

# Processing of oilseeds in decentralised oil mills in Germany —results of a survey

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## Abstract

Processing of oilseeds in decentralised oil mills becomes increasingly more important in Germany. Since 1999 the number of decentralised oil mills in Germany nearly has been tripled. In addition to the 79 existing plants in 1999 [1], the number of decentralised oil mills has grown since then by 140 (state of March 2004). In total about 219 plants are admitted until 2004 in the federal territory (figure 1). Against this background the Association for Technology and Structures in Agriculture initiated a survey in cooperation with the Technology and Support Centre of Renewable Raw Materials (TFZ) with the title "processing of oilseed in decentralised oil mills". Goal of the investigation was to do a stock-taking of the present status quo of oil mills' technical equipment. Furthermore, the investigation was supposed to seize mass flows of the assigned raw materials and the produced products and to determine the importance and relevance of the branch of business "processing of oilseed in decentralised oil mills".

**Key words:** cold pressed vegetable oil, rapeseed, rapeseed oil, decentralised oil mill

## Introduction

On behalf of the Association for Technology and Structures in Agriculture (KTBL) and financially supported by the Union for the Promotion of Oil and Protein Plants (UFOP) the Technology and Support Centre of Renewable Raw Materials (TFZ) conducted in March 2004 a written survey about "processing oilseed in decentralised oil mills". The questionnaire contained 10 pages with nine main topics and has been sent to 243 interviewees. The return rate amounted to 100 questionnaires (41 %). 90 questionnaires (37 %) met the criteria to be used in the survey, even though some of them were only partially completed. Information which has been asked besides general information regarding the operating company, were above all the individual equipment components, like seed preparation, pressing technique, oil cleaning technology and oil storage. Additionally data about quality of seed and oil, price information and proceeds, as well as information on sales and distribution was collected.



Figure 1: Locations of the 219 decentralised oil mills in Germany (state: March 2004)

Approximately 60 % of the decentralised oil mills (129 plants) are located in the states of Bavaria and Baden-Württemberg. An increase of decentralised oil mills can be noted above all for the states of North Rhine-Westphalia, Lower Saxony, Rhineland-Palatine and Brandenburg. New locations in the eastern states, especially in Thuringia, Saxony and Saxony-Anhalt are also to register. Overall a concentration of oil mills in the south of Germany, but also an increase in East

Germany is obvious. Only a few oil mills are resident in the states of Schleswig-Holstein and Mecklenburg-Western Pomerania.

Since 1990 most of the decentralised oil mills have been started-up. Only 2 % of the participating oil mills are older. Between 1990 and 1995 around 20 % of the plants were built. The date of commissioning of 29 % of the participating oil mills is between 1995 and 2000. A growing increase followed in the years 2001 to 2004, in this period 49 % of the participating oil mills were established (figure 2).

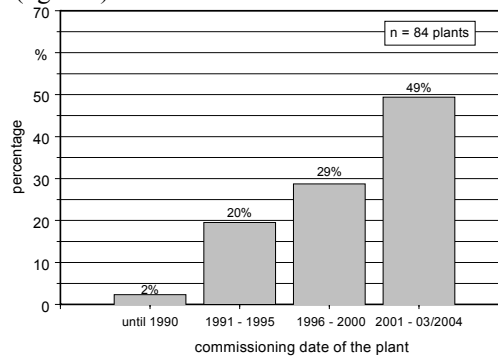


Figure 2: Commissioning date of the oil mills

## Results

**1. Processing Capacity and Production Emphasis:** 60 decentralised oil mills processed in the year 2003 about 104.000 t of rapeseed. This amount of seed is equivalent to 35.000 t of rapeseed oil and to 69.000 t of press-cake. The extrapolation of the quantity up to 219 decentralised oil mills results in 380.000 t of rapeseed, what is equivalent to 128.000 t of rapeseed oil and 252.000 t of press-cake, respectively. This amount of seed is equivalent to 10 % of the rapeseed harvest in Germany in 2003.

41 % of the participating oil mills are processing up to 50 kg seed per hour. Around 43 % of the decentralised oil mills work with throughput rates from 50 kg to 150 kg per hour or with rates between 150 kg and 500 kg. Processing capacities over 500 kg and over 1000 kg per hour, respectively, are represented by 16 % of the plants (figure 3).

The production emphasis of nearly half of the participants is rapeseed oil fuel for adapted diesel engines, followed by the products edible oil and oil for feeding animals. Other applications like rapeseed oil as a raw material for the biodiesel production, motor oil, hydraulic oil or oil for chain saws were also named. Some oil mill operators process press-cake not only as a by-product, but as a main product.

