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Review Article

Petroleum Jelly: A Brief Review of its History, Uses and Safety

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Abstract:

Petrolatum, commonly known as petroleum jelly, is a versatile topical agent widely used in dermatology. Despite its popularity, misconceptions persist about this dermatological staple. This review explores petrolatum's history, manufacturing process, and biological properties that make it an excellent moisturizer. It addresses concerns about flammability, allergenicity, and comedogenicity, dispelling myths about its use near oxygen and its potential to cause acne. Petrolatum's diverse applications in dermatology include serving as a patch test instrument, a vehicle for medicated ointments, and an essential wound care product. Given its ubiquity, dermatologists should understand the history, safety profile, and common misconceptions surrounding this humble yet invaluable skincare product. It also explores the substance's discovery, its widespread adoption in various industries, and current scientific understanding of its benefits and potential risks. The paper aims to provide a balanced perspective on this ubiquitous product, addressing both its practical applications and ongoing debates surrounding its use.

Keywords: Allergenicity, allergic contact dermatitis, comedogenicity, flammable, flammability, moisturizer, neonatal, petrolatum, petroleum jelly, safety, slugging, atopic dermatitis, trans epidermal water loss.

Introduction

Petrolatum, also known as petroleum jelly or Vaseline, is a long-standing skin treatment product widely used in cosmetics and pharmaceuticals [1]. In the pharmaceutical industry, it serves as a base for various topical ointments, effectively treating skin conditions [2]. Its occlusive and healing properties make it particularly beneficial for dry and damaged skin [3]. Due to its lipophilic nature, physical and chemical stability, petrolatum is a key ingredient in many cosmetic formulations. It provides skin care and protection by reducing friction, preventing moisture loss, and acting as a grooming aid [4].

It is a versatile substance widely used in both cosmetics and pharmaceuticals [5]. It is widely used in cosmetics and pharmaceuticals in the preparation of various cream, ointment, lotion etc. Good quality of petrolatum is used in quality toilet soaps and also as an anti-rusting agent for iron goods like blade, wire surgical instruments etc. It can be white, yellow, and green or may be of some colour depending upon ingredients used [6]. Despite its popularity, many myths are there about the use of this product. Meanwhile on social media, 'slugging' the application of a layer of petroleum jelly to 'seal in' skincare is gaining popularity. [7]

History

The discovery of petrolatum jelly was quite accidental. It was brought to market by an enterprising chemist [8]. Its story begins in 1859, and today it remains remarkably similar to the original 'wonder jelly' of Victorian times [9]. Sir Robert Chesebrough was initially tasked for extracting kerosene from whale oil [10]. This made him to travel to Titusville, Pennsylvania. There, Chesebrough got struck by an unusual practice [11]. Workers were applying a thick black substance that collected on the drills to their wounds [12]. This rod wax had damaged the machinery, but Chesebrough found that its healing properties were remarkable [13]. He brought the rod back to the Brooklyn laboratory and spent 11 years refining the product, before marketing as a 'wonder jelly' [14]. Initially, he found difficulty in selling the product. His sales pitched when he started treating his own inflicted injuries, along with copious free samples soon had customers clamouring for it [15]. By 1874, Chesbrough had registered the name Vaseline [vasser=water, elaio=oil] and he was selling in a jar [16]. He even ate a spoonful of Vaseline in the morning. On developing pleurisy, he instructed his nurse to rub him daily in vase line from head to toe. He lived to the impressive age of 96 years [17]. Queen Victoria was an avid user of this product and she knighted

Chesebrough in 1883 [18]. Vaseline's place was cemented in history when it travelled with Commander Robert Peary on the first successful North Pole expedition [19]. It was used in the dressings and on burns in the both world wars [20]. Vaseline popularity has scarcely waned since 1943 [21].Meanwhile it continues to be used in dermatology clinics and postoperative wound care worldwide.

Manufacturing Method

The materials required for preparing the product are Paraffin wax [20%], microcrystalline wax [20%], White oil [60%]. First of all, the ingredients are weighed as per the formulations [22]. Now paraffin wax is taken in to reaction vessel with electrical heater (Jacketed). Now micro crystalline wax is added in to reaction vessel [23]. Both the waxes are then melted with continuous mixing and the temperature is maintained between 120 degree C– 130-degrees C [24]. Now liquid paraffin is added with continuous stirring (150-200 rpm) at constant temperature, so that ingredients are mixed together to form emulsion or gel [25]. The whole mass is cooled down and sample is taken for testing. After testing, material is packed in suitable containers [26].

