilot plant for high value oils

Only fats for human consumption can be used in this process.

The fats are before use testes according to the QA/ QC system in insure the quality.

The fat is pumped into the hydrolyzing tank.



*Fig. 1 5000 L hydrolyzing tank*

The temperature of the fat is adjusted to 65 °C, and approximately 12 % glycerol is added. After mixing the fat

and the glycerol is Novozym 435 added. After approximately 12 h enzymes are separated.



*Fig. 2 Outlet valve and separations system for the enzymes.*

The fat is transported to the Short Path Distillation (SPD) system.

### Vacuum technology

For thermal separation via distillation, part of the product to be treated is evaporated using heat, and condensed separately. Many organic substances, e.g. vitamins, flavoring agents or pharmaceutical intermediates, however, become damaged even at low temperatures, e.g. due to thermal decomposition, polymerization and side reactions which have a negative influence on the quality of the end



product. There is an increasing loss of quality caused by rising temperature and duration of thermal stress. By means of extreme reduction of operating pressure and special design, the evaporation temperature and duration of thermal stress of a product can be reduced considerably and the quality is greatly improved.



## Distillators and evaporators

The product to be treated flows along the inside wall of the evaporator as a liquid film from the supply point to the discharge point. The residence time in the apparatus is very short which means that thermal stress is minimal. We have developed a unique wiper system for the operation inside the evaporator which ensures even distribution of liquid on the evaporator surface and ideal mixing of the product which flows downwards. This means that light volatile substances are continuously moved to the film surface and evaporate more efficiently. Heating of the evaporator is made via heat transfer medium, e.g. thermal oil or steam.

## Short Path Distillators

A special feature of this apparatus is that the vapors are condensed in an internally positioned condenser. The 'short path' of the vapor phase to the condenser results in only little pressure loss, meaning that extremely low pressures can be achieved. The Short path Distillators normally operate within a pressure range of 0.001 mbar and 1 mbar. Therefore, in Short Path Distillators, in comparison to Thin Film Evaporators, distillation can take place at considerably lower temperatures. This process is most gentle for the product

## Standard Glass Evaporators

Description	KDL5
Feed (g/h)	200 – 2,000
Design	Short Path Distillator
Max. evaporator T <sup>a</sup> (°C)	350

## Main features of the KDL plants

Main components	Short Path Distillator Thin Film Evaporator
Evaporation surface area	0.05 m <sup>2</sup>
Heating range: Evaporation area Residue discharge Distillate discharge	up to 350 °C up to 250 °C up to 200 °C
Typical feed rates	0.5-1.5 kg/h
Operating pressure Short Path Distillator Thin Film Evaporator	from 0.001 mbar from 1 mbar
Feed systems	Dosing vessel Gear pump Dosing pump
Discharge systems for distillate and residue	Glass bulb Cut measuring vessel Sample collecting carousel Gear pump
Vacuum systems	Rotary vane pump Oil diffusion pump
Heating devices and heating / cooling devices	Large selection, depending on temperature range and required capacity
Racks	Table rack Mobile floor rack

## Applications

While vacuum distillation plants cover large areas of the process industry, common requirements of all



applications are particularly gentle process conditions. The thermal load of heat-sensitive substances is minimized to avoid any deterioration of quality.

APPLICATION	BIODIESEL	FINE CHEMISTRY	FISH OIL	FOOD
PROCESSED MATERIALS	animal fats vegetable oils pyrolysis oils free fatty acids glycerol	silicone oils lactic acid synthetic vitamins additives plasticizers uv stabilizers polyols	fish oil ethyl esters omega-3-concentrates cholesterol removal	monoglycerides diglycerides oleoresins herb extracts sterols flavors sugar derivatives fruit concentrates
APPLICATION	OILS & FATS	PHARMA	POLYMERS	RECYCLING
PROCESSED MATERIALS	palm oil products free fatty acids tall oil sterols natural waxes tar essential oils squalene resin acids	pharma intermediates (API) THC tocopherol tocotrienol (vitamin E) carotene (vitamin A) alkaloid derivatives jasmine oil (cosmetic) fragrances (cosmetic) shea butter (cosmetic)	polyurethanes epoxy resins acrylates polyethylene waxes polyglycoethers monomers & prepolymers	lubricating oils used oils (waste oils) solvents base oils

## THE PROCESS FLOW DIAGRAM

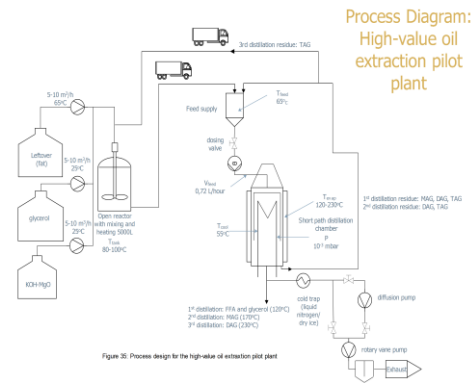
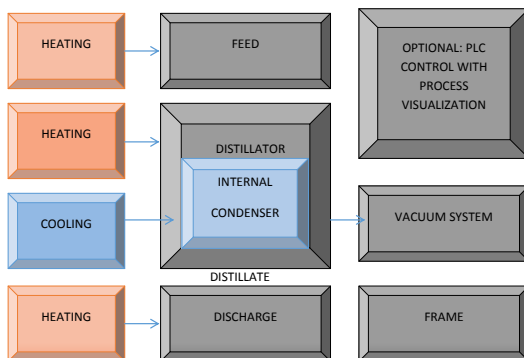


Figure 35: Process design for the high-value oil extraction pilot plant

## SHORT PATH DISTILLATION PLANTS

Material used in the main components	Borosilicate glass
Advantages of each material	Visual observation of the distillation process, e.g. film distribution, discharge of distillate and residue
Surface related evaporation capacity	Considerably lower than pilot plants
Preferred applications	Feasibility studies, determination of maximum separation efficiencies, production of very small quantities

## COMPONENTS OF THE KDL5 MODULAR PLANT



A video is available at the project's website.

Further information: <http://pilot-abp.eu>