

Extraction of castor oil for (medical use)

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الخلاصة

استخلاص زيت الخروع للاغراض الطبية وذلك باستخدام الكبس البارد لبذور الخروع عند ضغط وزمن كبس ودرجة حرارة وتم الحصول على اعلى كفاءة وقدرها 80% عند ضغط 140كغم/سم³ وزمن قدره 70 دقيقة ودرجة حرارة 38 م. تم استخلاص الزيت المتبقي من الكسبة والذي نسبته 17% بواسطة الهكسان كمذيب وتحت ظروف مختلفة من الحرارة وزمن الاستخلاص ونسبة المذيب الى الكسبة وتم قصر اللون للدهن المستخلص باستعمال مادة البنتونايت.

Abstract

Extraction of castor oil for medical uses by cold press of castor beans at 38°C with applied pressure 140 bars & pressing time of 70min., the maximum efficiency was found to be 80%.

The pressed cake which contains 17% oil was subjected to solvent extraction with hexane under operation conditions: temperature, time of extraction and solvent to feed ratio.

Bleaching of the castor oil with natural earth (bentonite) to improve the color.

Introduction

Castor oil and its derivatives have applications in the manufacturing of soaps, lubricants, hydraulic and brake fluids, paints, dyes, coatings, inks, cold resistant plastics, waxes and polishes, pharmaceuticals and perfumes^[1].

Ricinoleic acid is the main component of castor oil and it exerts anti-inflammatory effects^[2]. Castor oil decreased pain more than ultrasound gel or Vaseline during extracorporeal shock wave application^[3].

Castor oil derived from seeds of the plant "*Ricinus Communis*" with 40-50% oil content^[4].

Generally there are two methods to extract the oils from vegetable materials which are cold pressing & solvent extraction depends on the oil content of seed. Mechanical pressing is used for materials exceeding 20% oil

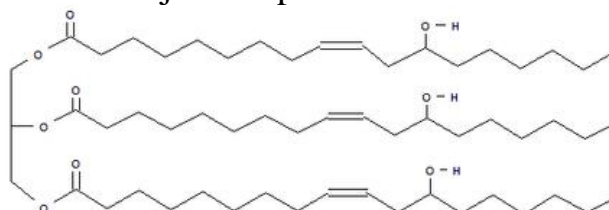
content, while solvent extraction may then be used to extract oil from materials containing less than 20 %^[5,6].

Castor oil like other common vegetable oil is triglyceride, but it contain fatty acids as shown in table (1)^[7].

Acid name	Percentage	Acid name	Percentage
<u>Ricinoleic acid</u>	95%	<u>Stearic acid</u>	0.5%
<u>Oleic acid</u>	2%	<u>Palmitic acid</u>	0.5%
<u>Linoleic acid</u>	1%	<u>Dihydroxystearic acid</u>	0.3%
<u>Linolenic acid</u>	0.5%	Others	0.2%

Table 1: Composition of Castor seed oil/fatty acid chains

The structure of the major component of castor oil is shown below:



Specifications for medicinal oils (British pharmacopoeia)^[8] are shown in the table (2).

Solubility	Soluble at 20° C in 2.5 part of alcohol (90%)
Acetyl value	Not less than 140
Acid value	Not more than 2
Iodine value	82 – 90
Refractive index at 20 ° C	1.477 – 1.481
Saponification value	177 – 187
Weight / ml at 20 ° C	0.953 – 0.964

Table 2: Specification for medicinal oils

Before extraction step there are some treatments tend to increase the overall efficiency of recovery of oil from seeds material & to increase the capacity of production.

These processes can be summarized by the following steps.

- 1 - Seeds cleaning, to remove foreign materials.
- 2 - Dehulling, to remove outer seed coat.
- 3 - Grinding, to reduction of the seeds to small particals size.

Materials and Methods

A - Pressing extraction

Materials:

- 1 - Castor beans (*Ricinus Communis*).
- 2 - Bentonite

Apparatus:

- 1 - Hydraulic press:
Consist of hydraulic cylinder fixed in a steel construction moves by pumping hydraulic fluid through cylinder with hydrauling pump operated by hand. The press is provided with pressure gauge to measure the pressure in the cylinder.
- 2 - Electronic balance type OHAUS model GT8000.
- 3 - Thermometer.
- 4 - Oven, type Gallen Kamp temperature range 20-200 °C.

Procedure:

- 1 - 500 gm of seeds are washed with water and heated in the oven to evaporate the water at 100°C.
- 2 - Seeds are heated in the oven to the desired temperature (38-80°C) and fed directly to the cylinder and pressed at constant pressure and time (140bars & 70min), the amount of the yellow oil are recorded.
- 3 - The yellow oil is filtered & the filtrated refined by bleaching with bentonite (1: 0.03) in 40°C with contact time 30min.

B- Solvent extraction

Materials:

- 1 - The press cake from pressing extraction stage.
- 2 - Commercial hexane.

Apparatus:

- 1 - Tow neck round bottom flask 1000ml.
- 2 - Water bath
- 3 - Thermometer
- 4 - Magnetic stirrer
- 5 - Buchner funnel
- 6 - Distillation unit

Procedure:

- 1 - The cake from pressing extraction stage is reflux with hexane (1:1) by heating (70°C) with water bath about 1.5 hr.

2 - The mixture filtered by Buchner funnel, the filtrate were distilled to recovered the hexane & the residual oil is measured.

C - Analytical Method

Determination of acid value:

The acid value of oil is determined according to British pharmacopeia, the procedure is as follows:

1 - 10 gm of oil are dissolved with equal volumes of alcohol (95%) & ether, adding phenolphthalein as indicator.

2 - The mixture is titrated with 0.1N aqueous KOH.

3 - The acid value is calculated from the formula:

$$\text{Acid Value} = e \times 0.00561 \times 1000 / \text{weight of substance}$$

Where e = no. of ml KOH

Results and Discussion

Pressing extraction:

The effect of temperature on the oil quality at selected pressure (140bar) and time pressing (70 min) are shown in table (3).The increasing of temperature (38°C-80°C) cause the increasing of acid value of extracted oil (2- 4.8), because higher temperature disintegration of triglycerides to produce fatty acid.

Temperature of extraction ° C	Aid value
38	2.0
54	3.6
65	3.8
70	4.6
80	4.8

Table 3: Effect of the temperature on the oil quality

The condition of cold press at 38°C with period time 70min & pressure 140 bars get press efficiency from 80% and the specification of oil extracted (show in table 4) coincide the British pharmacopoeia specification of castor oil, that is used for medical purposes.

Solubility	Soluble at 20° C in 2.5 part of alcohol (90%)
Acid value	2.0
Refractive index at 20° C	1.475
Weight / ml at 20° C	0.955

Table 4: Specification for castor oils extracted by cold press

Solvent extraction:

The specification of castor oil extracted by solvent shown in table (5):

Solubility	Soluble at 20° C in 2.5 part of alcohol (90%)
Acid value	4.4
Refractive index at 20° C	1.480
Weight / ml at 20° C	0.958

Table 5: Specification for oils extracted by solvent

The oil extracted by cold press has an acid value (2) less than the oil extracted by solvent (4.4) because the temperature needed in the cold press (38°C) is less than temperature in the solvent extraction (80°C). Then the cold press satisfied the specification of medical quality.

The oil having a high acid value required process tends to reduce free acid by neutralization process and this additional cost makes the solvent extraction less economic than the cold press.

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