RESEARCHES REGARDING THE OBTAINED OIL CHARACTERIZATION BY COLD PRESSING OF RAPE SEEDS

CERCETĂRI PRIVIND CARACTERIZAREA ULEIULUI OBȚINUT PRIN PRESARE LA RECE A SEMINȚELOR DE RAPIȚĂ

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Abstract: *The aim of paper is the determination of oil content from rape seeds, using a press type SK 130, made in Germany. Also, we follow up the determination of the viscosity and heat capacity, in view of the settlement of work method which will be use the little farmer and enterprising whence working in the domain.*

Rezumat: *Scopul lucrării este determinarea conținutului de ulei din semințele de rapiță, utilizând o presă tip SK 130, fabricată în Germania. De asemenea se va urmări determinarea vâscozității şi puterii calorice în vederea stabilirii unei metodici care va fi utilizată de micii fermieri care lucrează în acest domeniu.*

Key words**:** *oil, content, vegetables products, rape, testing*
Cuvinte cheie: *ulei, conținut, produse vegetale, rapiță, ni agricole, organe de rulare*

INTRODUCTION

In nature, the fat substances are spread in the plants and animals tissue, also in the secretion of some glands from the animal's bodies, for example in milk.

In plants, the fat substance is concentrated only in certain parts as: seeds, fruits and tubercles, stones, germs, playing the part of a reserve substance, which the plant uses in the development period as a source of energy.

The content of fat substance in these parts of the plants is variable. At the majority of the plants, this varies between 1 and 5 %.

Among the oleaginous plants there are: sunflower, soy, rape, ricinus, flax, hemp, cotton, poppy, tobacco plant, sesame plant, peanut plant, olive-tree, coconut and palm tree.

Although the oleaginous plants domain is very ample, the plants that can be used as raw material in the vegetable oil industry are not so many because a lot of them have a low content of oil – being uneconomic, and others with a high content of oil present difficulties in obtaining the oil because of the special structure of the plant.

✓ **Rape** is at the moment one of the most important oleaginous species. Rape seeds contain 48÷52 % oil. Rape oil has multiple utilizations in industry, for combustibles fabrication, but it is used more and more for cooking oil and margarine preparation. After the oil extraction – the extraction residues which are 40 % protein rich are used as forage, vegetal residues are used for the fabrication of the particle boards or for obtaining of combustible. Rape it is a very good preceding crop for the grain, the land being cleared in time and without weeds. Depending on the specie and the vegetation conditions, the chemical composition of the seeds is characterized by a content of:

- 33÷49 % fats;
- 19÷20 % raw protein;
- 17÷18 % extract without nitrate.

The oil content of the rape seeds exceeds 40 % at the erucic acid free species ("0" type). In comparative crop, at the ICCPT Fundulea, the oil content was between 43,3 and 48,3 %. For the species cultivated in our country, the oil content varies between 44,5 and 45,8 %. In general the oil content of the seeds has the percentage between 43 and 48 %.

MATERIAL AND METHOD

The oil obtained by cold pressing is extracted from the oleaginous seeds with a superior quality, being possible to be used for alimentary usage and also in medicine.

The main advantages of the cold pressing installations are:

- at medium scale, the cold pressing installations are used by both the government industry and private enterprise;
- its can be placed near the agricultural units;
- direct or indirect, the process performed by the cold pressing installations is connected to the harvest (without intermediaries);
- its have a production capacity up to 25 tone/day;
- by cold pressing there are being obtained vegetable oil and pressed extraction residue;
- pressed extraction residue has a superior value (12-17 % oil content)
- its require low costs for investments;
- its have a low energy consumption (80 kWh/tone of seeds – with a media of 6 times less than the energy required in the extraction industry);
- its didn't use chemical solvents or thermal regimes for seeds;
- it isn't being obtained any residual water;
- this process involves low logistical costs and low protection requirements;
- it stimulates local economy and short local distances (around 50 km);
- it has a superior flexibility (it's a faster accommodation process for other types of oleaginous seeds);

The extraction residues obtained by cold pressing contain a large quantity of residual oil and therefore it has a high utilization in animal forage in comparison with the extraction residues obtained by hot pressing.

For example, by pressing 3 kg of rape seeds, it can be obtained about 1 kg of rape oil and 2 kg of extraction residues. Using the cold pressing method of the rape harvest from 1 hectare it is being obtained oil and a quantity of extraction residues of about 2.000 kg.

Filtration

It represents the splitting out operation of the phases of a heterogeneous compound solid-liquid when the compound squeezes through a surface or through a filter layer, which retains the discontinuous phase (liquid sediment) and lets through the continuous phase (filtrate).

Depending on the filtration mechanism, the filtration processes can be separated in two groups:

- superficial filtering process, when the filtering material retains, at its surface, solid particles from the filterable suspension, by the means of the difference between the particles sizes and the holes (with which the vibration screen and the scraper separator are fitted);
- deep filtering process, when the retaining of the solid particles from the filterable suspension is made by the means of the filter layer, on all its depth (applied to the press-filters and to the alluvial filters).

The filtration speed depends on some factors as follows: pressure, thickness and structure of the separated sedimentary layer, viscosity, respectively the temperature at which values the filtration is performed.

