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PRICKLY PEAR SEED OIL EXTRACTION METHOD AND POTENTIAL HEALTH BENEFITS

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ABSTRACT

Prickly pear (*Opuntia ficus-indica L.*) is a member of the Cactaceae family, originally grown in South America, and it is now distributed to various parts of the world, including the Middle East. Researchers have investigated the chemical composition and biological activities of different parts of the prickly pear plant, including cladodes, flowers, fruit, seeds, and seed oil. Among these, the oil extracted from the seeds has garnered attention for its nutritive value and potential health benefits. Here are some key points about prickly pear seed oil. Extraction Techniques: Prickly pear seed oil has been extracted using various techniques, ranging from conventional to advanced methods. Chemical Composition: The oil is characterized by its high linoleic acid content. Its composition can vary based on factors such as variety, environment, and extraction method. Health Benefits: Researchers have reported several health benefits associated with prickly pear seed oil. For future research, additional studies are needed to explore the mechanisms of action underlying the reported biological activities. These findings could pave the way for developing nutraceutical products aimed at preventing various chronic human diseases.

KEYWORDS: Prickly pear oil, Nutraceuticals, Potential health benefits.

1. INTRODUCTION

Opuntia *ficus-indica L.*, which is known as a prickly pear belongs to the cactaceae family and has spread widely throughout the world. The prickly plant is used nowadays many forms, including food, health, and nutrition and also as prepared products including cosmetics, tea, jam, juice, and oil extracted from the seed oil extracted from the seeds. Health benefits and

biological activities have been reported for different parts of the prickly pear plant, such as cladodes, fruit, seeds and seed oil.[1] Prickly pear oil, also known as cactus seed oil, is a valuable natural oil extracted from the seeds of the prickly pear cactus. This oil has a long history of use in traditional and medicine skin care, and its popularity has grown in recent years due to its numerous potential benefits and uses. The extraction process involves cold pressing the seeds to obtain a highly nutritious and versatile oil that is reach in fatty acids, vitamins, and antioxidants. Prickly pear oil has gained attention for its potential application in cosmetics, skincare, culinary use and even medical and therapeutic practices. In this comprehensive review, we will explore the chemical composition, nutritional value, and potential benefits of prickly pear oil across various industries. Additionally, we will examine sustainability and ethical consideration related to the production and trade of prickly pear oil. Overall, this review aims to highlights the significant potential of prickly pear oil as a valuable natural resource with diverse application.[2]

The prickly pear cactus, also known as opuntia Ficus – indica, is native to Mexico and the southwestern united states but is also found in many other parts of the world with arid and semiarid climates. The cactus produces vibrant, colorful fruits that are commonly referred to as prickly pears or tunas. These fruits have been a staple in traditional diets for centuries and are known for their sweet, juicy flesh and numerous health benefits.

The seeds of prickly pear fruit are tiny, black, and contain a small amount of oil. The oil extraction process involves carefully removing the seeds from the fruit and then cold pressing them to obtain the precious oil. The cold pressing method is crucial in preserving the preserving the oils nutrition value and maintaining its natural properties.[3]

“Fig. 1:” Prickly Pear Plant.

Table 1. Representing the Kingdom, Species, Family and Genus of plant.

Name of plant	Kingdom	Family	Species	Genus
Prickly pear cactus	Plantae	Cactaceae	O. ficus- indica	Opuntia
Saguaro cactus	Plantae	Cactaceae	C. gigantea	Carnegiea
Rhipsalidopsis	Plantae	Cactaceae	R. gaertneri	Rhipsalidopsis
Schlumbergeratruncate	Plantae	Cactaceae	S. truncata	Schlumbergera
Moon cactus	Plantae	Cactaceae	G. mihanovichii	Gymnocalycium
Mammillaria plumosa	Plantae	Cactaceae	M. plumosa	Mammillaria
Opuntia	Plantae	Cactaceae	O. microdasys	Opuntia

1.1 CHEMICAL COMPOSITION AND NUTRITIONAL VALUE

Prickly pear oil is packed with essential fatty acid, including linoleic acid (omega-6) and oleic acid (omega-9), which are vital for maintaining healthy skin and hair. These fatty acids help to moisturize and nourish the skin, promote collagen production, and protect against environmental stressors. Additionally prickly pear contains a high concentration of vitamin E, a powerful antioxidant that helps to protect the skin from free radical damage and reduced the signs of aging.