Physical Properties

Petrolatum is a rare semisolid mixture of branched and cyclic saturated hydrocarbon of varying length greater than 25 [27]. This substance is tasteless and odourless. It is anhydrous, occlusive moisturizer with the ability to decrease trans epidermal water loss [28]. Petroleum jelly, a versatile semi-solid substance, melts between 40-70°C (105-160°F). It remains stable under normal conditions, becoming flammable only when liquefied. It is mostly colourless or pale yellow. Resistant to oxidation and most chemicals, it's insoluble in water but mixes with various organic solvents [29]. It acts as a plasticizer for polypropylene while remaining compatible with most plastics. At room temperature, it contains 20.9% solid fat, with a microstructure of crystalline lamellar sheets immobilizing the liquid portion [30]. Composition typically includes 7-13% high molecular weight paraffins, 30-45% medium paraffins, and 48-60% small paraffins [31]. Its unique properties allow it to maintain shape like a solid yet conform to containers like a liquid. Petrolatum itself is not highly flammable [32]. Petrolatum is highly non-flammable unless subjected to an extremely higher temperature of greater than 400-degree F. The National Fire Protection Association gives petrolatum a flammability score of 0, posing minimal flammability hazard [33]. The myth of petrolatum's flammability traces back to the manufacturers of oxygen equipment, who published "oil-based products" should not be used around oxygen piping [34].

Uses in Dermatology

1. Minor cuts, scrapes, and burns

Petroleum jelly is an effective treatment for minor cuts, scrapes, and burns. It acts as a modulator of antimicrobial activity on the skin, helping prevent infection. Additionally, it supports the epidermal barrier, reducing water loss from the skin [35]. These properties make petroleum jelly a valuable aid in wound healing and skin protection.

2. Chapped lips and skin

Petroleum jelly is a popular remedy for chapped lips, offering a safe and effective solution for dry, cracked skin. Many individuals apply it directly to their lips when they notice signs of chapping. This condition can arise from various factors, including exposure to cold weather and frequent lip-licking. By creating a protective barrier, petroleum jelly helps to lock in moisture and reduce the effects of environmental stressors on both lips and skin [36].

3. Dry skin

Petroleum jelly can protect the skin from the wind and cold by acting as a barrier, as well as being a beneficial moisturizing ingredient in itself [37]. Petrolatum jelly is the gold standard for reducing trans epidermal water loss and improving skin hydration [38]. It forms an occlusive layer that slows water loss by over 50%, outperforming other oils. Petrolatum penetrates the stratum corneum, diffusing into intercellular lipid domains, unlike many other oils limited to upper layers [39]. It increases stratum corneum thickness by 32% on average, possibly due to enhanced water absorption by corneocytes [40]. Importantly, it maintains lipid biosynthesis while retarding water loss, potentially enhancing its efficacy by supporting the skin's natural barrier recovery [41]. Despite claims of superior benefits from other moisturizing creams with active ingredients, few studies have shown better moisturizing effects than Petrolatum jelly [42].

4. Treating diaper rash

Petroleum jelly forms a protective barrier on baby's skin, reducing the risk of diaper rash caused by prolonged exposure to wetness. It also provides relief for existing rashes by soothing irritated skin. Regular application during diaper changes can help prevent and alleviate diaper rash, keeping baby's delicate skin healthy and comfortable [43].

5. Wound healing

While the American Academy of Dermatology recommends petroleum jelly for skin healing, citing its protective barrier properties, recent research

challenges this view [44]. A 2018 study suggests that petroleum jelly may actually hinder the skin's natural protective mechanisms, potentially slowing healing and increasing infection risk [45]. This conflicting information highlights the need for further research to determine the most effective use of petroleum jelly in skin care and wound healing [46]. Petrolatum jelly is as effective as topical antibiotics for wound healing and infection prevention, without the risks of irritation or antibiotic resistance [47]. Studies show no significant difference in infection rates or healing between petrolatum jelly and bacitracin post-surgery [48]. It rarely causes allergic reactions, unlike bacitracin which can induce dermatitis in up to 13% of patients [49]. It's also more cost-effective and widely recommended by surgeons. In a comparative study, Petrolatum jelly resulted in less erythema than other healing ointments [50]. A meta-analysis found no significant difference in postoperative wound infection rates between topical antibiotics and petrolatum/paraffin [51].