The filtering pressure is achieved by either the liquid column weight or by additional pressure, by the means of some pumps or of the vacuum applied at the filter layer evacuation from filter. In general, in the vegetable oil industry it is being used to create the pressure with centrifugal pumps, which can generate additional pressure of 1,5 – 3,5 atm.

The residue character has also an influence on the filtration speed. The residue layer separated from the crude oil contains phospholipids, proteins, mucilage and mechanical suspensions. It is compressible and therefore, at a pressure increase, an increase of the residue resistance appears, as a consequence to the capillary diameter diminution. Because of that, the filter must be brought out, for cleaning. In the case when to the crude oil a small quantity of soil or Kiselgur is added, an additional uncompressible filter layer forms, which considerable prolongs the operating period between the 2 cleanings.

The filtration speed drops once the viscosity rises, which at its turn varies inverse proportional to the temperature of the liquid. In practice, the increasing of the filtering temperature is limited due to technological considerations. Therefore, at the crude oil resulted from pressing, the maximal filtering temperature must be 70°C.

In case of crude oil filtration, the wet sludge (impurity) covers very fast the holes of the filter and stops the filtration. Because of this matter it is recommendable to dry the crude oil before filtration.

EXPERIMENTATIONS FOR OIL CONTENT DETERMINATION FROM RAPE SEEDS BY COLD PRESSING METHOD

The press used for the experimentations that had the purpose to determine the oil content from rape seeds is a press made by the firm STRAHLE (Germany), type SK 130 and it can be used for the pressing of: sunflower, soy, flax and ricinus.

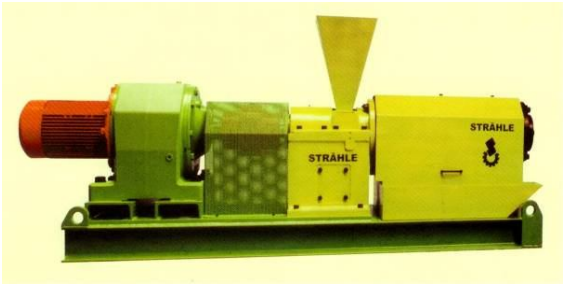
Dimensional characteristics of this press are:

- length: 2.330 mm;
- width: 560 mm;
- height of the supporting legs for the press: 760 mm;
- press height (without the feed hopper): 1.300 mm;
- press height (with the feed hopper): 1.700 mm.

Functional characteristics:

- engine power: 7,5 kW;
- rotative speed: 8,9 rot/min;
- supply voltage: 380 V;
- frequency: 50 Hz;
- maximum alimentation capacity 150 kg/h.

This type of press is designed to work 24 h/day, 260 days/year.



SK 130 press, used for the experimentations


The preparation of seeds and press for testing


The aspects from testing time


The collection of extraction residues


The filtering of brut oil

✓ **Experimentations in view of obtaining oil by cold pressing method from rape**

For the experimentations with rape seeds, the alimentation quantity of seeds in the press was **598,869 kg**.

From the cold pressing process resulted:

- Filtered oil: 228,250 kg
- Extraction residues: 356,300 kg
- Sediments in the collecting basin: 9,916 kg
- Impurity obtained from the filtration process: 1,078 kg
- Losses (at alimentation, evacuation): 3,325 kg

Before the beginning of the experimentations there were determined:

- seeds humidity: 8,9 %;
- impurity: 3,3 %;
- mass in hectolitres: 64,1 kg/hl;
- bad seeds: 0,99 %.

Once the press reached the operating rated capacity (maximum), the productivity of the cold pressing process for rape seeds was determined, taking a sample test of 39,5 kg (one bag), measuring the working time, the alimentation quantity of seeds, the quantity of oil obtained, the quantity of extraction residues obtained and losses.

- **Productivity determination:**
  - the alimentation quantity of seeds: 39,70 kg
  - star time: $14.32^{15\ sec}$
  - end time: $15.00^{05\ sec}$

It resulted:

  - extraction residues: 23,57 kg;
  - oil: 15,25 kg;
  - sediments; 0,66 kg;
  - losses: 0,22 kg.

In conclusion, for the cold pressing process of the rape seeds the productivity obtained was 84,57 kg/h, respectively 32,48 kg oil/h.

During the experimentations and after (with rape seeds), there were determined:

Unfiltered oil density

No.	Density ρ [g/cm^3]	Temperature t [°C]
1.	0,9120	28.5
2.	0,9125	27.5
3.	0,9130	26.0
4.	0,9135	25.0
5.	0,9150	24.0
6.	0,9160	23.0
7.	0,9160	22.0
8.	0,9170	21.0

Unfiltered oil

No.	Viscosity η [mPa.s]	Temperature t [°C]
1.	40.9	32.5
2.	48.2	28.3
3.	50.3	27.3
4.	53.0	26.0
5.	54.7	25.2
6.	56.2	24.6
7.	57.9	23.9
8.	59.4	23.2

CONCLUSIONS

As a result of the experimentations performed with the press SK 130 type in view of obtaining vegetable oils from rape seeds there results the following work capacities (productivities):

- ✓ *processed seeds*:
  - rape: 84,57 [kg/h];
- ✓ *filtered oil obtained*:
  - rape: 32,48 [kg/h];

The pressing process of the rape seeds has been performed in a long period of time, the cold pressing process of the rape seeds the productivity obtained was 84,57 kg/h, respectively 32,48 kg oil/h

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