Canola is one of the most important oilseed crops in the world. The oil from the seed has gained an excellent reputation for its excellent flavor, good nutritional value and utility in the food chain. In recent years, it has been recognized as an important component of the seed in terms of market value. The canola plant has a wide range of applications, from food and feed to industrial and bioenergy use. This book contains information on the production, processing, and utilization of canola oil.

Hydrogenated canola oil is a natural salad oil. This means that it remains liquid at room temperature, or lower. In some cases, it is desirable, especially for margarine and shortening production, to use canola oil or other vegetable oils. If trans isomers in fat and oil products must be reduced to an acceptable level, the product must be hydrogenated. The above hydrogenated canola oil stocks that are used in the production of the wide range of fat products used in shortenings made from hydrogenated canola oil.

**Canola Seed and Oil Processing**

Ted Mag

References:

7. Williams, J.A. 1950. Oil Mill Compos. 95, 3.
Oil Processing and Products

Alcohol and Physical Refining

Diesterification and alcoholysis are used to partially or completely reduce the free fatty acid content. This step may be delayed until other processes, such as hydrogenation of the oil, have been done. Diesterification and alcoholysis are particularly useful for refining the physical characteristics of the oil, such as viscosity and pourability, and for improving the oxidative stability. Today, it is often used in conjunction with other refining processes, such as deodorization, to improve the quality of the final product.

Table 2: Composition of Lipids in Lignified Canola

<table>
<thead>
<tr>
<th>Lipid</th>
<th>Canola oil</th>
<th>Fish oil</th>
<th>Other oils</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acid content</td>
<td>0.2-0.3%</td>
<td>0.1-0.2%</td>
<td>0.5-2.0%</td>
</tr>
<tr>
<td>Free fatty acids</td>
<td>0.4-1.0%</td>
<td>0.2-0.5%</td>
<td>0.5-2.0%</td>
</tr>
<tr>
<td>Total sterols</td>
<td>0.2-0.5%</td>
<td>0.1-0.3%</td>
<td>0.3-1.0%</td>
</tr>
<tr>
<td>Total tocopherols</td>
<td>0.1-0.5%</td>
<td>0.05-0.1%</td>
<td>0.1-0.5%</td>
</tr>
<tr>
<td>Total lipids</td>
<td>95-98%</td>
<td>92-95%</td>
<td>92-95%</td>
</tr>
</tbody>
</table>

Oleic acid is the most abundant fatty acid in canola oil, constituting about 70% of the total fatty acids. Linoleic acid is the second most abundant fatty acid, constituting about 20% of the total fatty acids. Linolenic acid is the third most abundant fatty acid, constituting about 6% of the total fatty acids.

Physical Refining

In physical refining, the oil is subjected to high temperatures and pressures to remove impurities. This process is used to remove free sterols, free sterol esters, phosphatides, and other impurities. Physical refining can be performed at three stages:

1. Decolorization
2. Deodorization
3. Bleaching

Table 3: Margarines with Canola Oil

<table>
<thead>
<tr>
<th>Type</th>
<th>Canola Oil Content (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>20-30</td>
</tr>
<tr>
<td>Low-fat</td>
<td>10-20</td>
</tr>
<tr>
<td>Margarine</td>
<td>5-10</td>
</tr>
<tr>
<td>Nutritional</td>
<td>0-5</td>
</tr>
</tbody>
</table>

Canola Oil is a valuable alternative to hydrogenated oils in margarines, as it provides high oxidative stability and low saturated fat content. However, it is often blended with other oils to achieve the desired physical characteristics and sensory attributes.

A detailed discussion of this process is beyond the scope of this text.
In edible oil processing, deodorization is the final "refining" step after neutralization and bleaching. It is therefore, to dewax the oil to avoid a hazy appearance. Waxes are usually solid at room temperature, and are found in all edible oils. The oil does occasionally contain a small concentration of waxes which may lead to a cloudy appearance. The oil is then cooled to about 90ºC, phosphoric acid is added to neutralize the base. The oil is then washed, or bleached, with activated bleaching clay in a standard bleaching process at 95-105ºC. The removal of the free fatty acids in the oil is done by steam distillation in a deodorizer. This simultaneously deodorizes the oil. Because deodorization is the last process normally carried out on crude oil, this step may be delayed until other processes, such as hydrogenation of the oil have been done. Subsequent washing and bleaching on commercial scale creates a product that is free of waxes. Oil that has been partially hydrogenated is not suitable for physical refining and the removal of waxes of physical refining has been associated with it.

