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COMPREHENSIVE REVIEW OF OINTMENT BASES: TYPES, PROPERTIES, AND APPLICATIONS

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Aim. This article aims to comprehensively review and analyze various types of ointment bases, examining their physicochemical properties, advantages, and disadvantages. This review also seeks to explore the potential use of specific excipients in developing ointment bases with enhanced therapeutic properties and increased bioavailability of active pharmaceutical ingredients.

Methods. A broad search and study of existing literature on ointment bases, focusing on their classifications, properties, and applications. A comparative analysis of the two main classifications of ointment bases based on interaction with water (water-emulsion, hydrophobic, hydrophilic) and physicochemical properties (oleaginous, absorption, water-removable, water-soluble). Analysis of real-world examples to highlight the practical implications of selecting or developing appropriate ointment bases.

Results. The differences, advantages, and limitations of each ointment's classification approach were highlighted. Detailed examination of the physicochemical properties of various ointment bases, such as consistency, stability, pH, and their impact on the pharmacokinetic and pharmacodynamic parameters was made. An assessment of how these properties influence the therapeutic efficacy and bioavailability of active pharmaceutical ingredients (APIs) was performed. Recommendations for future research and development based on the findings of the review were proposed.

Conclusions. This review examines various types of ointment bases, focusing on their physicochemical properties, advantages, and disadvantages while also exploring the potential use of specific excipients to enhance the therapeutic efficacy and bioavailability of active pharmaceutical ingredients (APIs). Understanding and selecting the appropriate ointment base is crucial for optimizing the therapeutic properties of medicinal products, and ongoing research in this area is essential for advancing pharmaceutical formulations.

Key words: ointment bases, pharmacokinetic properties, excipients, therapeutic efficacy, bioavailability, pharmaceutical formulations.

Ointments belong to the category of semisolid dosage forms for external use [1–4]. Various definitions of the term "ointment" can be found in the literature, but fundamentally, it refers to a semisolid delivery system for active pharmaceutical ingredients (APIs) [5, 6].

The history of the use of ointments dates back to ancient civilizations such as Egypt, where they were applied for medicinal and cosmetic purposes. Over centuries, ointments evolved from simple mixtures of herbs and fats to sophisticated formulations that incorporate APIs. Historical texts and pharmacopoeias

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have documented various formulations and uses, reflecting the ongoing development and refinement of ointment bases [7]. Today, the study and improvement of ointment bases are crucial for enhancing the therapeutic efficacy and stability of these semisolid dosage forms. This review highlights the current challenges and opportunities in developing practical ointment bases, emphasizing their significance in modern pharmaceutical formulations.

The primary components of an ointment are the ointment base and one or more APIs uniformly distributed within it [5]. The ointment base is a mixture of non-active ingredients, commonly referred to as "excipients," which constitute the major portion of the ointment's mass (sometimes up to 90% or more) and determine its physicochemical properties (e.g., consistency, stability, pH, etc.). Consequently, the base significantly influences the pharmacokinetic and pharmacodynamic parameters of the ointment [5, 8, 9]. The selection and development of the ointment base, which consists mainly of excipients, plays a crucial role in determining the consistency, stability, and overall efficacy of the formulation. With advancements in pharmaceutical science, understanding and optimizing the physicochemical properties of ointment bases have become paramount to enhancing therapeutic outcomes and increasing the bioavailability of APIs. Therefore, the correct selection or development of an ointment base is crucial, as it can potentially improve the therapeutic properties of the medicinal product and increase the bioavailability of APIs. The purpose of this review is to examine various types of ointment bases, analyze their advantages and disadvantages, and explore the potential use of specific excipients and their properties for developing ointment bases in laboratory settings.

Types of Ointment Bases

There is no universally accepted approach to the classification of ointment bases in the literature. Two main approaches can be identified:

1. Classification based on interaction with water: ointment bases are categorized as water-emulsion, hydrophobic, and hydrophilic. This classification is outlined in the State Pharmacopoeia of Ukraine (SPU) and is predominantly found in Ukrainian sources [1, 2, 5].

