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Review Article

Ozone And Ozonated Oils In Skin Diseases

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ABSTRACT

Many topical anti-infective agents have been developed by conventional medicine; however, due to the emergence of antibiotic- and chemotherapeutic-resistant pathogens, some of these agents are no longer very effective. Ozone has been known for more than a century to be a great disinfectant, but because of its oxidizing qualities, it needed to be used carefully. Only in the past ten years has it been possible to permanently incorporate the gas into triglycerides, where gaseous ozone chemically reacts with unsaturated substrates to produce ozonated derivatives that are therapeutically active, thereby taming its extreme reactivity. As of right now, ozonated oils have proven to be stable and effective. However, because there are so many commercial products available, this paper will examine these derivatives and offer a method for producing the best products possible.

INTRODUCTION

The issue of treating nearly 1.5 billion people with skin and mucosal infections brought on by bacteria, viruses, protozoa, and dysmetabolism has been brought to light by the rise in ageing, obesity, and diabetes combined with unsuitable healthcare programs. Pathologies include anal rhagades, diabetic foot (ulcer with necrosis), bed sores, ulcers following trauma or burns, human papilloma viruses, herpes virus I and II, chronic viral infections, vaginal infections—which are now common in young girls—and infections of the rectal mucosa caused by Candida, Trichomonas, and Chlamidia. Although these infections are rarely fatal, they can be extremely upsetting for patients because many have diabetes or other vascular diseases that cause tissue hypoxia; others have HIV infection and are immunosuppressed drug addicts. Because methicillin-resistant Staphylococcus aureus and Pseudomonas aeruginosa are present in infections in hypoxic tissue, official medicine offers a range of costly and frequently ineffective medications. Patients suffer from a lack of healing that demotivates them in addition to becoming noncompliant with frequent medication regimens [1]. Blood clotting, inflammation, tissue growth, and remodelling are all part of the multiphase process of wound healing

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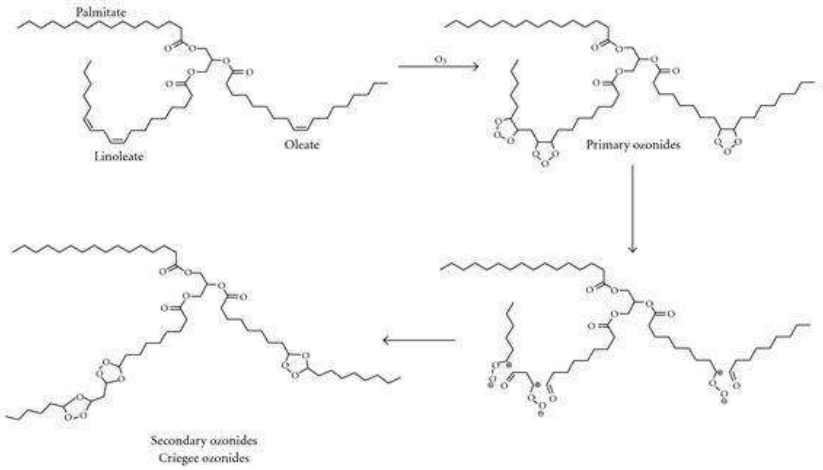
[2], but the chronic infection that makes healing so challenging for both innate and adoptive immune systems frequently impede these processes. This also explains why growth factors don't work in ulcers that are highly contaminated [3, 4]. The prudent application of ozone (O3) seems providential because it first eradicates the pathogens and, by releasing oxygen (O2), stimulates fibroblast proliferation. This leads to the formation of intercellular matrix, which in turn promotes keratinoblast proliferation and subsequent healing.

1. **The Analytical Methods for Characterizing the Process and Their Physical Chemistry in Oil Ozonation**

Oxygen-gas mixture insufflated with unsaturated lipid substrates produces therapeutically active ozonated derivatives.



The chemical reaction between ozone and unsaturated triglycerides forms representative structures of ozonated derivatives. The normal, secondary ozonide's—also referred to as Criegee ozonide's—are formed through the rearrangement of the transient, unstable primary ozonide's. In summary, the Criegee reaction is a postulated mechanism in which ozone reacts with an unsaturated bond to form an unstable primary ozonide that quickly breaks down into a carbonyl fragment and a zwitterion. These substrates combine to form the typical cyclic trioxolane derivative in an anhydrous environment. But if "ozonated" isn't linked to "how much" peroxides are in the oil, then the term itself has no scientific significance. From a medicinal perspective, ozonide compositions can actually supply active oxygen and/or other beneficial species far into the lesion without irritating the skin initially. The dose/behaviour response, which is defined as the quantity of peroxides present in the ozonated derivative used, is not examined in the few studies examining the therapeutic effects of ozonated oils on acute cutaneous wound healing in animal models [5]. Recently, using mice as an animal model, a quantitative assessment of the therapeutic benefit of topically applied ozonated sesame oil on acute cutaneous wound healing has been developed [6]. According to the results, cutaneous wound healing is delayed by both low (<1000) and high (>3000) doses, as indicated by the peroxide value (refer to the relevant section in this paper). Numerous results between groups support this theory, with the "middle" concentration (roughly 1500) having the greatest positive impact on wound closure ratio acceleration.

