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REVIEW ARTICLE

OILS WITH REFERENCE TO ANTI SNAKE VENOM ACTIVITY

[1]*Mishal, R.H. and [2]Mishal, H.B.

[1]Sir. Dr. M. S. Gosavi College of Pharmaceutical Education and Research, Principal T. A. Kulkarni Vidyanagar, Nashik-422005
[2]MET's Institute of Pharmacy, Bhujbal Knowledge City, Adgaon, Nashik-422003

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ABSTRACT

Oils may be animal, vegetable, or petrochemical in origin, and may be volatile or non-volatile. Fixed or volatile oil extracted from plants contain various phytochemicals that are used for treatment of various diseases. Physiologically fixed oils are emollients and demulcents and have nutritional value. Sometimes oils obtained from different plant species are also used for treating snake bite victims by the tribal people. In the present paper seed oils properties, their general extraction methods with reference to snake bite envenomation treatment is discussed.

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INTRODUCTION

Oil is any neutral, non-polar chemical substance that is a viscous liquid at ambient temperatures and is both hydrophobic and lipophilic. They are used for food, fuel, lubrication, and the manufacture of paints, plastics, and other materials. Oils are classified mainly into two classes - Organic oils and Mineral oils. Organic oils are produced in remarkable diversity by plants, animals, and other organisms through natural metabolic processes. Lipidis the scientific term for the fatty acids, steroids and similar chemicals often found in the oils produced by living things, while oil refers to an overall mixture of chemicals. Organic oils may also contain chemicals other than lipids, including proteins, waxes and alkaloids. Organic oils may be fixed oils or volatile oils (Alberts *et al.,* 2002). Fixed oils or fatty oils are the reserve food materials of plants and animals. Fixed oils derived from plants generally occur in seeds (Kokate *et al.,* 2001). Volatile or Essential oils, as the name implies, are volatile in steam. They differ entirely in both physical and chemical properties from fixed oils. Crude oil, or petroleum, and its refined components, collectively termed petrochemicals, are crucial resources in the modern economy. Crude oil originates from ancient fossilized organic materials, such as zooplankton and algae, which geochemical processes convert into oil.

Corresponding author: **Mishal, R.H.,**
Sir. Dr. M. S. Gosavi College of Pharmaceutical Education and Research, Principal T. A. Kulkarni Vidyanagar, Nashik-422005.

The name "mineral oil" is a misnomer, in that minerals are not the source of the oil—ancient plants and animals are. Mineral oil is organic. However, it is classified as "mineral oil"instead of as "organic oil" because its organic origin is remote (and was unknown at the time of its discovery), and because it is obtained in the vicinity of rocks, underground traps, and sands. Mineral oilalso refers to several specific distillates of crude oil.

Chemical Composition of Oils

Chemically major components of fixed oils are triglycerides of fatty acids. The minor components include mono- and diglycerides, free fatty acids, phosphatides, sterols, fatty alcohols, fat-soluble vitamins, and other substances. A triglyceride is composed of glycerol and three fatty acids. When all of the fatty acids in a triglyceride are identical, it is termed a "simple" triglyceride. The "mixed" triglycerides are those in which two or three kinds of fatty acids are present in the molecule. Free fatty acids are the unattached fatty acids present in a fat. Some unrefined oils may contain as much as several percent free fatty acids. The levels of free fatty acids are reduced in the refining process. Refined fats and oils ready for use as foods usually have a near to nil free fatty acid content. Phosphatides consist of alcohols (usually glycerol), combined with fatty acids, phosphoric acid, and a nitrogen-containing compound.

For all practical purposes, refining removes the phosphatides from the fat or oil. Although sterols are found in both animal fats and vegetable oils, there is a substantial difference biologically between those occurring in animal fats and those present in vegetable oils. Cholesterol is the primary animal fat sterol and is only found in vegetable oils in trace amounts. Vegetable oil sterols collectively are termed "phytosterols." Sitosterol and stigmasterol are the best-known vegetable oil sterols. The type and amount of vegetable oils sterols vary with the source of the oil. Long chain alcohols are of little importance in most edible fats. A small amount esterified with fatty acids is present in waxes found in some vegetable oils. Larger quantities are found in some marine oils. Fats and oils are very good sources of vitamin E. The fat-soluble vitamins A and D sometimes are added to foods which contain fat because they serve as good carriers and are widely consumed. Tocopherols are important minor constituents of most vegetable fats.