2. Classification based on physicochemical properties: ointment bases are divided into hydrocarbon (oleaginous), absorption (subdivided into anhydrous and w/o emulsions), water-removable (o/w emulsions), and water-soluble (water-miscible) bases. This classification corresponds to the system presented in the United States Pharmacopeia [6, 10–12].

We do not aim to compare these approaches, as each has its rationale. In the subsequent description, we will adhere to the second classification method while also indicating the water interaction properties of each type of ointment base to establish parallels between these two systems. The main characteristics of different types of ointment bases, along with their differences and standard features, are presented in Table 1.

Hydrocarbon (Oleaginous) Bases

Hydrocarbon bases (Table 1), often referred to as oleaginous bases, are hydrophobic ointment formulations primarily derived from hydrocarbon sources such as petrolatum, paraffin, and mineral oils. These formulations may also incorporate other lipophilic excipients, including vegetable oils, animal fats, waxes, and synthetic glycerides, to enhance their physical and functional properties [10–12].

Hydrocarbon bases are anhydrous and insoluble in water, which contributes to their distinctive emollient and occlusive properties. They effectively hydrate the skin by forming an occlusive layer that reduces transepidermal water loss. These bases are not water-washable, which promotes long-term contact of the active ingredients with the skin [13]. Hydrocarbon bases are unable to absorb or retain water and can hold only limited amounts of alcoholic solutions, so the incorporation of most liquid ingredients is quite challenging [10]. Thus, they can be protective of water-labile drugs. These bases are chemically inert and well-tolerated by most patients [10]. Despite these benefits, their greasy texture and resistance to water removal often reduce patient acceptability, as they may stain clothing and require specific agents for removal [12].

Hydrocarbon bases commonly include petrolatum (yellow or white) as a primary occlusive and stiffening agent, liquid petrolatum (mineral oil) for incorporating lipophilic solids, synthetic esters like glycerol monostearate, butyl stearate, etc., for improved spreadability, long-chain alcohols such as cetyl and stearyl alcohol for enhanced consistency, and lanolin derivatives for

Table 1. **Ointment bases types and their characteristics**

Characteristic	Hydrocarbon (oleaginous) bases	Absorption anhydrous bases	Absorption w/o emulsions bases	Water-removable (o/w emulsions) bases	Water-soluble (water-miscible) bases
Main components	Hydrocarbon (oleaginous) sources	Hydrocarbon base with w/o surfactant	Hydrocarbon base with water (< 45%) and w/o surfactant (HLB ≤8)	Hydrocarbon base with water (> 45%) and o/w surfactant (HLB ≥8)	Polymeric gel (mainly PEGs)
Interaction with water	Hydrophobic	Hydrophobic*	Hydrophobic*	Hydrophilic	Hydrophilic
Water Content	Anhydrous Does not absorb water	Anhydrous Can absorb water	Hydrous Can absorb water (limited)	Hydrous	Anhydrous / hydrous
Water washability	Non washable Insoluble in water	Non washable Insoluble in water	Non- or poorly washable Insoluble in water	Washable	Washable
Characteristics	Emollient Occlusive Greasy	Emollient Occlusive Greasy	Emollient Occlusive Greasy	Nonocclusive Non greasy	Nonocclusive Non greasy Mix well with skin secretions
Drug (API) release	Poor	Poor but better than hydrocarbon bases for hydrophobic APIs	Fair to good	Fair to good	Good
Uses and APIs incorporation	Protectants Emollients Vehicle for solids or oils, for apis prone to hydrolysis	Protectant Emollients Vehicle for solids, oils, and aqueous solutions (small amounts)	Emollients, Cleansing creams Vehicles for solids, oils, and aqueous solutions (small amounts) for non-hydrolysable APIs	Emollient Vehicle for solids, aqueous solutions (small amounts) for non-hydrolysable APIs	Vehicle for API with different properties
Examples	White petrolatum; White ointment; Vaseline	Hydrophilic petrolatum; Anhydrous lanolin; Aquabase™; Aquaphor®; Polysorb®	Cold Cream; Hydrous lanolin; Rose Water Ointment; Hydrocream™; Eucerin®; Nivea®	Hydrophilic ointment; Dermabase™; Velvachol®; Unibase®	PEG Ointment; Polybase™