6. Preventing skin peeling

Dry, peeling skin can be uncomfortable and irritating. Petroleum jelly offers an effective solution for soothing irritated skin and promoting healing. It's particularly useful for addressing dry, chapped lips and irritated eyelids during colder seasons. By creating a protective barrier, petroleum jelly helps retain moisture and allows the skin to repair itself naturally [52].

7. Managing eczema

Petroleum jelly effectively prevents and treats dry, peeling skin. Its occlusive properties create a protective barrier that locks in moisture, soothes irritation, and promotes natural healing [53]. Particularly beneficial for chapped lips and irritated eyelids during cold weather, petroleum jelly allows the skin to repair itself by retaining essential hydration. This versatile product offers a simple yet powerful solution for maintaining skin health and comfort in challenging conditions [54].

8. Baby skin

Preterm neonates have immature epidermal barrier allows microbial entry, which can lead to infections [55]. There are many studies demonstrating the benefits in neonates, including decreased Tran’s epidermal water loss and dermatitis severity [56]. However subsequent studies again showed increased rate of infection in infants with use of petrolatum jelly [57]. Infant skin (3-12 months) differs from adult skin in water management [58]. It has higher hydration and water content, as shown by Raman spectroscopy and conductance measurements.

However, it has lower water-holding capacity, evidenced by reduced natural moisturizing factors and increased Tran’s epidermal water loss [59]. This highlights the importance of protecting infants' delicate, developing skin. Petrolatum jelly is often recommended for preventing diaper rash and treating paediatric atopic dermatitis [60]. It's also widely used by African midwives for skin protection before, during, and after birth, due to its accessibility and affordability compared to baby lotions [61].

9. Managing Atopic dermatitis

Atopic dermatitis is a prevalent inflammatory skin condition characterized by dry, scaly, and red skin. Its pathophysiology involves dysregulation of both innate and adaptive immune responses, but skin barrier dysfunction is a crucial aspect of the disease [62]. The strongest evidence for this is the discovery that loss-of-function mutations in the filaggrin gene significantly increase the risk of developing atopic dermatitis [63]. Compromised skin barrier integrity allows irritants, microbes, and allergens to penetrate the skin. In the context of a dysregulated immune system, this can trigger the development of allergies and asthma, a progression known as the "atopic march." [64]

Atopic dermatitis patients are more prone to skin infections, possibly due to reduced antimicrobial peptide production [65]. Surprisingly, petroleum jelly has been shown to increase antimicrobial peptide production in both healthy individuals and atopic patients [66]. A study by Czarnowicki found that petrolatum application significantly boosted antimicrobial peptide gene expression, cytokine production, and improved epidermal differentiation [67]. It also decreased T cell and dendritic cell counts in atopic patients. While the exact mechanism is unclear, these findings suggest that petrolatum jelly’s benefits in atopic dermatitis extend beyond simple moisturization, potentially enhancing the skin's natural defence mechanisms and improving barrier function68.

10. Other applications

Petrolatum's benefits extend beyond leave-on care. Clinical trials have shown its effectiveness in cleansing formulations, particularly for individuals with dry skin conditions [69]. A study on subjects with moderate xerotic eczema found that a petrolatum-infused body wash outperformed conventional cleansers [70]. Another study on individuals with moderately dry legs demonstrated that a petrolatum-containing body wash improved stratum corneum health, including hydration and cohesion [71]. In hair care, petrolatum is used to coat hair fibers, preventing moisture loss and maintaining style. It's also applied to the scalp as a protective barrier before harsh treatments like chemical straighteners to reduce irritation [72].

