ISSN: 2231-3656

International Journal of Pharmacy and Industrial Research (IJPIR)

IJPIR |Vol. 16 | Issue 3 | Jul – Sep 2026

www.ijpir.com

DOI: https://doi.org/10.61096/ijpir.v16.iss3.2026.741.757

Biotex Nano Carbon Mask: Activated Charcoal and *Aloe vera* (*Aloe barbadensis*) for Adsorptive Cleansing, Hydration, and Skin-Soothing Support — A Critical Narrative Review

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Published on: 02.09.2026
Published by: Futuristic Publications

Abstract: Facial masks are increasingly used as multifunctional dermocosmetic systems that combine surface cleansing with skin-conditioning effects. Effective cleansing is desirable for the removal of excess surface oil, cosmetic residues, shed corneocytes, and environmental material; however, cleansing should occur without unnecessary disruption of stratum corneum hydration or post-use comfort. Biotex Nano Carbon Mask is considered in this review as a two-active formulation containing Activated Charcoal and *Aloe vera* (*Aloe barbadensis*) powder. Activated charcoal is a highly porous carbonaceous adsorbent whose physicochemical behaviour is governed by surface area, pore architecture, and surface chemistry. These properties provide a rational basis for surface-directed adsorption and wash-off removal of selected skin-surface materials and excess oil. In contrast, *Aloe vera* contributes a polysaccharide-rich botanical phase, with acemannan and related mannans providing a mechanistic basis for humectancy, skin conditioning, and cellular responses relevant to cutaneous recovery. Human topical studies report increased stratum-corneum hydration when a freeze-dried *Aloe vera* extract is formulated into a cosmetic base, together with reduced erythema under controlled conditions. Cellular and preclinical investigations further show effects on keratinocyte and fibroblast proliferation and migration, inflammatory signalling, growth-factor expression, collagen biology, and AKT/mTOR-associated pathways. The two ingredients therefore provide complementary functions: activated charcoal primarily contributes adsorptive cleansing and management of excess surface-associated material, whereas *Aloe vera* contributes hydration, soothing, and skin-conditioning support. The available ingredient-level evidence provides a coherent scientific rationale for positioning Biotex Nano Carbon Mask around cleansing, excess surface-oil management, hydration, soothing, skin comfort, and a refreshed appearance. Interpretation should nevertheless distinguish ingredient-level evidence from direct clinical proof of the finished rinse-off formulation.

Keywords: Activated charcoal; *Aloe vera*; acemannan; facial mask; adsorption; skin cleansing; skin hydration; cosmetic dermatology.

Abbreviations

AKT, protein kinase B;

bFGF, basic fibroblast growth factor;

ECM, extracellular matrix;

ERK, extracellular signal-regulated kinase;

GRADE, Grading of Recommendations, Assessment, Development and Evaluation;

IGF-1, insulin-like growth factor 1;

IL, interleukin;

JNK, c-Jun N-terminal kinase;

KGF-1, keratinocyte growth factor 1;

LPS, lipopolysaccharide;

MAPK, mitogen-activated protein kinase;

MMP, matrix metalloproteinase;

mTOR, mechanistic target of rapamycin;

NF-κB, nuclear factor κB;

NLRP3, NOD-like receptor family pyrin domain-containing 3;

PI3K, phosphoinositide 3-kinase;

PRISMA, Preferred Reporting Items for Systematic Reviews and Meta-Analyses;

TEWL, transepidermal water loss;

TGF-β, transforming growth factor β;

TNF-α, tumour necrosis factor α;

UVB, ultraviolet B;

VEGF, vascular endothelial growth factor.

1. Introduction

1.1 Facial cleansing and contemporary dermocosmetics

Facial skin continuously encounters endogenous material such as sebum, sweat, and desquamated corneocytes together with exogenous cosmetic residues and environmental particulates. Contemporary facial masks are designed to provide a temporary period of close contact with the skin and may be formulated to cleanse, hydrate, condition, or modify the immediate appearance and feel of the skin. Rinse-off masks are particularly suited to a cleansing-conditioning concept because the applied matrix can interact with surface material during contact and is subsequently removed from the skin[1].