*Absorption bases are not entirely hydrophilic but possess a unique balance of hydrophobic and hydrophilic properties; their primary purpose is to absorb and retain water while maintaining some of the occlusive and emollient benefits of hydrophobic bases.

additional emollient properties. Commercial products like Plastibase® (polyethylene-gelled mineral oil) also provide a stable and convenient medium for preparing ointments extemporaneously, particularly for heat-sensitive compounds [10].

Overall, hydrocarbon bases play a vital role in dermatological formulations due to their protective and hydrating properties. However, their inherent limitations necessitate careful consideration when designing formulations for specific therapeutic applications.

Absorption Bases

Absorption bases are a versatile category of ointment formulations that consist of oleaginous components combined with water-in-oil (w/o) emulsifiers [10, 11]. Absorption bases exhibit hydrophobic properties and provide moderate occlusion, making them effective at preventing transepidermal water loss. These bases are capable of absorbing water or aqueous solutions to form or expand w/o emulsions. While they share some characteristics with oleaginous bases, absorption bases offer additional functionality, such as increased emollient effects and the ability to incorporate aqueous components. Although less occlusive than hydrocarbon bases, they are helpful in softening and soothing the skin (emollient effect), reducing dryness, and improving skin texture [10–12]. Due to their hydrophobic nature, absorption bases hold active ingredients in contact with the skin for prolonged periods. Their oily external phase, however, contributes to a greasy texture and makes them resistant to removal with water alone. Another disadvantage is that bases with soap-type emulsifiers may encounter issues with specific active ingredients, potentially affecting the stability and efficacy of formulations [11, 12].

Absorption ointment bases can be divided into two main categories: anhydrous absorption bases and w/o emulsions (Table 1).

Anhydrous Absorption Bases. These bases do not initially contain water but can absorb significant amounts of aqueous solutions, forming w/o emulsions. They are composed of a hydrocarbon base like hydrophilic petrolatum and anhydrous lanolin and a surfactant or polar additive that acts as a w/o emulsifier. Examples of these additives include cholesterol, lanosterol, and other sterols, acetylated sterols, or the partial esters of polyhydric alcohols, such as monostearate or monooleate [10–12].

Water-in-Oil Emulsions. These bases are already w/o emulsions that can absorb additional small quantities of aqueous solutions. Bases containing water are prone to microbial growth and require preservatives. They may also be less chemically stable when incorporating hydrolysis-sensitive ingredients. Common examples include lanolin and cold cream bases [10–12].

Absorption bases provide a unique balance between oleaginous and hydrophilic properties, making them an essential component in dermatological and cosmetic formulations. Their ability to incorporate both aqueous and lipophilic ingredients allows for diverse therapeutic applications, particularly in managing dry or sensitive skin conditions.

Emulsion Bases (Water-Removable Bases)

Emulsion bases (Table 1), also known as water-removable bases, are oil-in-water (o/w) emulsions widely used in dermatological and cosmetic formulations. Their aqueous external phase makes them easy to wash off with water, providing a significant advantage over other ointment bases [10–12]. This type of ointment base has hydrophilic properties.

An emulsion base can vary in formulation depending on its intended use; however, it typically comprises three main parts:

(1) an internal oil phase, which is typically made of petrolatum and/or liquid petrolatum together with cetyl or stearyl alcohol;

(2) an o/w emulsifier with an HLB value greater than 8;

(3) an aqueous phase more than 45% w/w.