In addition to fatty acid and vitamin E, prickly pear oil is reach in other nutrients such as vitamin K, which helps to brighten dark undereye circles and even out skin tone, as well as vitamin C, which promotes skin elasticity and firmness. The oil also containsflavonoid and polyphenols, which have anti-inflammatory and antimicrobials properties and can benefits the skin.[4]

1.2 POTENTIAL BENEFITS AND USES

Due to its impressive nutritional profile, prickly pear oil offers a wide range of potential benefits for skin care, hair care and overall health. When applied topically, the oil can help to hydrate and soften the skin, reduce the appearance of fine lines and wrinkles, and calm redness and irritation and improve overall skin texture. It is stable for all skin types, including sensitive and acne-prone skin.

Prickly pear oil is also beneficial for hair health. It helps to nourish and condition the hair, improve its strength and elasticity, and add shine and luster. The oil can be used as a leave-in treatment or added to hair masks and conditioners for an extra boost of hydration.

In addition to its cosmetics uses, prickly pear oil has potential application in culinary uses. The oil has a light, nutty flavor that makes it suitable for use in salad dressing, marinades, and

other recipes. It can also be drizzled over dishes as a finishing oil to add a unique flavor and nutritional benefits.

Furthermore, prickly pear oil has been studied for its potential medical and therapeutic uses. Prickly pear oil may have anti-inflammatory, antiviral, and antimicrobial properties. That could be beneficial for treating various skin condition such as eczema, psoriasis, and acne. Additionally prickly pear oil has been investigated for its potential role in managing the diabetes, lowering cholesterol levels and supporting overall heart health.[5]

2. METHODS OF EXTRACTION OF PRICKLY PEAR OIL

The extraction method of prickly pear oil can vary from conventional to advanced, and they affect the yield and quality of the oil. Some of the common extraction methods are:

Table 2: Represent different method solvent, extraction time and yield of prickly pear oil.

Extraction technique	Method	Yield (%)	Reference
Solvent extraction			
2-Methyloxolane and n-hexane	Soxhlet system for 8hrs	9.55± 0.12 2-methyloxolane 8.86± 0.25 n-hexane	[6]
Diethyl ether	Soxhlet system for 3 hrs.	2.61 – 7.69	[7]
Methanol	Soxhlet system for several hrs.	16.20	[8]
n-hexane	Soxhlet apparatus for 4 to 6 hrs.	5.40± 0.5	[9]
n-hexane	Soxhlet system for 9 h at 120º c	7.30 -9.3	[10]
Petroleum ether	Soxhlet system for 6 hrs. at 50ºc	5.00- 14.4	[4]

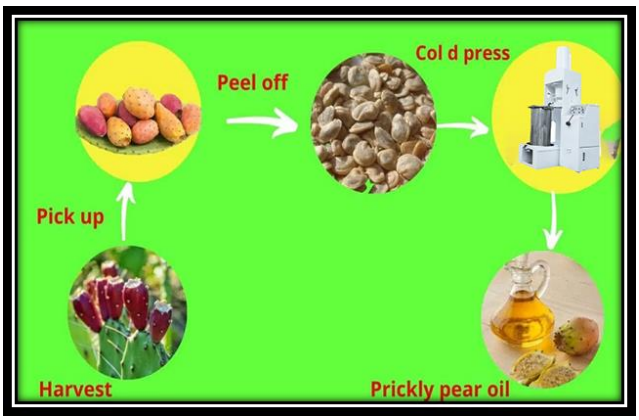
Table 1: cont.

