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Review Article

Ozone And Ozonatated Oil for Skin Diseases

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ABSTRACT

Many topical anti-infective drugs have been developed by conventional medicine; however, due to the emergence of antibiotic and chemotherapeutic-resistant bacteria, some of these agents are no longer: very effective. Ozone has been recognized for more than a century as a great disinfectant, but because of its oxidizing characteristics, it must be utilized carefully. It has only been possible to control its extreme reactivity in the last ten years by carefully adjusting its concentration and adding the gas permanently to triglycerides, where gaseous ozone chemically combines with unsaturated substrates to produce derivatives that are therapeutically active. The stability and effectiveness of ozonated oils have previously been shown today, but because there are so many commercial products, this research will examine these derivatives and offer a method.

INTRODUCTION

We want to provide a quick overview of oil ozonation's physical chemistry in along with all the fundamental analyses required to prove the high caliber of the resultant products. It seems helpful to note that skin and mucosae are susceptible to high concentrations of gaseous O3, as there are evident examples of various changes associated with an extended exposure. We will then go over the several methods used to improve O3's ability to dean and promote healing Lastly, we will attempt to offer recommendations for the future medical use of topical ozone and its derivatives following a thorough examination of a plethora of suggestions The largest organ In the body that has an impact on our daily life is the skin. It serves a variety of vital purposes, but one of the most crucial is to act as a shield, shielding the body's tissues from infections, chemicals, and UV radiation, among other dangers found in the outside world. Since skin serves as a barrier between the internal and exterior environments, it is subject to a variety of insults; as a result, skin illnesses are highly prevalent and regarded as a high burden [1]. A third of the world's population is thought to be affected by these diseases, which rank as the fourth most common illnesses affecting

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the human body [2]. According to the American Academy of Dermatology Association (AAD), almost 85 million Americans, or 27% of the population, saw a dermatologist in 2013 for skin conditions

1.Ozonation Process

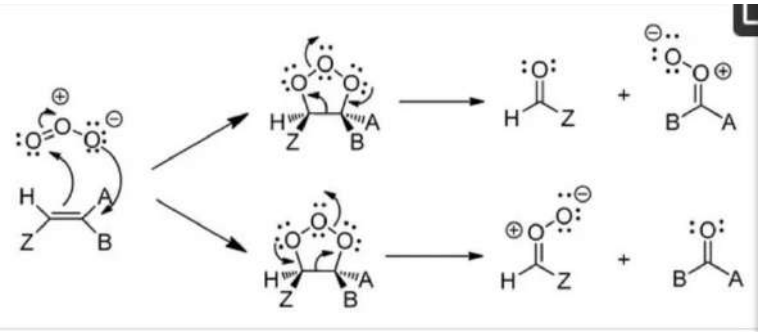
Ozone generators are used to create ozonated oils, and the quality of ozonated derivatives can vary depending on a number of factors. Approaching ozonation techniques requires taking into account a number of factors, including: The effectiveness and caliber of ozone generators; the type and quantity of vegetal oil; the presence of water or another catalyst; and the ozonation parameters, including time, temperature, agitation, and ozone concentration and flow. Additionally, using medical grade oxygen could be a way to prevent the formation of potentially hazardous nitrated by-products, which are cauhighl the nitrogen concentration of the air and consequently result in a drop in ozonation efficiency

Longer ozonation reaction durations are associated with larger degrees of unsaturation in the interaction between ozone and carbon–carbon double bonds It is evident that this component affects the ozonation kinetics in relation to the origin of the vegetable oils and their fatty acid composition. This is particularly true when the oxidation process is applied to sunflower oils, olive oils, and, more significantly, “classical” or “high oleic” sunflower oils. As linoleic acid (18:2) makes up the majority of the composition of classic sunflower oil, requires less ozonation time than its high oleic counterpart, which is more akin to olive oil and contains roughly 90% oleic acid

1.1 Ozonation Mechanism

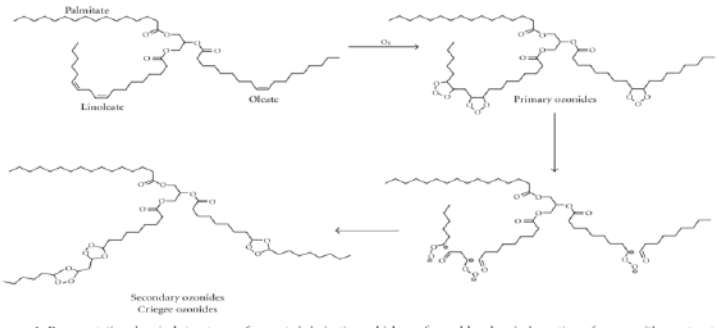
Ozone is a potent oxidizing agent that can react with the unsaturated triacylglycerides present in vegetable oils. The oxidative breakage of double bonds, which is the mechanism postulated by Criegee in 1975, has gained widespread acceptance [21]. The products were identified a aldehydes and ketones, as well as the carboxylic acids that resulted from the oxidation of aldehyde compounds and their peroxidic counterparts.