API can be included in one of these phases before forming the emulsion or can be added to the formed emulsion [10–12].

Water-removable bases offer a less greasy and non-occlusive alternative to oleaginous and absorption bases. Due to their water-washable nature, these bases are widely accepted for both medical and cosmetic applications. The majority of topical dermatologic drug products utilize water-removable bases, which can efficiently deliver active ingredients while minimizing residue on the skin [10–12].

The disadvantages of water-removable bases include reduced occlusion and protection properties compared to hydrocarbon or absorption bases, stability issues due to microbial growth and ingredients susceptible to hydrolytic degradation, evaporation risks leading to potential drying of the product, soap-type emulsifiers may have compatibility issues with specific active ingredients, and the need to add preservatives to ensure safety due to the aqueous phase being susceptible to microbial growth [10, 11].

Water-removable bases strike a balance between therapeutic efficacy and cosmetic acceptability, making them a preferred choice for a wide range of topical applications. Their ability to be easily removed and tailored to specific therapeutic needs ensures their continued relevance in both pharmaceutical and cosmetic industries.

Water-Soluble Bases

Water-soluble bases, also known as water-miscible or hydrophilic ointment bases, are generally greaseless and widely used for their ease of removal and compatibility with different types of API [10, 11].

These bases include formulations containing hydrophilic non-aqueous solvents and polymers like propylene glycol, polyethylene glycol (PEG), polyvinylpyrrolidone, polyacrylamide, derivatives of cellulose, collagen, etc. as the base. Water-soluble bases absorb water to the point of solubility. They are water-washable and may be anhydrous or contain some water [10, 12].

Hydrophilic bases are unique due to their ability to mix with water and solubilize both water-soluble and some water-insoluble drugs [10, 12, 14]. The water-insoluble drugs are solubilized by the cosolvent action of the non-aqueous hydrophilic polymers present in the base [14, 15]. These bases are chemically stable and compatible with a wide variety of drugs. However, they may absorb water from the skin, potentially leading to dehydration and reduced percutaneous absorption [10, 14, 15]. The disadvantages of hydrophilic ointment bases include the ability to cause irritation, especially on damaged or sensitive skin, may interact with drugs that are prone to oxidation or are incompatible with water, and also, those that contain water require preservatives [10].

Polyethylene glycol (PEG) is commonly included in water-soluble ointment bases due to its chemical stability, hydrating properties, resistance to mold growth, weak bactericidal effect, and ability to absorb exudate [16 19]. PEGs differ in their physical and chemical properties depending on their molecular weight: PEGs are liquids when molecular weights are less than 1000 and turn to waxy solids with increasing molecular weights [20]. PEGs are widely used in a variety of pharmaceutical formulations as solvents, lubricants, humectants, or thickening/gelling agents [6, 18–20].

Other components, such as humectants (glycerin or propylene glycol) and hydrophobic modifiers, may be added to improve the water-absorbing potential or physical stability [10, 15].

Hydrophilic bases provide a versatile platform for various dermatologic and cosmetic applications. Their ability to incorporate and deliver active ingredients effectively, combined with their water solubility, ensures their utility in modern pharmaceutical formulations.

Excipients

Excipients, as noted earlier, are inactive components of an ointment base, typically comprising more than 90% of a topical product [8]. Different classes of these substances are specifically selected based on their physicochemical properties to serve specific purposes, enhancing the functionality of each formulation [5, 20–22].

It is advisable to fully utilize excipient functionalities to develop products with specific performance characteristics, including but not limited to improving the solubility of API to allow its incorporation at the target concentration, controlling drug release and permeation, improving general aesthetics of the product to increase patient compliance (free from objectionable odor, nontoxic, non-sensitizing, nonirritating, easy to apply, and nongreasy); improving drug; and vehicle stability; improving drug skin permeability and/or deposition;and preventing microbial contamination and growth [5, 8, 10, 20, 21]. Before describing individual classes of excipients, it is necessary to note that many excipients have multiple properties and effects on the skin.