### Table 1: Major Constituents of Crude and of De-gummed Canola Oil

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Crude Canola Oil</th>
<th>De-gummed Canola Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fatty acids</td>
<td>19.4%</td>
<td>19.4%</td>
</tr>
<tr>
<td>Saturates</td>
<td>4.3%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Monounsaturates</td>
<td>10.2%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Polyunsaturates</td>
<td>8.9%</td>
<td>8.9%</td>
</tr>
<tr>
<td>Chlorophylls</td>
<td>7.4 ppm</td>
<td>&lt;0.1 ppm</td>
</tr>
<tr>
<td>Phosphatides</td>
<td>500 ppm</td>
<td>&lt;50 ppm</td>
</tr>
<tr>
<td>Total phosphorus</td>
<td>670 ppm</td>
<td>200 ppm</td>
</tr>
</tbody>
</table>

### Table 2: Composition and Stability of Lightly Hydrogenated Canola Oil

<table>
<thead>
<tr>
<th><strong>Characteristic</strong></th>
<th><strong>C16:0</strong></th>
<th><strong>C18:0</strong></th>
<th><strong>C18:1</strong></th>
<th><strong>C18:2</strong></th>
<th><strong>C18:3</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Melt point</td>
<td>15°C</td>
<td>30°C</td>
<td>50°C</td>
<td>50°C</td>
<td>70°C</td>
</tr>
<tr>
<td>Melt range</td>
<td>10°C</td>
<td>20°C</td>
<td>30°C</td>
<td>30°C</td>
<td>50°C</td>
</tr>
<tr>
<td>Saponification</td>
<td>150°C</td>
<td>200°C</td>
<td>250°C</td>
<td>250°C</td>
<td>300°C</td>
</tr>
<tr>
<td>Acid value</td>
<td>1 ppm</td>
<td>0.2 ppm</td>
<td>0.5 ppm</td>
<td>0.5 ppm</td>
<td>1 ppm</td>
</tr>
</tbody>
</table>

### Table 3: Margarine with Canola Oil

<table>
<thead>
<tr>
<th>Margarine Type</th>
<th>Margarine 1</th>
<th>Margarine 2</th>
<th>Margarine 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type</td>
<td>Canola</td>
<td>Canola</td>
<td>Canola</td>
</tr>
<tr>
<td>Fat content</td>
<td>72%</td>
<td>72%</td>
<td>72%</td>
</tr>
<tr>
<td>Water content</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
</tr>
<tr>
<td>Salt content</td>
<td>6%</td>
<td>6%</td>
<td>6%</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>0.1%</td>
<td>0.1%</td>
<td>0.1%</td>
</tr>
</tbody>
</table>

### References

Canola oil is a natural salad oil. This means that it remains
spray. The oil must be very dry and low in free fatty acids.
agitated tank, equipped with a vacuum system and a water
acid compositions are formed that can be sufficiently different
applied to blends of different oils, triglycerides with fatty
the triglyceride is changed randomly. When the process is
properties of fats and oils. The position of fatty acids in
Interesterification is another process for changing the melting
Nutritional profile is used as the liquid, non-hydrogenated com-
shortening products has been studied extensively by deMan
his studies on the crystallization behaviour of margarines and
effect of commercial crystallization conditions and product
shortening oils are converted into semi-solid form for final
With the exception of bulk frying fats, margarine and
impart typical odour and taste and must be removed. Further,
volatile compounds from the oil such as free fatty acids. Steam
refining process. It is then contacted with acid-activated
the phosphatides from degumming, or it can be acidulated and
This oil is now ready for bleaching. The soap phase from this
mixing is used. Temperatures and contact times may vary from
mixer to help precipitate phosphatides. It is then contacted
the extractor. A variety of extractor designs are in use. Some
are used. Their adsorptive properties are especially effective
and Oil Processing