In summary, the ozonation mechanism works in separate phases, such as the reversion and 1,3-dipolar cycloadditions. The main ozonide, also known as molozonide, 1,2,3-trioxolane, or Criegee intermediate, is first produced and then breaks down into carbonyl oxide.



2.Physical Chemistry Of Oil Ozonation With A Description Of The Analytical Method For Characterizing The Ozonatated Oil

Process Unsaturated lipid substrates react with insufflated gaseous02/03mixture leading to therapeutically active ozonated derivatives (Figure 1). Briefly, the postulated mechanism known as Criegeereaction provides that ozone combines with an unsaturated bond to form an initial, unstable primary ozonide which readily decomposes to form a zwitterion and a carbonyl fragment. In anhydrous environment these substrates com-bine to give the typical cyclic trioxolane derivative. However, the word “ozonated” is itself without



scientific meaning if it is not associated with "how much" peroxides are present in the oil. In fact, from a therapeutic point of view, the ozonide compositions have the capacity to deliver active O2and/or other useful species deep within the lesion without causing primary skin irritation. The few studies concerned with the therapeutic effects of ozonated oils on acute cutaneous wound healing in animal models do not investigate the dose/behaviour response, expressed as the amount of procerodids expressed in terms of beroxidevalue (see the corresponding section in this paper), delay cutaneous wound healing. Such an evidence is reinforced by a number of results between groups where the "middle" concentration (about 1500) has the most beneficial effect in accelerating the wound closure ratio. From an industrial Nicative viewpoint, the overall quality of ozonated derivatives depends upon several param-e uch as: (i) the type and the quality of ozone generators; (ii) the ozonation conditions, in terms of reactors anytime, material type and amount, presence of water and/or catalyzers; (iii) the efficacy of the ozonizer, in terms of03concentration output, gas flow, gas carrier. As for the latter, the use of medical grade O2instead of air is an important point to be considered; in fact, air feedstock (containing about 78% of nitrogen) used for the ozonation of unsaturated substrates could lead to the production of potentially toxic nitrated by-products [7], and to a significant decrease of the ozonation efficiency (8). Another important feature is that ozonated oil has to be unequivocally characterized in terms of the species contents as well as the reaction kinetics. For these purposes, the knowledge of the physicochemical properties of ozonated vegetable oils during production has a great importance for their characterization and identification. For determining the quality of ozonated products, spectroscopic techniques, as Fourier-Transformed infrared (FT-IR) and 1Hand13 C- NMR [9], together with analytical methods as peroxide, acidity, and iodine values as well as viscometrical determination are usually carried out[10].2.1. FT-IR Spectroscopy. FT-IR spectroscopy is used to highlight differences in the functional groups during the oil ozonation, in particular the decrease of the bands corresponding to both C-Cand-C-H stretching (e.g., sesame oil at 1654 cm-1and 3009 cm-1, respe), and the increase of the band corresponding to ozonide CO stretching., sesame oil at 1105 cm-1). Ozonated samples can be analyzed using two different methods. (1) An adequate aliquot (usually about 2 ul) of sampleis deposited between two disks of KBr, avoiding air bubble formation, then the percentage transmittance or other suitable parameters are measured in the range 4000-800cm-1. Spectra are obtained setting the appropriate scan summations and minimal res-olution (generally, 16 at 4 cm-1,resp.). (2) An adequate aliquot (usually about 2 µL) of sampleis dissolved in a suitable solvent (preferably chloro-form) and then the solution is settled in the sample holder avoiding air bubble formation, then the trans-mittance (expressed as a percentage) or other suitable parameters are