Stiffening Agents and Thickeners/Gelling Agents

In ointment bases, thickeners/gelling agents and stiffening agents serve different purposes. However, their functions can, in some cases, overlap, and for this reason, we consider it appropriate to consider these excipients in one section (Table 2).

Stiffening agents are used to provide shape and structure to ointment bases, particularly in hydrophobic or absorption formulations, enhancing their hardness and stability during storage. Examples include waxes like beeswax and carnauba wax, fatty alcohols such as cetyl alcohol and stearyl alcohol, as well as petrolatum and paraffin. These agents increase the consistency and stability of the base, especially at higher temperatures, ensuring the physical stability of the ointment and allowing it to maintain its form and remain in place after application [5, 9, 15, 23, 24].

Thickeners or gelling agents are used in water-removable or water-soluble bases to increase viscosity or to create a gel-like structure. Examples include polymers such as carbomers, cellulose derivatives like carboxymethylcellulose and hydroxyethylcellulose, as well as alginates, xanthan, and guar gums. These agents form a

Table 2. **Comparison of stiffening and thickeners/gelling agents**

Characteristic	**Thickeners agents**	**Stiffening agents**
Base type	Gel-like or semi-solid bases	Semi-solid or solid bases
Physicochemical effect	Increase viscosity	Increase viscosity, provide hardness and rigidity
Medium	Hydrophilic systems	Hydrophobic systems
Purpose	Stability and uniformity	Stability and hardness

three-dimensional network that traps liquid, stabilizing the base while providing a gel-like texture, improved stability, and controlled release of active ingredients [5, 15, 24].

Thus, both thickeners and stiffening agents are primarily used to achieve the desired consistency and mechanical stability of the formulation. However, they have differences and nuances in the application.

Humectants

Humectants are hygroscopic substances that function similarly to the skin's natural moisturizing factor [6]. They easily penetrate the stratum corneum and act like biological sponges, attracting and retaining water in the skin either by drawing moisture from the dermis into the epidermis or from the environment when humidity is above 80% [6, 15, 23]. Additionally, humectants can cause water evaporation, so they should be used with occlusive agents to reduce or prevent transepidermal water loss, thereby improving epidermal barrier function and hydration. Some humectants also have emollient properties. Examples of humectants can be lactic acid, pyrrolidone carboxylic acid, amino acids, glycerol, triacetin, polyols, etc. Humectants are commonly incorporated into hydrophilic formulations to enhance moisturizing and occlusive effects, which they may lack compared to hydrophobic bases [5, 6].

Emulsifiers/Solubilisers

Emulsifiers, as schematically depicted in Fig. 1, play a significant role in the stability of ointment bases by reducing the interfacial tension between immiscible liquids or substances (such as oil and water), allowing them to form a stable homogeneous mixture and keeping them from separating [15, 23, 25].

In other words, emulsifiers are surfactants that stabilize emulsions. The hydrophilic-lipophilic balance (HLB) of an emulsifier is a measure of its degree of hydrophilicity or lipophilicity. Emulsifiers that are more soluble in water (HLB $\geq$ 8) will generally form oil-in-water emulsions, while emulsifiers that are more soluble in oil (HLB $\leq$ 8) will form water-in-oil emulsions [26]. Examples of emulsifiers include anionic and non-ionic surfactants, polysaccharides, and glycerides. In addition, emulsifiers such as hydrocolloids (e.g., acacia, tragacanth), as well as polyethylene glycol, glycerine, and other polymers (e.g., carboxymethyl cellulose), all increase the viscosity of the medium, which helps create and maintain the suspension of globules of dispersed phase [6, 25, 26].