Maceration extraction with solvent			
n-hexane	Macerating for 24 h.	6.2±0.3-15.5±0.5	[11]
Different solvent, n-hexane, ethanol, and ethyl acetate	Mixing the powdered seeds with solvents	Hexane yield 11.8 ethanol and ethyl acetate 10.00	[12]
n-hexane	Powdered seeds were immersed in hexane at 25ºc in a dark place for 24 hrs.	NR	[10]
Chloroform and methanol 2.1	Powdered seeds were immersed in chloroform and	4.1 – 8.8	[13]

	methanol 2:1 while adding BHT at a concentration of 0.001%		
Chloroform and methanol 2:1	Powdered seeds were immersed in chloroform and methanol 2:1 with adding BHT at a concentration of 0.001%	5.4 -6.7	[14]
Cold pressure	First cold pressure using a mechanical oil press	NR	[14]
Hydro distillation using Clevenger apparatus	Ground seed were extracted with n - hexane as a solvent and a Clevenger type apparatus	0.6 – 3.0	[10]

❖ Maceration-Percolation

This method involves soaking the seeds in the solvent, such as hexane, and then filtering the oil. The yield can range from 6.2% to 15.5%, depending on the variety of prickly pear.[15]



"Fig. 2:" Maceration-Percolation Method of Extraction.

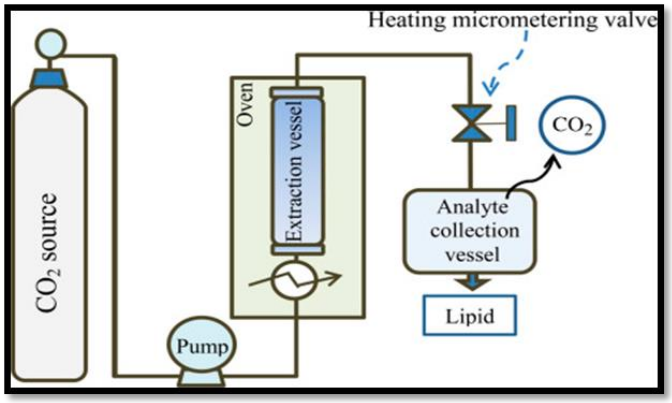
❖ COLD PRESSING METHOD

This method involves crushing the seeds and applying pressure to extract the oil. The yield can range from 0.5% to 6.1%, depending on the variety and the temperature of the process. This method preserves the natural antioxidant and fatty acid of the oil better than the solvent extraction.[15]

"Fig. 3:" Cold pressing method of extraction.

❖ SUPERCRITICAL CARBON DIOXIDES

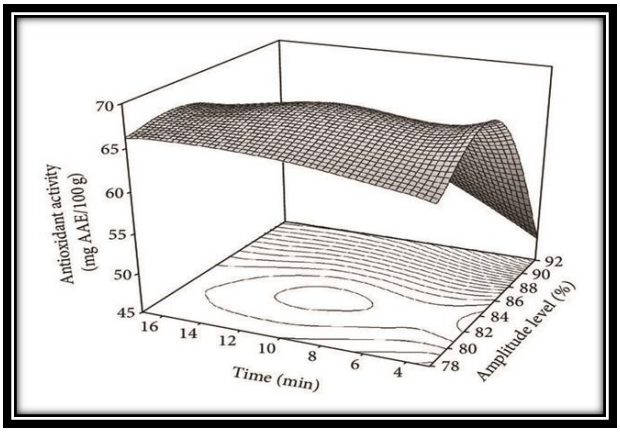
This method involves using carbon dioxide at high pressure and temperature to extract the oil. The yield can range from 1% to 20%, depending upon the conditions of the process. This method is considered environmentally friendly and produces high-quality oil.[15]



"Fig. 3:" Supercritical carbon dioxide extraction method.