They serve as antioxidants to delay rancidity and as sources of the essential nutrient vitamin E. There are four types of tocopherols varying in ant oxidation and vitamin E activity. Among tocopherols, alpha-tocopherol has the highest vitamin E activity. Carotenoids are colour materials occurring naturally in fats and oils. Most range in colour from yellow to deep red. The levels of most of these colour bodies are reduced during the normal processing of oils to give them acceptable colour, flavour, and stability. Volatile oils are generally mixtures of hydrocarbons and oxygenated compounds derived from these hydrocarbons. In some oils the hydrocarbons predominate and only limited amounts of oxygenated constituents are present while in others the bulk of the oil consists of oxygenated compounds. Many oils are terpenoid in origin.

Extraction Methods of Oils

Most fixed oils are derived from either seeds or fruits. Extraction of oil may take the form of cold or hot expression, centrifuging or solvent extraction depending on the nature of the oil. The oil obtained from nuts and seeds are usually extracted by one of two different methods. The first process is known as 'cold pressing' and is restricted to relatively small scale production these days due to the higher cost. The nuts or seeds are placed in a horizontal press with a rotating screw known as an 'expeller' and the oil is literally squeezed out. Despite the processing name, a certain amount of heat is produced during the process due to friction, but this rarely exceeds 70° or 80° C and causes little damage to the oil. The oil is then filtered and stored in suitable containers. Large scale industrial production uses a method called 'hot extraction' and uses a similar process, but tremendous heat is applied during the process to increase the yield of oil, and temperatures used can reach up to 200° C which destroys the important vitamins and fatty acids. The waste product from both methods of extraction, known as 'cake' is often re-processed using solvents to extract even more oil. Essential oils are generally derived from one or more plant parts, such as flowers, leaves and stems, bark, wood, roots, seeds, fruits and gums or oleoresin exudations. Today distillation is still the most common process of extracting essential oils from plants. The advantage of distillation is that the volatile components can be distilled at temperatures lower than the boiling points of their individual constituents and are easily separated from the condensed water. During distillation the plant material is placed upon a grid inside the still.

Once inside, the still is sealed, and, depending upon the method, steam or water/steam slowly breaks through the plant material to remove its volatile constituents. These volatile constituents rise upward through a connecting pipe that leads them into a condenser. The condenser cools the rising vapor back into liquid form. The liquid is then collected in a vehicle below the condenser. Since water and essential oil do not mix, the essential oil will be found on the surface of the water where it is siphoned off. Occasionally an essential oil is heavier than water and is found on the bottom rather than the top, such as with clove essential oil. The three types of distillation include Water distillation, steam distillation and percolation or hydro-diffusion. Expression, also referred to as coldpressing, is a method of extraction specific to citrus essential oils, such as tangerine, lemon, bergamot, sweet orange, and lime. A more modern method of extraction, and less labor-intensive, has been termed the ecuelle a piquer process that involves a prodding, pricking, sticking action to release the essential oil.

Quantitative Tests

A number of quantitative tests are commonly used to evaluate fixed oils and fats. Acid value refers to the number of mg of potassium hydroxide required to neutralize the free acids in 1 gm of the oil. Saponification value refers to the number of mg of potassium hydroxide required to neutralize the free acids in, and to hydrolyse the esters in, 1 gm of the oil. Ester value is the difference between the saponification and acid values. Iodine value gives a measure of the unsaturation of the oil. Another useful standard is Acetyl value, which is the number of mg of potassium hydroxide required to neutralize the acetic acid freed by the hydrolysis of 1 gm of the acetylated fat or oil (Anonymous, 1996).

Applications of oils

Cooking

Several edible vegetable and animal oils, and also fats, are used for various purposes in cooking and food preparation. In particular, many foods are fried in oil much hotter than boiling water. Oils are also used for flavoring and for modifying the texture of foods. Cooking oils are derived either from animal fat, as butter, lard and other types, or plant oils from the olive, maize, sunflower and many other species.

Cosmetics

Oils are applied to hair to give it a lustrous look, to prevent tangles and roughness and to stabilize the hair to promote growth.

Painting

Color pigments are easily suspended in oil, making it suitable as a supporting medium for paints. The oldest known extant oil paintings date from 650 AD.

