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Castor Processors' Workshop
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Castor Oil

Properties & Chemical Composition

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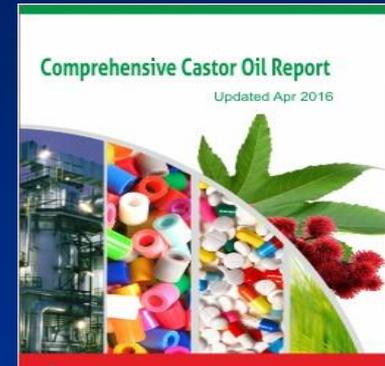
BACKGROUND

- Castor - *Ricinus communis*
- Castor Oil / Ricinus Oil - Seeds of the Castor Plant.
- Obtained by Pressing, Solvent Extraction or a Combination.
- Brown / Dark Brown – Jamaican Black CO
- Pale Straw Colour – Crude Form
- Colourless / Slightly Yellow – Refined & Bleached.



BACKGROUND

- **Contributes to only 0.15% of Vegetable Oil Produced Globally** (Patel et al., 2016).
- **Global Demand – 14 M Tonnes** (Jam. Observer, April 2017)
- **Supplies – 7.5 M Tonnes** (Jam. Observer, April 2017)
- **Global Castor Oil & Derivatives Market in 2015 – Exceeded US\$1.3B** (Grand View Research, August 2016)
- **Projections for 2024 – US \$2.33B** (Grand View Research, August 2016)
- **Global Annual Retail Sales for JBCO – US\$75M – US\$100M** (JAMPRO, August 2016)



CASTOR OIL'S UNIQUENESS

- Only commercial source of hydroxylated fatty acid.
- High Purity: Fatty Acid Portion is about 90% Ricinoleic Acid.
- High Product Uniformity and Consistency.
- Nontoxic, Biodegradable, Renewable Resource.



CASTOR OIL APPLICATIONS

Important Commodity to Industry

- Food & Agriculture
- Cosmetics & Perfumeries
- Plastics & Rubbers
- Textile Chemicals
- Electronics & Telecommunications
- Pharmaceuticals
- Paints, Inks & Adhesives
- Lubricants
- Biofuels.



COMPOSITION OF CASTOR OIL

Seeds Contain:

- 40 – 55 % Oil
- 12 - 16 % Protein
- 5 % Moisture
- 3 – 7 % NFE (Sugars, Starches, etc.)
- 27 % Crude Fibre
- 2 - 2.2 % Ash
- Phosphorous, Uric Acid, Enzymes etc.