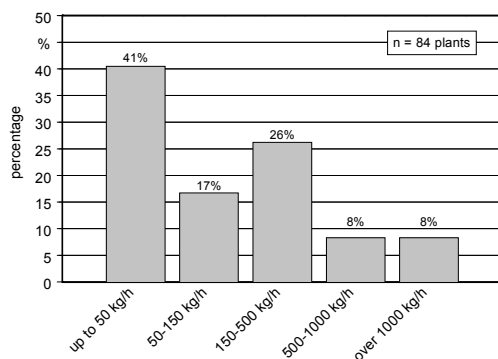


Figure 3: Processing capacity of the German decentralised oil mills

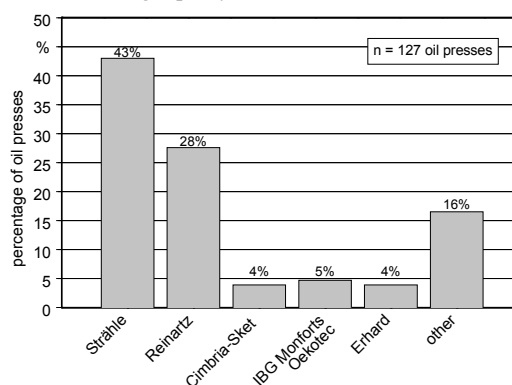


Figure 4: Manufacturer of oil presses used in decentralised oil mills in Germany

**2. Technical Plant Units and Equipment:** Around 59 % of the participating oil mills.

possess technical plant units for seed conditioning. Components for drying and purifying the seed before processing are represented in 70 % and 50 % of the decentralised oil mills, respectively. An additional foreign body separation is in 73 % of the plants in use. Only 18 % of the oil mill operators crush the oilseed before processing to oil.

Oil presses from the companies Karl Strähle GmbH & Co. KG and from the Maschinenfabrik Reinartz GmbH & Co. KG are mainly installed in the decentralised oil mills. Further manufacturer, like Cimbria-Sket, IBG Monforts Oektotec and Import Erhard are also represented. Other producers appear with smaller numbers of oil presses. Especially oil presses with throughput rates up to 50 kg seed per hour and over 50 kg up to 150 kg seed per hour are build-in. Figure 4 shows the distribution of the oil presses per manufacturer.

The purification of the muddy oil, as an important segment in the process flow, is conducted in different ways in the participating oil mills. One quarter of the mill operators work just with one-step purification, the main purification. Over 50 % of the operators purify oil in a second step with a safety filter. Another quarter the participants use not only one safety filter, but also or more safety filters to purify the oil. For the main purification mainly chamber filter-presses and vertical pressure leaf filters are in use. 38 % of the oil mills are working with a continuous sedimentation. 62 % of the participants have installed bag filters and cartridge filters for the safety filtration.

In general 92 % of the oil mill operators store the output product rapeseed oil in different kind of tanks or containers. The favourite types for storing oil are IBC - containers made of poly-ethylene or tanks made out of steel.

The by-product press-cake is usually stored locally in boxes or on stock for a short time. Over 50 % of the decentralised oil mills possess as distribution technique a filling station or a tank truck for sale the oil. The processed oil and press-cake is collect by the customers as well as it is delivered by the oil mill operators.

A comprehensive overview of the technical plant units and equipment is given in figure 5.

**3. Quality and Quality Assurance:** Around 60 % of the participating oil mill operators are working in compliance with the “Quality Standard for Rapeseed Oil as a Fuel (RK-Qualitätsstandard 05/2000)”. The RK-Quality Standard was worked out by the Technology and Support Centre for Renewable Raw Materials (TFZ) (<http://www.tfz.bayern.de/>) and describes a standard operation procedure for the production of rapeseed oil fuel. Characteristic and variable properties and their limiting values, for example the contamination, the acid value or the oxidation stability of the oil, are defined [3]. The RK-Quality Standard is 2006 replaced by the new pre-standard DIN 51605 [4].