Heat transfer

Oils are used as coolants in oil cooling, for instance in electric transformers. Heat transfer oils are used both as coolants, for heating and in other applications of heat transfer.

Lubrication

Given that they are non-polar, oils do not easily adhere to other substances.

This makes them useful as lubricants forvarious engineering purposes. Mineral oils are more commonly used as machine lubricants than biological oils are. Whale oil is preferred for lubricating clocks, because it does not evaporate, leaving dust, although its use was banned in 1980. As no suitable substitute is available, whale oil is still used in space.

Fuel

Some oils burn in liquid or aerosol form, generating light, and heat which can be used directly or converted into other forms of energy such as electricity or mechanical work. To obtain many fuel oils, crude oil is pumped from the ground and is shipped via oil tanker or a pipeline to an oil refinery. There, it is converted from crude oil to diesel fuel (petrodiesel), ethane (and other short-chain alkanes), fuel oils (heaviest of commercial fuels, used in ships/furnaces), gasoline (petrol), jet fuel, kerosene, benzene (historically), and liquefied petroleum gas.

Classical Uses and Other Pharmacological Studies on Fixed Oils

Fixed or volatile oil extracted from plants contain various phytochemicals that are used for treatment of various diseases. Physiologically fixed oils are emollients and demulcents and have nutritional value. The unsaturated fatty acids namely linoleic, linolenic and arachidonic acids present in several seed fixed oils are termed essential fatty acids. Fixed oils containing essential fatty acids serve as nutritive and dietary supplements. Polyunsaturated fatty acids including omega 3 fatty acids present in many fixed oils help to reduce cholesterol formation and deposition (Preedy *et al.* Nuts and Seeds in Health Prevention 2011). Fixed oils mainly containing unsaturated fatty acids are used as neutraceuticals in the prophylaxis of atherosclerosis and hypercholesteremia. Phospholipids present in fixed oils are hepatoprotective (Awang, 2009). Arachis oil or peanut oil is used as a vehicle for intramascular injections. Antimicrobial activity of peanut shells was reported by Vaughn in 1995.

DHC released from peanut shells are responsible for suppressing pathogenic fungal infection. Since peanut phytoalexins appear to play a role in defense mechanisms, the stilbenoids were evaluated first for their antifungal effects. Sobolev *et al.,* in 2011 reported the antifungal activity of arachis oil. Peanut butter contains a substance called Resveratrol which appears to inhibit viral inhibition/replication by regulating inflammatory responses and cellular stress pathways (Rangari, 2009). Castor oil is one of the oldest drugs. When given orally, it has a laxative effect and induces labor in pregnant females. The effects of castor oil are mediated by ricinoleic acid, a hydroxylated fatty acid released from castor oil by intestinal lipases. Despite the wide-spread use of castor oil in conventional and folk medicine, the molecular mechanism by which ricinoleic acid acts remains unknown. The findings of Tunaru *et al.,* in 2012 identify the cellular and molecular mechanism underlying the pharmacological effects of castor oil and indicate a role of the EP(3) receptor as a target to induce laxative effects. Seed oil from species of the Hydnocarpus genus is used for medicinal purposes, predominantly for various skin disorders. This oil is reported to contain a characteristic class of compounds known as cyclopentenyl fatty acids. Furthermore, seeds of this genus are reported to contain triglycerides of fatty acids, sterols, flavonoids, and flavonolignans. Hydnocarpin, a flavonolignan, is reported to potentiate antimicrobial and anticancer activity. The extracts and compounds isolated from this plant show a wide spectrum of pharmacological properties, including antibacterial, antileprotic, antitubercular, antipsoriatic, ant rheumatic, hypolipidemic, antidiabetic, anticancer, anti-inflammatory, and antioxidant activities. The antileprotic activity is postulated to be due to the cyclopentenyl fatty acids present in the seed oil (Sahoo *et al.,* 2014). Linseed has a long history of medicinal use, its main effects being as a laxative and expectorant that soothes irritated tissues, controls coughing and relieves pain. The seeds or the oil from the seed are normally used. Kaithwas *et al* in 2011 suggested the anti-inflammatory, analgesic and antipyretic activities of linseed oil. Sesame oil is used as a nutritive, laxative, demulcent, emollient and in the preparation of liniments and ointments. Salerno et al., in 1991 summarized the use of sesame oil in the inhibition of human colon cancer in vitro. Recently Monteiro *et al.* in 2014 proved that sesame oil was significantly effective against rat paw edema. The results further justify the antinociceptive and anti-inflammatory properties of sesame oil. Karanja oil is used in the treatment of scabies, leucoderma and other cutaneous diseases. Baswa *et al* in 2001 reported the antibacterial activity of karanja oil and suggested that this activity was mainly due to the inhibition of cell membrane synthesis in the bacteria. Shanmugasundaram *et al* in 2008 reported the larvicidal activity of karanja oil. Neemoil has a long history of medicinal use. Neem oil has been therapeutically used as folk medicine to control leprosy, intestinal helminthiasis, respiratory disorders, constipation and also as a general health promoter (Kirtikar, 1975). Neem oil is also reported to show immunostimulant, hypoglycemic, anti-fertility, anti-malarial, anti-bacterial and anti-oxidant activity (Banerjee *et al.,* 2002). Mahua oil is used as laxative, in the treatment of piles and haemorrhoids. The other different ailments treated include tuberculosis, rheumatoid arthritis, cholera, paralysis, snake-bite, debility, tonsillitis, influenza, piles, arthritic pain, helminthiasis, low semen count, headache, flatulency, and infections, besides being used as a blood purifier and as an antidote to poison. (Patel *et al.,* 2012).