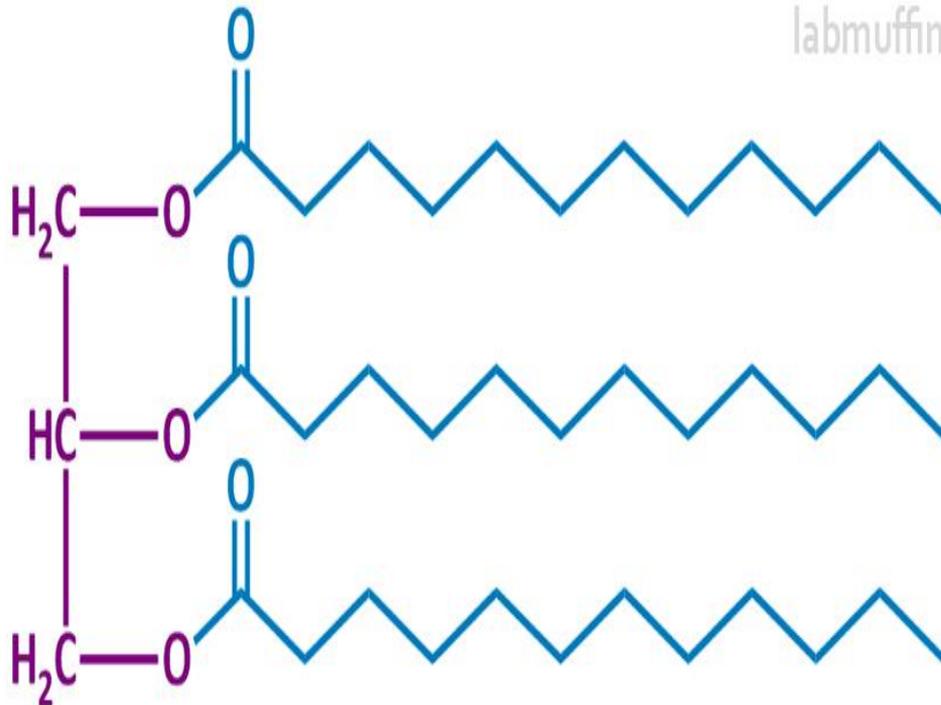


COMPOSITION OF CASTOR OIL

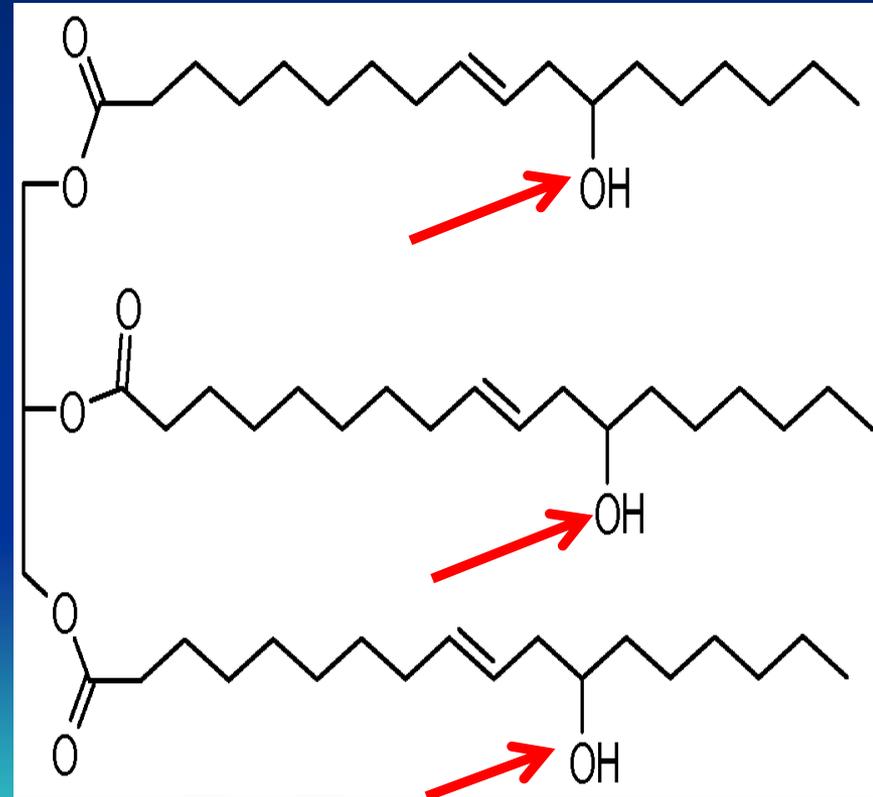
Acid Name	Average percentage Range
Ricinoleic acid	85 to 95%
Oleic acid	2 to 6%
Linoleic acid	1 to 5%
Linolenic acid	0.5 to 1%
Stearic acid	0.5 to 1%
Palmitic acid	0.5 to 1%
Dihydroxystearic acid	0.3 to 0.5%
Others	0.2 to 0.5%