Table 1: Minor Constituents of Crude and of
Depregnated Canola Oil

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Crude Oil (%)</th>
<th>Depregnated Oil (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Fatty Acids</td>
<td>8.4 – 18.0</td>
<td>0.8 – 7.0</td>
</tr>
<tr>
<td>Water content (%)</td>
<td>0.2 – 0.5</td>
<td>1.0 – 3.0</td>
</tr>
<tr>
<td>Chlorophylls</td>
<td>0.02 – 0.06</td>
<td>0.00 – 0.00</td>
</tr>
<tr>
<td>Carotenoids</td>
<td>0.01 – 0.05</td>
<td>0.00 – 0.00</td>
</tr>
<tr>
<td>Total Carotenoids</td>
<td>0.03 – 0.10</td>
<td>0.00 – 0.00</td>
</tr>
<tr>
<td>Total Pigment</td>
<td>0.03 – 0.30</td>
<td>0.00 – 0.00</td>
</tr>
</tbody>
</table>
| Total Pigment and
  Chlorophylls           | 0.04 – 0.40  | 0.00 – 0.00        |

The next most developed degumming uses acid and
solvent such as hydroxids, rather than acid.

The oil is then contacted with a dilute sodium hydroxide
solution. The ash is filtered off and the oil is washed with
water. The soap phase is removed, and the oil is then
neutralized. The next step is to remove the

The removal of the fatty acids in the oil is by means
destillation in a distillation unit. This simultaneously deodorizes
the oil. Because deodorization in the last process normally
cleaned on-site, this may be delayed until other

<table>
<thead>
<tr>
<th>Process</th>
<th>Description</th>
</tr>
</thead>
</table>
| Destillation          | Heating the
  oil to a high
  temperature to
  separate the
  fatty acids |
| Bleaching             | Treatment of
  the oil with
  sodium hydroxide
  solution to remove
  trace amounts of
  phosphatides |
| Hydrogenation         | Treatment of
  the oil with
  hydrogen to
  increase its
  melting point |
| Physical Refining      | Heating the
  oil to a high
  temperature to
  separate the
  fatty acids |

<table>
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  hydrogen to
  increase its
  melting point |
| Physical Refining      | Heating the
  oil to a high
  temperature to
  separate the
  fatty acids |

Adsorptive Blaeking

Adsorptive bleaching is the removal of most of
the chlorophyll compounds present in the crude oil, by
bleaching. These compounds are classified into


References

7. Williams (7) have written on details of various aspects of
canola oil. These products are becoming very popular because
in part, to the high content of monounsaturated fatty acids in
hydrogenated oils for their exceptional stability. This is due,
other oils, are used. Their adsorptive properties are especially effective
and Oil Processing

Table 2: Composition and Stability of Lightly
Hydrogenated Canola

<table>
<thead>
<tr>
<th>Oil</th>
<th>Saturated Fatty Acid (%)</th>
<th>Monounsaturated Fatty Acid (%)</th>
<th>Polyunsaturated Fatty Acid (%)</th>
<th>Total Fatty Acids (%)</th>
</tr>
</thead>
</table>
| Lightly
  Hydrogenated Canola Oil | 50 – 55                  | 20 – 25                       | 20 – 25                       | 90 – 95               |
| Canola Oil   | 70 – 75                  | 15 – 20                       | 15 – 20                       | 90 – 95               |

The above hydrogenated canola oils that are used in
margarines, are also used extensively in confectionery and for
the frying fats. Bakery uses a wide variety of these
hydrogenated oil stocks for various cooking purposes.

Very lightly hydrogenated canola oils are used in
margarines and margarine shortening, because of their
exceptional stability. The characteristics of these
products are becoming very popular because
of their good physical and stability and the low saturated fatty acids.
Table 2 gives typical data from industry
experience.
In edible oil processing, deodorization is the final "refining" step. It involves removing volatile compounds, flavor precursors, and off-flavors from the oil. The process typically consists of five main stages: heating, boiling, absorption, distillation, and cooling. The oil is heated to about 275°C (530°F) and held for 30-60 minutes, followed by boiling and absorption of volatiles. The oil is then passed through a series of stainless steel tubes or heat exchangers (A-units), followed by resting units (B-units) before it is cooled to about 130°C (266°F) and distilled. The distillate, or "off steam," is discarded, and the oil is cooled further to about 70°C (158°F) before packaging. This process removes about 90% of all volatiles.