Anti Snake Venom Activity of Oils

Till date published classical literature reports the use of 73 plant families having 198 species as anti snake venom remedies ethno botanically in Asia Pacific region. Families like leguminoceae (25 species), Apocynaceae (16 species), Asteraceae (11 species), Lamiaceae (10 Species), Malvaceae (9 species), Acanthaceae (8species), Amaranthaceae (8species), Solanaceae (5species), Asparagaceae (4 species), Euphorbiaceae (4 species), Menispermaceae (4 species), Moraceae (4 species), Aristolochiaceae (4 species), Rubiaceae (4species) are prominantly utilized by the tribal people for treatment of snake bite victims (Dey *et al*., 2012).

Most of the time aerial parts of the plants are used in the form of fresh pulp, decoctions or infusions for treating snake bite victims. Sometimes oils obtained from different plant species are also used for treating snake bite victims by the tribal people. For example Bhamre has reported the use of seed oil obtained from *Tinospora cordifolia*, family Menispermaceae for the treatment of snake bite poisoning in the tribal areas of North Maharashtra (Bhamre, 1995). Tariq *et al* has mentioned the use of oil obtained from *Acorus calamus* (family Araceae) for snake bite treatment in Pakistan (Tariq *et al.,* 2010).

Torres has reported the use of oil obtained from the seeds of *Nectandra angustifolia* for the neutralization of *Bothrops neuweidi* snake venom. Makhija has mentioned the use of oil obtained from *Helianthus annus* and *Madhuca indica* for the treatment of snake bite victims by the ethnic groups inhabiting various terrains in India (Makhija *et al.,* 2010). Reports are available on the anti snake venom activity of oil obtained from the seeds of *Balanites aegyptiaca* (Mishal *et al.,* 2013).

Conclusion

About 54 million people belonging to different ethnic groups inhabiting various terrains live in India. These indigenous groups have their own ethnic culture, religious rites, food habit and a sound knowledge of traditional medicine. Even today these groups practice the use of herbal medicines to cure a variety of diseases, with plants particularly used as folk medicine to treat snake bite poisoning. Topical application of plant extracts on the bitten area, chewing leaves or barks, drinking or injecting extracts, can counteract snake venom activity. In most of the cases these traditional practitioners do not have a standardized procedure for the exact dosage of these plant extracts. Effective dose may provide significant protection but administration of higher dose of the extracts may produce toxicity and deaths as a result of increased toxicity of the extract in combination with the snake venom (Asaauta *et al.,* 2011). Fixed oil extracted from the seeds on the other hand are formed from essentially similar compounds like linoleic acid, oleic acid and these fixed oils constitute some of the basic elements of human diet. Reports suggest that oils obtained from some plants like *Sesamum indicum* and *Urtica pilulifera* are completely non toxic (Ozbek *et al.,* 2004). This justifies the use of fixed oils obtained from the seeds of plants against snake bite envenomation.

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