Solvents

Solvents serve various purposes, such as improving the solubility of the active ingredient and aiding its absorption into the skin. In hydrophilic bases, water is typically the primary solvent. Still, water-miscible options like polyols (e.g., polyethylene glycol, propylene glycol) and alcohols (e.g., ethanol, isopropyl alcohol, benzyl alcohol) are often added to enhance drug solubility. Additionally, solvents are used in formulations to dissolve other components, including coloring agents, preservatives, and stabilizers [6, 15, 23].

Penetration Enhancers

To promote drug delivery into the skin, excipients known as penetration enhancers are employed to alter the structure of the stratum corneum (SC) [10, 15, 23]. These enhancers function through three primary mechanisms: (1) disrupting the organized structure of SC lipids, (2) interacting directly with SC lipids, or (3) enhancing the drug's partitioning into the SC. However, because penetration enhancers inherently compromise the SC barrier, it is crucial to carefully select and use them at optimal concentrations to minimize the risk of excessive systemic drug absorption and skin irritation [27]. Many penetration enhancers are also solvents (e.g., propylene glycol, transcutol), and can be used alone or in combination [6, 23, 27].

Chelating Agents

In ointment bases, chelating agents play a crucial role in enhancing the stability and efficacy of the formulation. Their primary function is to bind metal ions, such as iron, copper, or calcium, which may be present as impurities in the base or packaging. By forming stable complexes with these metal ions, chelating agents prevent oxidation processes that could degrade active ingredients or the base itself. They improve the chemical stability of sensitive components, such as vitamins, antioxidants, and preservatives, and enhance the efficacy of preservatives by preventing metal ions from interfering with their antimicrobial action. Common examples of chelating agents include ethylenediaminetetraacetic acid (EDTA) and its salts, citrates (e.g., citric acid), and phosphates. Overall, chelating agents help maintain the integrity of the ointment base, prevent undesirable chemical reactions, and prolong the product's shelf life. [6, 24].

Antioxidants

Many drugs in aqueous solutions are prone to oxidative degradation, which can be mitigated by incorporating antioxidants [23]. Certain excipients, such as fixed oils, fats, and diethyl ether-based compounds, may contain low levels of peroxides that accelerate oxidation and should be avoided for oxidation-sensitive API. Examples of commonly used antioxidants in topical formulations include alkyl gallates, butylated hydroxyanisole, ascorbyl palmitate, sodium ascorbyl phosphate, butylated hydroxytoluene, and tocopherols, where most exhibit synergistic effects when used in combination or the presence of metal chelators such as edetic acid [6, 9, 28].

In recent years, fullerenes have gained attention as potent antioxidants in topical formulations due to their unique ability to neutralize reactive oxygen species (ROS) and inhibit lipid peroxidation [29]. Moreover, fullerenes demonstrate excellent stability, biocompatibility, and the ability to penetrate the stratum corneum without causing cytotoxic effects, making them promising API delivery systems as well as excipients in ointment bases. Studies suggest that fullerene-based formulations can enhance skin protection against oxidative stress, improve wound healing, and support anti-aging treatments by mitigating UV-induced damage and inflammation [30, 31]. Thus, the incorporation of fullerenes into ointment bases may be a promising approach to extending the stability of oxidation-sensitive drugs while simultaneously providing dermatological benefits.

Preservatives

Preservatives are commonly incorporated into topical formulations containing water to prevent microbial contamination and growth [6, 32, 33]. Selecting an appropriate preservative is a complex and challenging process, as preservatives and active pharmaceutical ingredients (APIs) may interact in ways that compromise their efficacy and stability. Since preservatives, alongside APIs, are biologically active components of ointments, they can exert effects on the skin or the treated surface. Furthermore, preservatives may interact directly with the excipients in the ointment base and APIs, potentially altering their activity, stability, and overall effectiveness.