COMPOSITION OF CASTOR OIL

General Fat / Oil

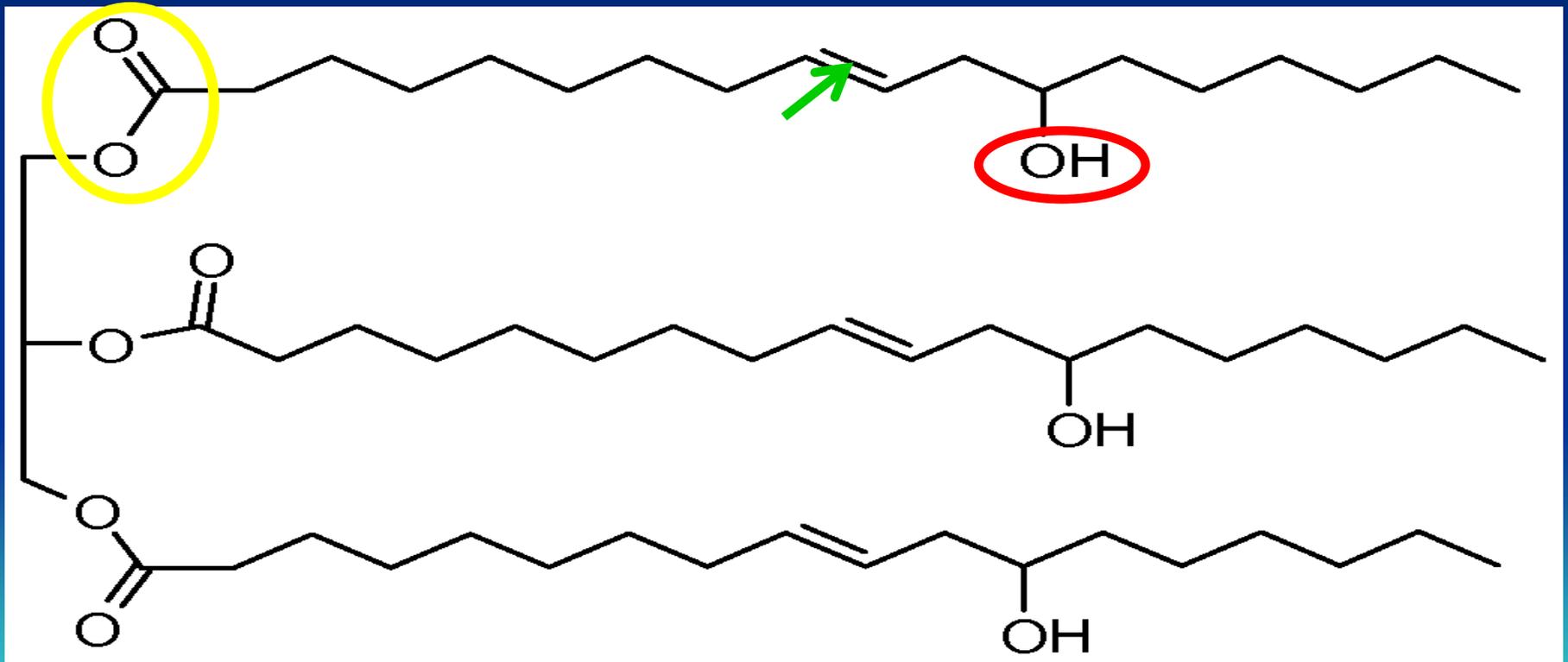


Castor Oil



COMPOSITION OF CASTOR OIL

Castor Oil's Chemistry is based on the high Ricinoleic Acid Content and its Functionality:



PROPERTIES OF CASTOR OIL

- Unique Structure Offers Interesting Properties – Various Applications.
- Methods of Extraction affects Physical and Chemical Properties
 - Cold Pressed versus Solvent Extracted
- Physical and Chemical Properties Determine Quality.



PROPERTIES OF CASTOR OIL

Physical Properties

Hydroxyl Groups (OH) - Unique Combination of the Physical Properties:

- **Relatively High Viscosity / Thickness**
 - Unusual for Vegetable Oil
 - Important for Blending Lubricants

- **Relatively High Specific Gravity**
 - Heaviness of oil compared to water

- **Solubility in Alcohol in any Proportion.**
 - E.g. Methanol Allows for Conversion to Biodiesel.



PROPERTIES OF CASTOR OIL

Physical Properties

➤ Relatively High Shelf Life

- OH group Prevents Peroxide Formation.
- 1 – 2 Years, 3 – 4 Years ?

➤ Hydroxyl Value

- Measures free –OH groups formed on oil decomposition
- Indicator of Rancidity - 10% reduction in HV after 90 days storage.

➤ Refractive Index

- Measures Reduction in Light Speed Through Oil.
- Indicator of Adulteration.



PROPERTIES OF CASTOR OIL

Physical Properties

➤ Fatty Acid Composition

- Indicates Concentrations of Various Oil Components
- Important for Industry e.g. Soap Formulators.

➤ Colour

- Off – Colours - Inconsistency in Processing Method
- Important for Product Consistency

➤ Odour

- Off - Odours - Bacterial Contamination, Rancidity etc.
- Important for Product Consistency



PROPERTIES OF CASTOR OIL

Chemical Properties

➤ Iodine Value

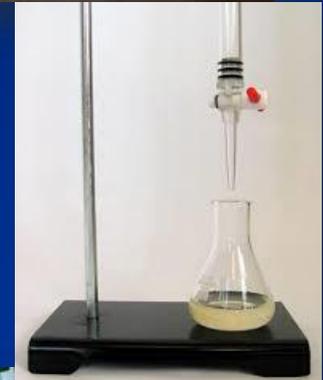
- Estimates unsaturation of oil
- Classifies oils: drying (130-200) , semi-drying (100-130) or non-drying (< 100).

➤ Acid / Free Fatty Acid Value

- Measures free fatty acids in oil
- Indicator of inadequate processing or storage condition

➤ Peroxide Value

- Measures rancidity in unsaturated fats and oil



PROPERTIES OF CASTOR OIL

Chemical Properties

➤ Saponification Value

- mg KOH required to saponify 1 g of fat.
- Measures the average MW of all fatty acids in oil.

➤ Unsaponifiable Matter

- Measures other organic components not saponified by alkali hydroxides.
- High UM retards ability to form soap.

➤ Moisture Content

- Measures water in the oil
- Affects SV, IV, Colour, Oil Yield etc.



Standard Specifications of the ICOA

CASTOR OIL

CASTOR OIL, STANDARD OF QUALITY

The quality of castor oil described in the sales contract shall be the designated grade conforming to the standard specification of the INTERNATIONAL CASTOR OIL ASSOCIATION, INC. (ICOA), as follows.

Castor Oil, a clear viscous liquid of the following types shall be the triglyceride oil derived from the seed of the castor plant, genus *Ricinus communis*.