Dewaxing is another important step in the refining process. It is performed to remove wax crystals that form during the cooling and crystallization of the oil. Wax crystals can affect the clarity and stability of the oil, so they must be removed to improve the oil's quality. The wax crystals are removed by adding a small amount of an alkali to the oil, which dissolves the wax. The mixture is then heated to about 100°C (212°F) and held for 30-60 minutes, followed by cooling and settling. The wax crystals then float to the top of the oil and are removed by draining or skimming.

Hydrogenation is used to improve the oxidative stability and food safety of the oil. It involves adding hydrogen to the double bonds in the oil's fatty acids to form saturated fats. This process is performed in a reactor where the oil is mixed with a hydrogen-rich gas and heated to about 200°C (392°F). The reaction is catalyzed by a metal catalyst, such as platinum or palladium, which is introduced into the reactor. The reaction is monitored to ensure the desired level of saturation is achieved. Hydrogenation also improves the oil's stability, reduces its free fatty acids, and increases its melting point, making it suitable for a wide range of applications.

Interesterification is another process that can be used to modify the properties of vegetable oils. It involves rearranging the fatty acid chains in the triglycerides of the oil. This can be done by heating the oil with an alcohol and a catalyst, such as potassium hydroxide or sodium hydroxide, and then passing it through a series of reaction vessels. The process can be used to tailor the oil's melting properties, volatility, and stability to suit specific applications.

In modern plants, the refining process is carried out in a heated, agitated tank, equipped with a vacuum system and a water spray. The oil is heated to about 200°C (392°F), and the vacuum system is used to remove volatiles. The water spray is used to cool the oil to about 150°C (302°F) before it is passed through the refining tanks. The tanks are equipped with heat exchangers and cooling coils to control the temperature of the oil as it passes through the process.

Catalyst removal is an important step in the refining process. It involves removing the catalyst and other impurities from the oil. This is usually done by passing the oil through acid-activated bleaching clay, which is a mixture of clay and sulfuric acid. The acid reacts with the impurities, such as phosphatides, gums, and gums, to form a soluble salt that can be removed from the oil. The acid-activated bleaching clay is typically used two or three times, and the oil is filtered after each treatment to remove the remaining impurities.

Protein removal is another important step in the refining process. It involves removing the proteins that are present in the oil. This is usually done by passing the oil through a series of filters, a centrifuge, or a decanter. The filter elements are made of a porous material, such as nylon or polypropylene, and they are designed to trap the proteins while allowing the oil to pass through. The proteins are then collected and disposed of, or they may be used as a feedstock for other processes.

Extraction of Seed for Oil and Meal

Solvent is one of the most important oil crops in the world. The most common method of extracting oil is to use hexane, which is a petroleum solvent. Hexane is a volatile solvent that is used to dissolve the oil from the canola seeds. The solvent is then removed by evaporation, leaving a residue of oil and meal. The oil is then further processed to remove any remaining impurities.

Canola oil is one of the most important oil crops in the world. It is one of the most popular oils for frying and cooking, and it is also used in the production of margarine and shortening. Canola oil is a good source of monounsaturated fatty acids, which are beneficial for heart health.

The extraction process typically involves the following steps:

1. **Preparation of canola seeds:** The seeds are cleaned and dehulled to remove any debris or impurities.
2. **Extraction:** The prepared seeds are mixed with solvent and pressed to extract the oil. The solvent is typically hexane, and it is used at a concentration of about 6-8%.
3. **Removal of solvent:** The oil is then separated from the meal by removing the solvent. This is typically done by steam distillation, which is a process that removes the solvent by boiling it off.
4. **Refining:** The extracted oil is then refined to remove any remaining impurities.

Bibliography:

behavior of hydrogenated canola oil for margarine and
shortening products has been thoroughly examined, and by
the use or possible use of the oil or fat mixture to reach
crystallization. The properly crystallized, but still pumpable
fat mixture is then packed again as the refined and
bleached product. When done properly, there should be no
more than 10% of the total fat content left in the package.

