

CREOL : A PILOT PLANT FOR OIL AND PROTEIN CROP PRODUCTS

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ABSTRACT

The CREOL oil-mill pilot plant, as a part of the French oilseeds organization, deals with problem-oriented research essentially directed at improving competitiveness of oilcrops, valorizing seeds but also diversifying their outlets. CREOL is a subsidiary of CETIOM and SOFIPROTEOL. This pilot plant, located in the South-West of France, close to Bordeaux, has been operating since 1980. The plant is fitted to process small batches of seeds, from some hundred kilograms to about ten tons, by pressing and hexane extraction. It is therefore particularly convenient to provide processing backing to development programs of new oilcrops. It has been involved in numerous domestic and European R&D programmes on oil and meal development for food and non-food uses. Numerous oilseeds have been processed in the pilot plant in the framework of public or private programs.

In 1998, the plant was revamping, to improve its potentialities, under grant-aided EC program (European Funds for Regional Development).

KEYWORDS : outlets, process, feed, food, non-food

INTRODUCTION

The CREOL pilot basic mission is to help to improve competitiveness of oilcrops by exploring new feed, food and non-food uses for oilseeds and developing or improving new processing techniques.

The programs mainly focus on :

- ◆ Process improvement and new equipment evaluations,
- ◆ Seed and meal assessment for animal feeding,
- ◆ Identification of potential markets for new seeds from classical breeding and biotechnology,
- ◆ Evaluation of new raw materials,
- ◆ Industrial crop expertise,
- ◆ Production of specialty oils.

The pilot plant can handle experimental lots (different range of sizes) without cross-contamination between lots, making it attractive particularly to plant breeders, grain processors, ingredient suppliers and other private and public sector researchers. The plant is designed for setting up and developing new equipments proposed by industrial partners.

After a first modernization in 1989, the plant was revamped in 1998, under EC grants, for developing broader missions.

The modifications include notably the setting up of :

- ◆ a continuous De Smet belt extractor (throughput : 300 kg/h),
- ◆ a stainless steel flash distillation, specially designed to process 'sensitive' oils,
- ◆ an ethanol extraction plant designed for protein concentrates manufacturing,
- ◆ a CLEXTRAL prototype of extruder cooker fitted with a draining barrel, designed to recover oil from seeds in a single operation.

The quality assurance system is in accordance with ISO 9002 and IQNet* compliance for operating projects under conditions of strict confidentiality.

PILOT PLANT DESCRIPTION

The CREOL's oil-mill pilot plant is well-equipped to reproduce the main process options of industrial oil plants by keeping an identity preservation of oil and meal all along the process chain. This one is designed for setting up and developing new equipments put at its disposal by industrial partners.

It is composed of six unit plants including the following facilities :

1 - Seed preparation

Drying, cleaning/sorting, dehulling are performed in this area. Traditionnally applied to rapeseed and sunflower, dehulling system can be adapted to a great variety of seeds.

2 - Deoiling by pressing

The deoiling by pressing includes the following unit processes : cracking and/or seed flaking, cooking (up to 130°C), continuous pressing, from 150 to 400 kg/h throughput of seeds, centrifugation and/or oil filtration, nitrogen blanketing. From the press exit, the oil is processed in stainless steel devices. The press shaft may be heated or cooled, by steam or cold water circulation.

3 - Deoiling in a cooker extruder with draining barrel

It is a twin screw extruder prototype, from CLEXTRAL company, fitted with a de-oiler barrel. The unit processes of the traditional pressing (flaking, cooking and pressing) are made by this single machine within 3 minutes. The machine can be heated by heating bands, or cooled by water circulation in sleeves.

4 - Hexane extracting

The hexane extraction plant is a state-of-the-art processing facility, entirely made of stainless steel, designed for two extraction systems. One processes batches from 50 to 60 kg of solid marerial, the other is continuous, from 100 to 300 kg/h throughput. In both cases, the miscella distillation is made in a facility specially designed to work at low temperature (80°C).

The extraction area is secure mainly by a spark-proof electrical material and a system continually monotoring the working environment for the presence or level of escaped solvent.

4.1 - Batch extraction (agitated filter from GUEDU Company)

It is a 450 l tank closed in its bottom part by a filter, and fitted with a stirrer. The solid - usually a powder - is deoiled by successive washing by immersion and stirring in hexane. Between two

washings, the miscella is drained off by filtration. The deoiled solid is desolventized by heating and/or vacuum in the same device.