Measured in the range 4000-800cm-1. Spectra are obtained setting the appropriate scan summations And minimal resolution (generally, 16 at 4 cm-1, resp.).2.2. NMR Spectroscopy. 1Hand13C NMR Spectroscopies are performed to obtain more information about the variation of the functional groups. Involved in the reaction of ozonation. Both the disappearance of the signals relative to protons And carbons on the double bond (e.g., in sesame oil 5.29 ppm, and various signals in thep range 127.8- 130.0 ppm, resp. Jand the parallel appearance of a signal on the proton and carbon of 1,2,4trioxolane (e.g., in sesame oil in the5.11-5.08 ppm range, and 103.4-104.3ppm range, resp.) are evidenced. Quantitative analysis can be performed by spectra normalized with respect to the integral areas of the OCH2protons (glycerol) that remain constant during the whole process. Spectra will be obtained using Suitable instruments by solubilizing the ozonated sample in a proper solvent (prefer-ably CDC13). Particularly, an adequate aliquot (usually about 100 µL) of sample is solubilized with 750 µLofCDC13ina 5 Mm NMR tube, then the analysis will be performed. To obtain quantitative data, it is sufficient to Perform a1H-NMR, while 13C-NMR essentially provides qualitative in formations [9].2.3. lodine Value. The iodine value (IV) represents the quantity of iodine (in grams) that will react with the double bonds in 100 grams of Procedure Ozonated compounds that are therapeutically active are produced when Unsaturated lipid substrates react with insufflated gaseous 02/03 mixture (Figure 1). According to the hypothesised process known as the Criegeer reaction, ozone first forms an unstable primary ozonide with an unsaturated link. This ozonide then rapidly breaks down into a zwitterion and a carbonyl fragment. These substrates combine to form the common cyclic trioxolane derivative in an anhydrous. Environment. But if the term “ozonated” isn’t linked to “how much” peroxides are in the oil, it lacks scientific significance. From a medicinal perspective, the ozonide compositions actually possess the ability to introduce active 02 and/or other beneficial species deeply into the lesion without producing initial skin irritation. The dose/behavior response is not examined in the few studies examining the therapeutic benefits of ozonated oils on acute cutaneous wound healing in animal models.

The Application Of Ozone

3.1 Ozonated hydrotherapy

Triatomic oxygen atoms make up the extremely reactive oxidant molecule known as ozone. Ozonated hydrotherapy, ozonated oil, ozone autohemotherapy, and other cutting-edge ozone product dosage forms can all be used to achieve ozone therapy. A number of cutaneous conditions, such as pressure ulcers, dermatitis, eczema, dermatitis, axillary osmidrosis, infectious skin illnesses, and wound healing, are commonly treated with ozone as a supplemental therapy. Furthermore, ozone therapy has demonstrated greater potential in treating cancer and aging, as well as enhancing gut and skin microbiomes. Ozone therapy is a new kind of treatment that works through a variety of intricate methods, such as immunomodulatory ability, antioxidant benefits, and local microcirculation regulation. In recent years, the amount of research evaluating the ozone process has gradually increased

3.2 Ozonated Oil

Ozonated oil is created when 03 reacts directly with vegetable oil that contains a lot of unsaturated fatty acids, which are essential components that keep ozone active. Ozone produces 1,2,4-trioxolane by oxidizing unsaturated fatty acids, which then releases 03 gradually into the surface of skin lesions.29 Ozonated oil can keep its stable qualities and pharmacological effects for two years when kept in storage at 4°C 25, 30 As such, ozonated oil is thought to be a great addition to unstable ozonated water. Additionally, ozonated

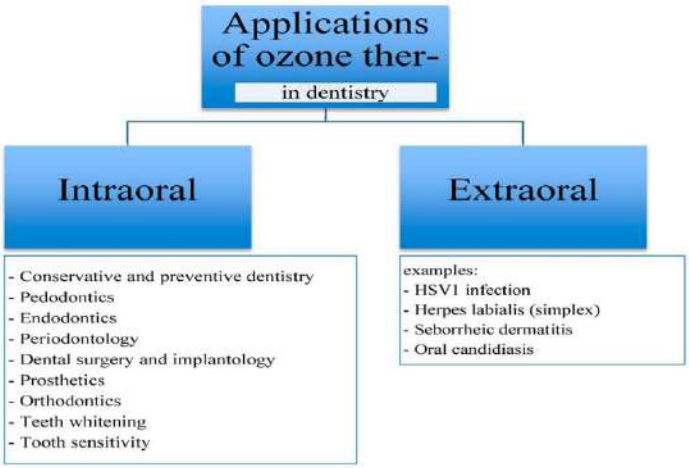
oil is easy to use and transport. Furthermore, ozone oil has a favorable affinity for skin and has the ability to provide an emollient effect. Controlling the level of peroxidation is crucial, though, since it has an impact on how effective ozonated oil is.29 Furthermore, frequent topical use