Safety

Petrolatum jelly has a long history of safe use spanning nearly 150 years in both cosmetic and pharmaceutical applications [73]. It's recognized as an active ingredient in over-the-counter skin protectants by the FDA [74]. When refined to meet FDA and European Pharmacological standards, it's even safe for ingestion in food products [75]. It is suitable for all skin types, being fragrance-free, nonirritating, hypoallergenic, and noncomedogenic. Despite its occlusive nature, it can effectively moisturize acne-prone skin without worsening the condition [76].

Petrolatum rarely causes allergic contact dermatitis (ACD), with an incidence of 0.03% in suspected ACD patients and likely lower in the general population [77]. A study of 440 patients showed 0% developed ACD from petrolatum in postoperative wound care, compared to 0.9% with bacitracin [78]. While rare, petrolatum allergy can complicate ACD diagnosis as it's the primary vehicle in patch testing [79]. Affected patients may show intolerance to many topicals and multiple positive patch test results, sometimes presenting with the "angry back" phenomenon of widespread hyperreactivity [80].

Petrolatum rarely causes allergic reactions due to its stable chemical structure [81]. Petrolatum is recognized for its non-irritating properties. Although allergic contact dermatitis has been reported it remains exceptionally rare [82]. It's commonly used in safety testing for various skin reactions. Petrolatum doesn't irritate skin cumulatively and remains primarily in the stratum corneum, with minimal penetration into deeper skin layers [83]. While some studies initially suggested petrolatum might be comedogenic, more comprehensive research has disproven this claim [84].

Early studies showing mild comedogenicity used extreme conditions of continuous application under occlusion for six weeks [85]. However, subsequent research, including a study on 910 post adolescent acne patients, demonstrated that petrolatum actually decreased acne lesions. Furthermore, rabbit ear studies, which simulate human skin reactions, showed no clinical or histological evidence of comedogenicity when petrolatum was applied daily for two weeks [86]. These findings collectively indicate that petrolatum is not comedogenic under normal use conditions and may even be beneficial for acne-prone skin [87].

Polyaromatic hydrocarbon s are the known carcinogens. Consumption orally is implicated in several types of cancers. However, polyaromatic hydrocarbon concentrations in petrolatum are negligible, as they are eliminated during the refinement process [88]. The Food and Drug Administration does not set a specific limit on Polyaromatic hydrocarbon concentration in cosmetic products. Extensive research shows no systemic exposure from topical application [89]. Food and Drug Administration regulations ensure low levels of polycyclic aromatic hydrocarbons in petrolatum [90]. Numerous studies have found no evidence of toxicity or carcinogenicity [91]. With its long history of use and extensive testing, petrolatum is confirmed safe for both topical application and ingestion. Petrolatum use in preterm neonates is controversial. While it can improve skin barrier function, decrease water loss, and reduce dermatitis severity, studies have shown increased infection risks [92].

A retrospective review found higher rates of systemic candidiasis in extremely low birth weight neonates when petrolatum was used [93]. A large multicentred trial demonstrated higher rates of nosocomial bacterial sepsis in neonates treated with prophylactic petrolatum [94]. Due to these infection concerns, many hospitals discourage petrolatum use in extremely low birth weight neonates. However, for babies born with collodion membrane or other cornification disorders, sterile petrolatum is still recommended under strict infection control measures to prevent trans epidermal water loss and encourage membrane shedding [95].

Conclusion

Petrolatum, widely known as petroleum jelly, is a safe and effective topical and ingestible substance. Its extensive history and thorough testing demonstrate its non-irritating, hypoallergenic, and non-toxic properties. Petrolatum excels in treating barrier impairment and promoting wound healing, often outperforming other ointments, moisturizers, and oils in comparative studies. It's cost-effective compared to steroid-, calcineurin-, and antibiotic-containing alternatives. Uniquely, petrolatum accelerates skin barrier repair and stimulates innate immune responses, such as antimicrobial peptide production.

Robert Chesebrough's description of it as a "wonder jelly" remains accurate today, affirming its enduring value in skincare and medical applications. Petrolatum has a wide range of uses in dermatology, including as a patch test instrument, a carrier for medicated ointments, and a standalone treatment. This paper provides an evidence-based review, highlighting its non-flammable, noncomedogenic, rare carcinogenic and rare allergic properties. Recently, its popularity has risen, particularly with the trend of “slugging.” As it gains more attention, it is crucial to understand its history, safety profile, and misconceptions.

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