<u>VALUES</u>	<u>AOCS TEST METHODS</u>	<u>ICOA CASTOR OIL SPECIFICATIONS (2003)</u>
COLOR-LOVIBOND, 5/4" SCALE	Cc 13e-92	20 Y 2.0R MAX
HYDROXYL VALUE	Cd 13-60	160-168
VISCOSITY, STOKES	Tq 1a- 64	6.3-8.9
FREE FATTY ACIDS	Ca 5a-40	1.00% MAX
MOISTURE & VOLATILE	Ca 2c- 25	0.25% MAX
INSOLUBLE IMPURITIES	Ca 3a-46	0.02% MAX
RICINOLEIC ACID CONTENT	ISO 5508/9	85% MIN
APPEARANCE @ 25°C	CLEAR AND FREE OF SUSPENDED MATTER	
ODOR	SLIGHT, CHARACTERISTIC	
SOLUBILITY IN ALCOHOL @ 20°C	COMPLETE WITHOUT TURBIDITY IN TWO VOLUMES OF SPECIALLY DENATURED ALCOHOL FORMULA 3A (95%)	

ADDITIONAL GENERAL SPECIFICATIONS

SPECIFIC GRAVITY @ 25/25°C	Cc 10a-25	0.957-0.965
REFRACTIVE INDEX @ 25°C	Cc 7-25	1.476-1.479
IODINE VALUE	Cd 1d-92	83-88
SAPONIFICATION VALUE	Cd 3-25	175-185
UNSAAPONIFIABLE	Ca 6a-40	0.7% MAX
COLOR-GARDNER	Td 1a-64	3 MAX
ACID VALUE	Cd 3d-63	2 MAX

HOW CAN SRC ASSIST?

Provision of Certificate of Analysis (COA)

- ✓ Complete List of Physical & Chemical Specifications of Product Tested.
- ✓ Ensures Product Conformity to Specifications.
- ✓ Ensures that Product is not Degraded / Contaminated.
- ✓ Contains Minimum, Maximum, Target Specifications.
- ✓ **Extremely Important for Quality Control.**



HOW CAN SRC ASSIST ?

Provision of Certificate of Analysis (COA)

➤ Current Capabilities Include Determination of:

- Moisture Content of Beans & Oil
- Oil Content of Beans (Solvent Extraction)
- Peroxide Value
- Refractive Index
- Specific Gravity
- Saponification Value
- Solubility in Alcohol
- pH Value (If Required)
- Fatty Acid Composition (Near Future)



HOW CAN SRC ASSIST ?

Development of JAMAICAN Specifications for JBCO

- Traditional Processing Method Different
- Different Method = Different Oil Properties
- Different Oil Properties = Different Quality



HOW CAN SRC ASSIST ?

- **Develop Distribution Profile of JBCO**
 - **Collection of Oil Samples from Beans from Different Varieties of Castor Plant.**
 - **Involve Castor Oil Processors Island wide.**
 - **Analytical Testing to Determine Physical & Chemical Properties of Oils Collected.**
 - **Compilation of Results into Standard Specifications (Collaboration).**



Standard Specifications for JBCO ?



NATURAL SOURCING™
Specialists in Cosmeceutical Ingredients

Jamaican Black Castor Oil INCI: Ricinus Communis (Castor) Seed Oil

Specifications

Analytical Details

Appearance:

Odor:

Free Fatty Acid:

Acid Value:

Solubility in Ethyl Alcohol:

Specific Gravity @ 30°C:

Refractive Index @ 40°C:

Iodine Value:

Saponification Value:

Insoluble Impurities:

Moisture:

Hydroxyl Value:

Viscosity:

Specifications

Golden Brown to Blackish Viscous Oil

Mild burnt to smoky

1.0 Max

2.0 Mg KOH/g Max

Completely Soluble without turbidity

0.954-0.960

1.470-1.4740

82-90

17-185 Mg KOH/g

0.02% Max

0.25% Max

158-165

6.0-9.0 Poise

Black Castor Oil is extremely versatile and is easily incorporated into all kinds of cosmetics from rinse-off to leave-on products. It is highly emollient and is used to bind ingredients in cosmetic and soap formulas. Acts as a humectant with soothing and emollient actions. Recommended usage rate is 3-10%.

Shelf Life:

3-4 Years

Date: 01/13/2015

Disclaimer: All information, appearing herein on our products is based upon data that are believed to be reliable. However, it is the user's responsibility to determine the suitability of the product before use. Since the actual use of the product is beyond our control, no guarantee, express or implied, is made by Natural Sourcing of the product nor does Natural Sourcing assume any liability arising out of use, by others, of the product referred to herein.

Jamaican Black Castor Oil Standards to Protect the Market



THANK YOU ALL!!!