The choice of preservatives largely depends on the type of ointment base used. For water-washable bases, preservatives such as parabens, sorbic acid, and phenoxyethanol are recommended. In water-soluble bases, parabens and benzyl alcohol are commonly employed. Absorption bases typically require agents like chlorhexidine or benzalkonium chloride, while hydrophobic bases rarely need preservatives. However, the addition of phenols or alcohols can be considered for these formulations when necessary. For biological formulations, particularly protein-based preparations, a wide range of synthetic preservatives is utilized, as detailed by Stroppel et al. [32]. Examples of commonly used preservatives in topical applications are shown in the table below (Table 3).

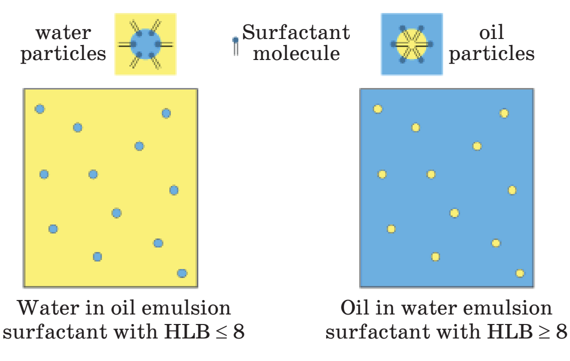

Figure. **Types of emulsions**

Table 3. **Examples of commonly used preservatives**

Preservative	Ointment Base Type	Concentration Range	Notes
Parabens (derivatives of parahydroxybenzoic acid, eg. Methylparaben (E218), Propylparaben (E216))	Water-washable, water-soluble*	0.01–0.3% **	Effective against bacteria and fungi; may cause rare allergic reactions
Organic acids and their salts (eg. Sorbic acid, Benzoic acid (E210), Potassium sorbate salt)	Water-washable*	0.05–0.2% **	Effective against fungi; limited antibacterial activity
Synthetic Preservatives (eg. Phenoxyethanol)	Water-washable*	0.5–1.0% **	Broad-spectrum activity; suitable for emulsions
Benzyl Alcohol	Water-soluble*	1.0–2.0% **	Antimicrobial and anesthetic properties; volatile
Chlorine-Containing Compounds (eg. Chlorhexidine, Benzalkonium chloride)	Absorption*	0.01–0.1% **	Broad-spectrum activity; effective in low concentrations; may interact with anionic substances
Phenols (eg. Phenol, Cresol, Chlorocresol)	Hydrophobic*	0.05–0.5% **	Broad-spectrum activity; strong odor limits usage
Alcohols (e.g., ethanol, isopropanol)	Hydrophobic*	Variable**	Effective against bacteria; often used in combination with other agents

Note. *there may be other application options, depending on the full composition;
**the concentration depends on certain type of preservative.

The use of preservatives in pharmaceutical formulations is strictly regulated by standards such as pharmacopeias. According to the Ukrainian State Pharmacopeia, preservatives must be compatible with the active substances and excipients in the ointment base. They should not cause irritation or allergic reactions and must be used in concentrations that comply with pharmacopeial limits. These regulations are essential to ensure the microbiological stability of ointment bases, particularly those containing water or other components susceptible to microbial contamination.

A summary of commonly used preservatives in ointment formulations is provided in the table below, highlighting their compatibility with different ointment bases and their regulatory compliance.

Selection of ointment bases

The selection of an appropriate ointment base depends on several key factors, including the solubility of the active drug and the desired drug release profile. Hydrophilic drugs in o/w emulsions are released more rapidly compared to their incorporation in w/o emulsions, which provide a slower release rate [34]. The purpose of the ointment also plays a critical role; for instance, formulations intended for percutaneous absorption differ significantly from those designed solely for topical application [35]. Additionally, the base's properties, such as water washability, occlusiveness, and user convenience, influence the choice. For cosmetic applications, factors like ease of removal and nonstaining are critical, whereas clinical formulations for wound care may prioritize occlusion and durability over aesthetic considerations [36].