83 % of the oil mills, which produce mainly rapeseed oil fuel for adapted diesel engines comply with the RK-Quality Standard. Nearly 70 % of the participants accomplish one or up to six analyses of the oil per annum. More than 7 or more than 12 analyses per annum are rarely. Table 1 shows the distribution of the number of analyses. Besides the requirements

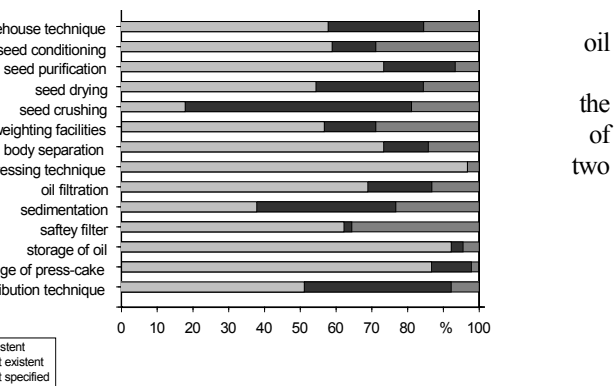


Figure 5: Technical plant units and equipment

contamination, acid value, phosphorus content, water content and oxidation stability other properties like content of sulphur, residues of pesticides, fatty acid composition or the content of vitamin E were analysed.

**4. Distribution and Sale:** The provenance of the processed oilseed is mainly regional. About 13 % of the participants are using their own seed. Approx. 55 % of the oil mill operators are buying the seeds in regions not farer away than 25 km. Seed from a distance between 25 and 50 km is

**Table 1: Implementation of analyses of rapeseed oil (n = 64 plants)**

| Number of analyses | 1 - 6 p.a. | 7 - 12 p.a. | >12 p.a. |
|--------------------|------------|-------------|----------|
| Percentage         | 69 %       | 15,5 %      | 15,5 %   |

bought by 20 % of the participants.

58 % of the processed oil is distributed as raw material for the biodiesel production. Rapeseed oil fuel for adapted diesel engines (22 %), oil for feeding animals (14 %) and edible oil (1 %) are other utilisation forms. Around 11 % of the participating oil mill operators use their oil by themselves, for example in their tractors or in combined heat and power stations (CHP). One quarter of the participants deliver the oil in a radius up to 25 km and an other quarter even up to 50 km. Delivery in regions farer away than 100 km is offered by 36 % of the oil mill operators.

Around 11 % of the oil mill operators feed the obtained press-cake to their own cows, bulls or pigs. More than half of the participants deliver the press-cake into an area up to 25 km and 16 % up to 50 km. Delivery to places farer away is offered by 16 % of the oil mills. Besides the utilisation as a high-quality fodder for the agriculture, press-cake is also been sold to biogas plant operators.

**5. Costs and Proceeds:** Costs and proceeds for the input and output products vary extremely. Rapeseed edible oil, for example, is offered between 0.55 € and 5.00 € (zero rated for VAT) per litre. This wide range is traced back to the input of

conventional and ecological seed. The purchase quantity and the setting of distribution take influence of the pricing. Costs and proceeds of all input and output products are presented in table 2.

**Table 2 Costs and proceeds of the input and output products of German decentralised oil mills**  
(n = 55 plants), without VAT

| Input/Output product   | Unit     | Mean | Median | Min. | Max.  |
|------------------------|----------|------|--------|------|-------|
| Costs                  |          |      |        |      |       |
| Rapeseed               | €/ton    | 251  | 246    | 210  | 440   |
| Proceeds               |          |      |        |      |       |
| Rapeseed oil as a fuel | €/ton    | 617  | 610    | 490  | 750   |
| Fodder oil             | €/ton    | 646  | 620    | 500  | 1,200 |
| Edible oil             | €/litres | 2.1  | 1.54   | 0.55 | 4.98  |
| Press-cake             | €/ton    | 168  | 165    | 100  | 320   |

## Summery

Since 1999 the number of decentralised oil mills in Germany nearly tripled. Around 50 % of the known 219 plants have been started-up between 2000 and 2004. The processing capacity of 40 % of the oil mills is up to 50 kg seed per hour. Throughput rates between 50 kg and 150 kg and also between 150 kg and 500 kg seed per hour are represented by further 40 % of the participating oil mills. Around 16 % of the decentralised oil mills processed more than 500 kg seed per hour. In 2003 an approximated amount of 380.000 t of rapeseed, based on a machine running time of 24 hours, on 250 days per year, was processed in 219 decentralised oil mills. This amount is equivalent to 10 % of the German rapeseed harvest in 2003. The provenance of the oil seed was mainly regional, only a small amount of the seed was bought from distances further than 100 km. The output products oil and press-cake was sold mainly locally. Half of the oil mill operators declared rapeseed oil fuel for adapted diesel engines as their main production emphasis followed by edible oil and oil for feeding animals. Other utilisations for rapeseed oil are technical oils like motor oil, hydraulic oil or rapeseed oil as a raw material for the biodiesel production.

## Acknowledgements

The authors wish to thank the 'Union for the Promotion of Oil and Protein Plants' (UFOP) for the financial support of this study (project 530/042).

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