3.3 Ozonzted Autohemotherapy (Oaht)

The term "ozonated autohemotherapy" (OAHT) describes a procedure wherein a small volume of blood is injected back into the body after being subjected to a carefully regulated ozone dose in a sterile setting. The temporary oxidative stress that arises during this process can be swiftly neutralized by the antioxidant system. Precise exposure time and dosage remain crucial for both safety and efficacy. In order for OAHT to be successful, the cytokine cascade must be started by the antioxidant system. Reaching a specific threshold; at the same time, the antioxidant capacity must not be exceeded. A safety standard for ozonated autohemotherapy was put forth by Di Paolo et al.33 For OAHT, the therapeutic ozone concentration should be in the range of 10-80 µg/mL.30 Research has shown that different cytokines are stimulated by varying concentrations of ozone. Consequently,

3.4 Topicl Application Of Ozone In Medicine

The best of our knowledge, gaseous O3 was originally used in World War I to treat German soldiers suffering from gaseous gangrene as a result of infections with Clostridium anaerobic bacteria that were highly sensitive to O3 [41, 42]. The initial suggestion for the insufflation of gaseous O2/O3 in the rectum to treat chronic colitis, anal ragadis, and fistulae was made by Dr. P. Aubourg in 1936, using a metal cannula. Physicians from Cuba currently make up the majority of those who employ this highly empirical and imprecise method. The concept to employ it in his profession was conceived in 1937 by E. A. Fisch, a Swiss dentist (1899-1966), who ironically treated surgeon Dr. E. Payr (1871-1946) for a painful gangrenous pulpit. Payr was ecstatic.



The Ozonated Oils Act Is still unclear. The extended disinfection and stimulatory effect of the stable triozonide may be explained by the gradual breakdown of the compound into various peroxides that easily dissolve in water when it comes into touch with the heated exudate of the wound. One such peroxide is hydrogen peroxide. If this logic is sound, it means that during the inflammatory septic phase I, regenerative phase II, or remodeling phase III, respectively, we ought to have titrated preparations with high, medium, or low ozonide concentrations [2]. These stages have been linked to the fast alterations in cell types as well as the secretion of growth factors and cytokines that influence the intricate healing process. Hyperbaric oxygen therapy is a different approach to treating diabetic foot ulcers.

To get a final yield of 5 to 25 µg/mL, the water ozonation procedure requires double distilled water and O3 concentrations ranging from 20 to 100 µg/mL of gas. The surplus gas is then sent through a dehydrator and a destructor after O3 is immediately bubbled into the water. A 5-to 20-minute ozonation interval is enough to saturate the water with gaseous O3, depending on the water volume and gas flow. Indeed, in the absence of chemical reactions, O3 physically dissolves in ultrapure water, and the concentration only halves in a glass bottle sealed with a Teflon lid after 300 hours at 0°C. Nevertheless, the half-life at 20°C is around when are oils and water ozonated used? Chronic wounds can be caused by burns, trauma, limb atherosclerosis, diabetic foot, or stinking, deep ulcers. Furthermore, immunosuppressive chemotherapy and/or malnourishment result in difficult-to-treat conditions such as osteomyelitis, furunculosis, bed sores, anal fissures and fistulae, and abscesses that frequently worsen with continued treatment. In the US, the condition affects about 7 million patients and costs more than $25 billion a year. Due to the unmodified disturbed metabolism and local hypoxia, several kinds of disinfectants, antibiotics, antifungals, antiprotozoals, and growth hormones are not effective. Other methods have been suggested and employed in varying degrees, including suction therapy [47, 48], maggot therapy [49], and devices for applying topical oxygen therapy in a clinical setting.

CONCLUSIONS

The body's immune system and antioxidant systems can be stimulated by ozone. Ozone therapy has therefore demonstrated great potential in clinical settings, including anti-infective qualities, enhancing microcirculation, and reducing pain. In the meanwhile, ozone therapy holds considerable promise for treating COVID-19, improving skin microecology, and preventing aging. Ozone therapy also provides benefits including low cost, excellent efficacy, and minimal adverse effects. Ozone is a great adjunctive therapy for cutaneous conditions as a result. We intend to investigate the usefulness of ozone application in the treatment of additional skin conditions in later research. Furthermore, advancing the application depends on elucidating the underlying molecular mechanism. Since sexual infections are becoming more common, particularly in young people, a suitable, effective medicine containing ozonated chemicals will be extremely valuable from an economic and societal standpoint. Elderly people also suffer from a multitude of sores and ulcers, some of which never heal and cause misery. It is hoped that this paper would help official medicine move forward and encourage further research.

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