❖ ULTRASOUND EXTRACTION

This method involves using ultrasound waves to break the cell walls of the seeds and release the oil. The yield can range from 1.5% to 3.5%, depending on the power and duration of the ultrasounds. This method is fast and efficient, and can enhance the antioxidant activity of the oil.[15]



"Fig. 5:" Ultrasound extraction method.

Prickly pear oil is rich in linoleic acid, oleic acid, palmitic acid, stearic acid, which have various health benefits for the skin and the body. Prickly pear oil can be used as a carrier oil, a food supplement, or a cosmetic ingredient.[15]

3. Therapeutic Uses of Prickly Pear Oil

3.1 Antioxidant activity of prickly pear oil

Prickly pear oil has been found to possess significant antioxidant activities. The oil is rich in tocopherols (vitamin E), which are potent antioxidants that protect the skin from oxidative stress and free radical damage. Additionally, prickly pear oil contains betalains, which are water-soluble pigments that have strong antioxidants properties.

Studies have shown that prickly pear oil can scavenge free radicals and reduce oxidative stress in the body. This can help prevent cell damage and reduce the risk of chronic disease such as, cancer, cardiovascular disease and diabetes.

In addition to its antioxidant's properties, prickly pear oil also has anti-inflammatory effects. Overall. Prickly pear oil is a powerful natural antioxidant that can provide numerous health benefits when consumed or applied topically.[16]

3.2 Antimicrobial Activity of Prickly Pear Oil

Prickly pear oil has been found to possess antimicrobial activity against various microorganisms. Studies have shown that the oil has antibacterial activity against both gram positive and gram-negative bacteria, including staphylococcus aureus, Escherichia coli, and pseudomonas aeruginosa.

The oil has been found to have antifungal activity against various fungal strains, including candida albicans, Aspergillus flavus, and Trichophyton mentagrophytes.

The antimicrobial activity of prickly pear oil is attributed to its high content of fatty acids, particularly linoleic acid disrupts the cell membrane of microorganism, leading to their death.

The antimicrobial properties of prickly pear oil make it potential natural alternative to synthetic antimicrobial agents. It can be used in various application, such as food preservation, wound healing, and skin care products.[17]

3.3 Antidiabetic Properties of Prickly Pear Oil

Prickly pear oil has been found to have antidiabetics properties due to its ability to regulate blood sugar levels and improve insulin sensitivity. It has shown that prickly pear oil can help reduce fasting blood glucose levels, improve glucose tolerance, and increase insulin secretion.

Once study conducted all diabetics rats found that prickly pear oil supplementation significantly reduced blood glucose levels and improved insulin sensitivity compared to the control group. Another study on human subject with type-2 diabetes found that prickly pear oil supplementation led to a significant reduction in fasting blood glucose levels and HbA1c levels (A measure of long- term blood term blood glucose control).

The antidiabetics properties of prickly pear oil are thought to be due to its high content of antioxidants, particularly betalains, which have been shown to have anti-inflammatory and hypoglycemic effects. Additionally, prickly pear oil contains high levels of unsaturated fatty acids, which have been linked to improve insulin sensitivity and glucose metabolism.

Overall, these finding suggest that prickly pear oil may be promising natural remedy for managing diabetes and improving blood sugar control.[16]

3.4 Effect of Prickly Pear Oil onLipid Profile and Cholesterol Regulation

Prickly pear oil has been shown to have a positive effect on lipid profile and cholesterol regulation. It has found at prickly pear oil can help reduce levels of total cholesterol, LDL (bad) cholesterol, and triglycerides while increasing level of HDL (good) cholesterol.