2. **FTIR Spectroscopy:-**

In particular, the decrease of the bands corresponding to both C = C and =C–H stretching (e.g., sesame oil at 1654 cm −1 and 3009 cm −1, respectively), and the increase of the band corresponding to ozonide CO stretching (e.g.,

sesame oil at 1105 cm −1) are highlighted by FT-IR spectroscopy during the oil ozonation.

NMR spectroscopy:-

To learn more about the variations in the functional groups involved in the ozonation reaction, 1 H and 13 C NMR spectroscopies are conducted. Evidence includes the simultaneous appearance of a signal on the proton and carbon of 1,2,4-trioxolane (e.g., in sesame oil in the 5.11–5.08 ppm range and 103.4–104.3 ppm range, resp.) and the disappearance of signals relative to protons and carbons on the double bond (e.g., in sesame oil 5.29 ppm, and various signals in the range 127.8–130.0 ppm, resp.). Spectra normalized with respect to the integral areas of the OCH2 protons (glycerol), which stay constant throughout the process, can be used to perform quantitative analysis.

Iodine value:-

The amount of iodine (in grams) that will react with the double bonds in 100 grams of sample is indicated by the iodine value (IV). IV is calculated using the monographs published by the Pharmacopoeia. The following formula is used to calculate the IV:

The acid value:-

The acid value (AV) is a metric that indicates how much potassium hydroxide (mg) is needed to neutralize the free acids contained in one gram of the material. The following formula is used to determine the AV

Peroxide value:-

Because peroxide value (PV) is so inexpensive, quick, and easy to calculate, it is frequently used to track the progress and/or control of the ozonation process. Furthermore, the PV seems to be crucial for both commercial distribution and figuring out the best storage options, and it might be sufficient for evaluating the stability of vegetable oil ozonide's. But standardizing the process had been required for a verified PV.

3. Cutaneous Responses to Environmental Ozone Exposure

The respiratory system and skin are both directly exposed to environmental contaminants, such as O 3, a significant component of photochemical smog. Ozone-3's effects on the respiratory tract in humans and animals have been extensively studied [12–15], but only recently have some studies describing the substance's effects on cutaneous tissue been published [16–20]. The skin is made up of two main layers: the outer epidermis, which contains keratinocytes that eventually differentiate into enucleate corneocytes by becoming embedded in a lipid matrix, and together they form the outermost part of the epidermis, known as the stratum corneum (SC) [21, 22]. The inner dermis is primarily made up of fibroblasts and connective tissue matrix. According to earlier research, exposure to O 3 causes the depletion of antioxidants that are both lipophilic and water soluble, such as tocopherol, ascorbic acid, and uric acid. This is accompanied by an increase in the parameters of protein modification and lipid peroxidation, which are mostly seen in the outermost layers of the skin [16, 17, 23]. Through additional research, we were also able to demonstrate that O 3 exposure causes hairless mice to become less antioxidant-rich and more oxidative marker-positive, but that these molecules can also trigger active cell responses.

4. Skin Age-Related Responses to Ozone Exposure: Wound Healing.

One of the most important functions of the skin is wound healing, which has been shown to be impacted by oxidative stress and to diminish with aging [32]. The process of cutaneous wound healing involves a complex series of events, but it starts with the transformation of stationary keratinocytes into cells that can replicate and migrate through the action of wounding-induced signalling factors. These cells express a variety of molecules that encourage the invasion of the

damaged epithelial matrix and the reepithelialisation of the wound surface after undergoing transformation [33]. Elderly people's delayed wound healing has been extensively documented [34].As was already mentioned, exposure to O 3 is also linked to the activation of the transcription factor NFkB, which is necessary to control inflammatory responses and, ultimately, the healing process of wounds. Exposure to O 3 resulted in elevated levels of Transforming Growth Factor (TGF-β), a crucial component in tissue remodelling [35].

CONCLUSION

Venereal infections are becoming more common these days, especially in young people. As a result, a suitable, effective medication containing ozonated compounds will be extremely valuable from an economic and social standpoint. In addition, many wounds and ulcers plague the elderly, some of which never heal and cause misery. It is hoped that this paper will help official medicine make sense of this advancement and encourage the planning of appropriate clinical trials to demonstrate the full effectiveness of ozone therapy through evidence-based medicine.

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