As mentioned earlier, deodorizing serves to physically refine
the mixture to remove chlorophyll and other relatively
insolubles (chlorophylloids, carotenoids) are not affected
significantly. The degummed oil must be further contacted
with about 5-10% of concentrated phosphoric acid in a
high intensity milling operation (acidulation) to achieve
the desired dephiloidation. The oil is then centrifuged to
remove the phosphatides from degumming, or it can be
acidulated and then centrifuged. The centrifuged oil
must be further contacted with about 5-10% of concentrated
phosphoric acid. This is the first and most important
step in the degumming process. The phosphoric acid
also serves to neutralize the sodium from the alkali
refining, hence there is no need to adjust the pH
for this further step. The centrifuged oil is now ready
for further degumming.

The oil is further degummed in a similar manner, and
this second degumming, being optional, is not performed
unless a higher level of dephiloidation is required.
The second degumming is generally performed with
about 10-15% phosphoric acid, and the final
centrifugation is necessary to remove the minor
residues of the phosphatides from the second
degumming. The oil is then centrifuged again, and
the centrifuged oil is ready for further degumming.

Prepressing

Prepressing is the initial stage in the canola seed
extraction. It is done to reduce the oil content of the
seed from about 42% to about 10% and to allow
for the efficient and economical solvent extraction.

The heat-conditioned seed is passed into continuous
prepressing sections, which consist of two sections:
the prepressing and the extrusion. The oil is
extracted from the seed in the extrusion section
by a process called solvent extraction.

The miscella containing the oil is desolventized in three-stage
evaporator equipment. The hexane vapour from this operation
is further processed before being sent to the solvent recovery
unit. The biomass is sent to the oil mill for further
processing.

To meet the demands of processors for
higher quality oil, the desolventizing process has
been improved. The desolventizing process is
an important step in the canola seed extraction
process. The desolventized oil is then ready for
further processing.

Solvent Recovery

The desolventized oil is then passed through a
solvent recovery unit, where the oil is
subjected to vacuum (2-4 mm Hg pressure) to
exclude air. This increases the oil's
purification, as the air is removed
from the oil. The oil is then
fractionated into different
components, based on their
boiling points and densities.

The recovered solvent is then
processed further, and the
process is repeated to
maintain the purity of
the oil. The recovered
solvent is then sent
back to the solvent
recovery unit for
further use.

Canola Seed and Oil Processing
by Ted Mag

Canola is one of the most important oilseed crops in the world. It
has been used for various purposes, such as food, feed, and
industrial applications. The oil is produced by pressing the
seed, dehulling, and degumming. The oil is then filtered and
refined to produce a high-quality product.

The production process includes several steps:

1. Prepressing: The seed is ground and the oil is
extracted using a solvent. The oil is then
centrifuged to remove the solids.

2. Degumming: The oil is degummed to remove
phosphatides and other impurities.

3. Bleaching: The oil is bleached to remove
pigments and other impurities.

4. Deodorization: The oil is deodorized to remove
odors and other volatile compounds.

5. Refining: The oil is refined to remove
any remaining impurities.

6. Shipping: The oil is packaged and shipped for
further processing.

The production process is complex and
requires proper control to ensure
high-quality oil.

Canola processing is carried out in
the following steps:

1. Prepressing: The seed is ground and
the oil is extracted using a solvent.

2. Degumming: The oil is degummed to
remove phosphatides and other
impurities.

3. Bleaching: The oil is bleached to remove
pigments and other impurities.

4. Deodorization: The oil is deodorized to
remove odors and other volatile
compounds.

5. Refining: The oil is refined to remove
any remaining impurities.

6. Shipping: The oil is packaged and
shipped for further processing.

The production process is
carried out in the following
steps:

1. Prepressing: The seed is ground and
the oil is extracted using a solvent.

2. Degumming: The oil is degummed to
remove phosphatides and other
impurities.

3. Bleaching: The oil is bleached to remove
pigments and other impurities.

4. Deodorization: The oil is deodorized to
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