One study on rats with high cholesterol levels found that supplementation with prickly pear oil led to a significant reduction in a total cholesterol, LDL cholesterol, on triglycerides compared to control group. Another study on human subject with high cholesterol levels found that prickly pear oil supplementation led to a significant reduction in total cholesterol and LDL cholesterol levels after just four weeks. The cholesterol lowering effects of prickly pear oil are thought to be due to its high content of unsaturated fatty acid, particularly linoleic acid and oleic acid. These fatty acids have been shown to improve lipid profile and reduce the risk of cardiovascular disease. Additionally, prickly pear oil contains high levels of antioxidants, which have been shown to have anti-inflammatory effects and protect against oxidative stress. This may also contribute to its cholesterol-properties.[17]

3.5 Anti-inflammatory Effect of Prickly Pear Oil

Prickly pear oil has been shown to have anti-inflammatory properties, which may be beneficial for a variety of health condition. Inflammation is a natural response of the body to injury or infection, but chronic infection, but chronic inflammation that contribute to the development of many diseases, including cardiovascular disease, diabetes and cancer. Prickly pear oil may be a natural remedy for reducing inflammation and managing condition associated with chronic inflammation.

3.6 Anti-ulcer Activity of Prickly Pear Oil

Prickly pear oil has been studied for its potential anti-ulcer activity. Ulcer are open sores that develop in the lining of the stomach or small intestine, and they can be caused by factors such as infection, stress, or prolonged use of non-steroidal anti-inflammatory drugs (NSAIDS).[17]

Table 3: This table represents chemical constituents, therapeutic and action of drug.

Drug Name	Chemical constituents	Therapeutic Uses	Action	Reference
Prickly pear	Tocopherol, carotenoids, flavonoids, betalains	Antioxidant activity	**Tocopherol:** That protect cell from oxidative damage caused by free radicals.	[18]
Prickly pear	Fatty acids, Tocopherol, betalains, phytosterols	Antimicrobial activity	**Fatty acids:** Which have been shown to have antimicrobial activity against various bacteria and fungi.	[18]
Prickly pear	Flavonoids, betalains,	Antidiabetics	**Flavonoids:**To	[18]

	phenolic compound, fatty acids	activity	improve glucose tolerance and insulin sensitivity.	
Prickly pear	Phytosterol, fatty acids, tocopherol, betalains	Lipid profile and cholesterol regulation	**Phytosterol:**To reduce cholesterol absorption in the gut and lower LDL(Bad) cholesterol levels.	[18]
Prickly pear	Betalains, vitamin-E, linoleic acid, flavonoids	Anti-inflammatory activity	**Betalains:** By inhibiting the production of pro-inflammatory cytokines and enzymes.	[18]
Prickly pear	Betalains, flavonoids, vitamin-E, linoleic acid	Anti-ulcer activity	**Vitamin-E:** They help protect the gastric mucosa from damage.	[18]

4. CONCLUSION

The prickly pear oil has been extracted from prickly pear seeds using different extraction methods or techniques, from conventional to advanced, and the prickly pear oil yield varied depending on many factors, including geographical region, harvest period, fruit variety, maturation, extraction method and type of extraction solvent. It is based on physiochemical properties of prickly pear oil. It is considered an edible oil and can be used by human being. The prickly pear oil has nutritive values. Prickly pear oil is characterized by a high level of polyunsaturated fatty acids, with a high content of linoleic acidand a good level of oleic acid. Some variety of prickly pear oil showed high n-6 fatty acids. There has been a great deal of attention on n-3 fatty acids for health, but linoleic is now also being considered as beneficial. Prickly pear oil also rich in phytosterols, among which β-sitosterol is the major and prickly pear oil was found to be a good source of vit. -E. It contains carotenoids, phenolic compounds and volatile compounds. Experimental studies have reported that the prickly pear oil shows several potential health benefits and biological activities, including antioxidants activity, antimicrobial, antidiabetic, anti-inflammatory and anti-ulcer activities. Prickly pear oil reduced cell death due to UV-radiation of human dermic fibroblasts.

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