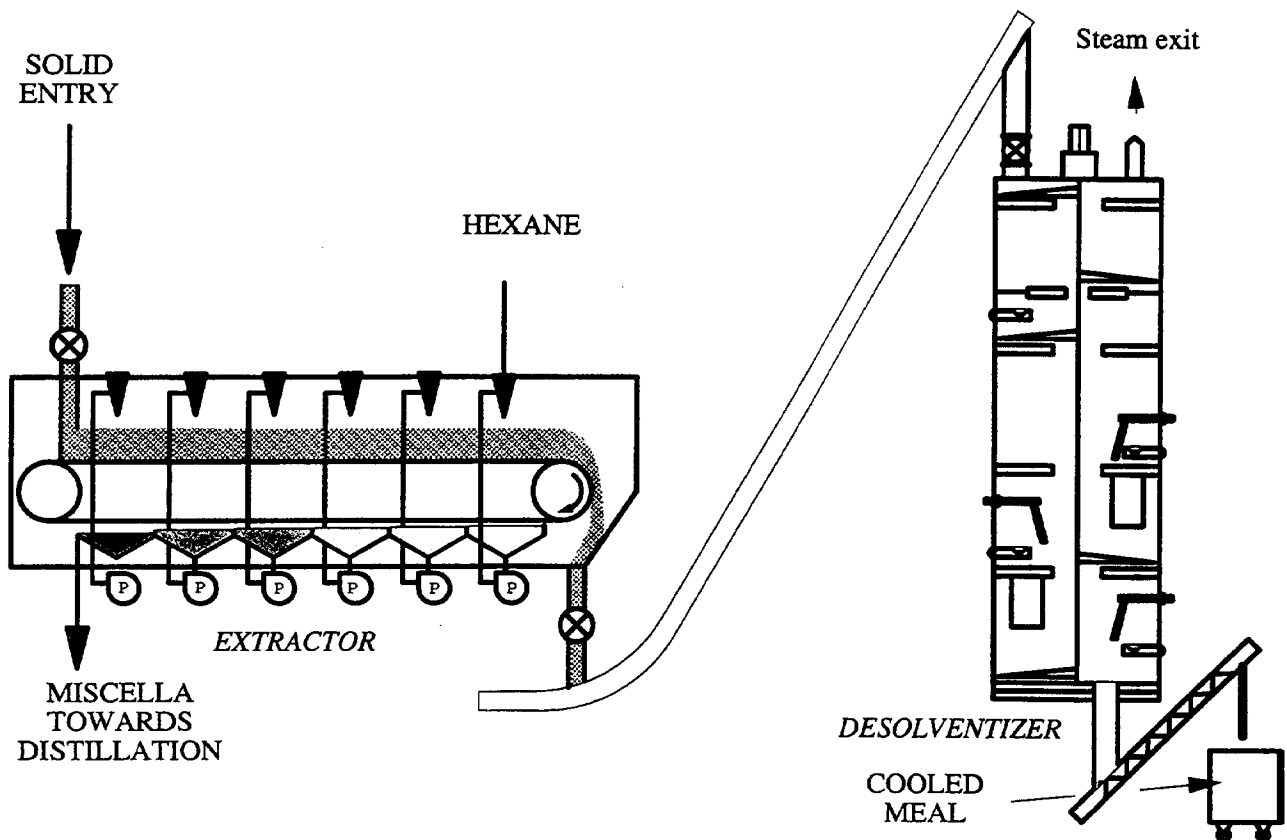
4.2 - Continuous extraction (Belt extractor from De Smet Company)

It is a continuous solid liquid extractor, by hexane countercurrent on a belt. Its throughput varies from 100 to 300 kg/h of solid according to the processed material. It is fitted with a 6 trays meal desolventizer, Schumacher type, with live steam injection in the first tray.

4.3 - Continuous distillation (from De Smet Company)

This facility has been specially designed to process reactive oils without damage. It is a 3 stages distillation under 3 increasing levels of vacuum (400 mbar, 133 mbar, 67 mbar)

Belt extractor and Schumacher desolventizer from De Smet Company



5 - Ethanol Extraction

The ethanol extraction plant is designed for protein concentrate processing, by carbohydrates extraction from the raw material. The extraction is achieved on a continuous counter current belt filter, from Philippe Company. The concentrate is dried on a fluidized air dryer (from Comessa Company).

The distillation is achieved on the hexane facility completed with a rectification column. The throughput is 30 kg/h of raw material.

This facility may be used for any type of ethanol extraction.

6 - Oil Refining

The unit processes of degumming, neutralization, bleaching, winterization and deodorization are achieved in glass reactors, by batches of 15 kg of oil.

ITERG, the French Fats and Oils Research Institute, operates the oil refining pilot plant.

MAIN PROCESSING RESEARCH AREAS

<p>Crushing</p> <p>Process improvement and new equipment evaluation</p> <ul style="list-style-type: none"> • Meal desolventizing parameters • Seed dehulling improvement • Crushing parameters and meal quality • Additives for screw presses <p>Feed</p> <p>Seed and meal competitiveness for animal feeding</p> <ul style="list-style-type: none"> • Quality improvement by technologies (dehulling, crushing, extrusion...) • Meals from new crops (GMO, Crambe, Camelina and other oilseeds) <p>Seed</p> <p>Potential markets for new seeds (classical breeding or biotechnology)</p> <ul style="list-style-type: none"> • Processing of new oilseeds for oil and meal evaluation 	<p>Crop protection</p> <p>Traces of pesticides in oils and meals</p> <ul style="list-style-type: none"> • Control of degradation level at the different steps of crushing and refining <p>Cosmetics and pharmacy</p> <p>New active components</p> <ul style="list-style-type: none"> • Oil extraction from new seeds • Fractionation <p>Oleochemicals</p> <p>New industrial markets for oils</p> <ul style="list-style-type: none"> • Extraction process research for new oilseeds <p>Equipment</p> <p>New process evaluation</p> <p>The plant is designed for setting up and developing new equipments proposed by industrial partners : dehullers , press, pulsed column...</p>
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A FRAMEWORK OF PARTNERS FOR INTERDISCIPLINARY RESEARCH

The CREOL pilot plant is linked with other research centers in France and abroad : ITERG (the French Fats and Oils Research Institute) located in the same place, several French universities, TNO (Netherlands) and Fraunhofer (Germany)... The pilot plant activities are stimulated by a dynamic scientific and industrial environment in Bordeaux area : University of Bordeaux, crushing and refining plants (CEREOL-SAIPO) and soya protein concentrates plant (Central Soya European Proteins).