When selecting an appropriate ointment base, it is essential to consider factors that critically influence the effectiveness of topical medications. Beyond the type of ointment base, the solubility and concentration of the active pharmaceutical ingredient (API) in the base, several other parameters significantly affect efficacy. These include the quantity of the substance interacting with the skin, the rate of release, penetration, and absorption of the API from the vehicle, and the extent of the treated surface area. Additional factors include the frequency and method of application, duration of contact, degree of excoriation or skin barrier disruption, the accuracy of diagnosis (including the characteristics of etiological agents, pathogenicity, and resistance), the amount of hair, and the presence of organic matter [37].

Conclusions

This review meticulously examines various types of ointment bases, emphasizing their physicochemical properties, advantages, and disadvantages. Additionally, it explores the potential usage of specific excipients to elucidate methods for enhancing the therapeutic efficacy of topical applications. The formulation of an ointment base is a complex and multifaceted task that necessitates a comprehensive approach, as the selection of the base and excipients profoundly impacts the stability, bioavailability, effectiveness, and patient acceptability of the pharmaceutical product. Our review offers a fundamental understanding of the key concepts and principles in the development of topical formulations, systematizing current knowledge in this field. In parallel, the practical development of high-quality pharmaceutical products requires the consideration of a broader spectrum of factors, including the characteristics of the active ingredient, manufacturing techniques, regulatory requirements, and clinical application aspects. Continued research and analysis of current trends are imperative for advancing pharmaceutical formulations and optimizing approaches to the development of effective topical preparations, particularly ointments.

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КОМПЛЕКСНИЙ ОГЛЯД ОСНОВ МАЗЕЙ: ТИПИ, ВЛАСТИВОСТІ ТА ЗАСТОСУВАННЯ

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Мета. Всебічний огляд та аналіз різних типів основ мазей, дослідження їхніх фізико-хімічних властивостей, переваг і недоліків. Огляд також спрямовано на вивчення можливого використання певних допоміжних речовин для розроблення основ мазей з підсиленими терапевтичними властивостями та підвищеною біодоступністю активних фармацевтичних інгредієнтів.

Методи. Широкий пошук та аналіз наявної літератури щодо основ мазей, з фокусуванням на їх класифікації, властивостях і застосування. Порівняльний аналіз двох основних класифікацій основ мазей: за взаємодією з водою (водно-емульсійні, гідрофобні, гідрофільні) та за фізико-хімічними властивостями (жирова, абсорбційна, водорозчинна, що змивається водою). Аналіз реальних прикладів для підкреслення практичних аспектів у контексті вибору або розроблення відповідних основ мазей.

Результати. Виявлено відмінності, переваги та недоліки кожного підходу до класифікації основ мазей. Докладно досліджено фізико-хімічні властивості різних основ мазей, такі як консистенція, стабільність, pH, та їхній вплив на фармакокінетичні і фармакодинамічні параметри. Оцінено, як ці властивості впливають на терапевтичну ефективність і біодоступність активних фармацевтичних інгредієнтів (АФІ). Запропоновано рекомендації для майбутніх досліджень і розроблень на основі висновків, зроблених в огляді.

Висновки. В огляді наведено інформацію стосовно різних типів основ мазей. Увагу зосереджено на їхніх фізико-хімічних властивостях, перевагах і недоліках, а також розглянуто можливе використання конкретних допоміжних речовин для підвищення терапевтичної ефективності та біодоступності АФІ. Розуміння і вибір відповідної основи мазі є критичним для оптимізації терапевтичних властивостей лікарських засобів, а подальші дослідження в цій галузі є необхідними для вдосконалення фармацевтичних формулювань.

Ключові слова: основи мазей, фармакокінетичні властивості, допоміжні речовини, терапевтична ефективність, біодоступність, фармацевтичні формулювання.