Cleansing efficacy must be considered alongside preservation of barrier integrity. The stratum corneum is a structured lipid-protein barrier, and aggressive cleansing systems may extract endogenous lipids, interact with corneocyte proteins, and increase sensations of dryness or tightness. Modern cleanser science therefore emphasises removal of unwanted surface material while minimising unnecessary disruption of the stratum corneum[2-4]. This balance provides the conceptual basis for pairing an adsorptive carbonaceous ingredient with a skin-conditioning botanical in a rinse-off facial mask.

1.2 Activated charcoal in topical cosmetics

Once confined to adsorbent uses outside cosmetics, activated charcoal now appears widely in the personal-care category, with facial cleansers, soaps and masks among the common formats. Its relevance derives primarily from material science rather than from a pharmacological action on living skin. Activation generates a highly porous carbon structure with extensive internal surface area, while the resulting adsorption behaviour depends on pore dimensions, pore volume, surface chemistry, and the properties of the material being adsorbed[5-7].

In dermatology, charcoal-containing products are generally regarded as topically well tolerated, although the clinical literature is substantially smaller than the commercial visibility of the ingredient[5]. For a facial mask, the scientifically appropriate mechanism is therefore surface adsorption followed by physical removal during rinsing, rather than systemic detoxification or deep transdermal extraction.

1.3 *Aloe vera* in dermatological and cosmetic formulations

Aloe vera, also known botanically as *Aloe barbadensis Miller*, has a long history of topical use and remains widely incorporated into cosmetic and dermatological preparations. Its inner-leaf gel-derived material contains a polysaccharide-rich fraction that includes acemannan and related acetylated mannans and glucomannans, alongside preparation-dependent minor constituents[8-10]. These macromolecules are particularly relevant to water binding, topical conditioning, and cellular signalling.

Unlike activated charcoal, *Aloe vera* has direct human topical evidence relevant to cosmetic endpoints. Freeze-dried *Aloe vera* extract has been shown to increase stratum-corneum water content in human volunteers, supporting a humectant moisturising action[11]. In a controlled human study, a highly concentrated *Aloe vera* gel applied under occlusion reduced ultraviolet-induced erythema at the 48-hour reading, which the investigators interpreted as evidence of some anti-inflammatory activity relevant to a skin-soothing domain[12].

1.4 Rationale for combining activated charcoal and *Aloe vera*

The scientific rationale of the formulation is therefore complementary rather than redundant. Activated charcoal acts predominantly at the skin surface, where its porous structure can interact with surface-associated lipids and residues. *Aloe vera* provides a different functional axis centred on hydration, soothing, and skin conditioning. In a rinse-off mask, these properties converge into a practical cosmetic sequence: adsorption and cleansing during contact, removal of adsorbed material during rinsing, and a conditioned post-use skin state. This dual-function concept is particularly relevant because excessive removal of skin-surface components can be associated with dryness or tightness, while appropriate conditioning can improve cosmetic comfort[2-4,11].

1.5 Aim and scope

The present narrative review critically integrates physicochemical, experimental, and human dermatological evidence relevant to activated charcoal and *Aloe vera* (*Aloe barbadensis*) to evaluate their complementary roles in adsorptive cleansing, management of excess surface oil, skin hydration, soothing, and cutaneous conditioning, with specific translational relevance to Biotex Nano Carbon Mask. The review treats Charcoal Powder and Activated Charcoal as the same carbonaceous active and *Aloe barbadensis* leaf powder and *Aloe vera* powder as the same botanical active. Evidence is interpreted according to study type and translational proximity, and ingredient-level findings are not presented as finished-product clinical efficacy.

2. Literature Search and Evidence-Selection Strategy

A narrative literature-search approach was used to organise the evidence base relevant to the two-active formulation. Literature was identified through PubMed/MEDLINE and cross-referenced with indexed material available through Scopus, Web of Science, and Google Scholar. Search concepts included combinations of activated charcoal, activated carbon, charcoal facial cleanser, facial mask, adsorption, sebum, oily skin, pore appearance, *Aloe vera*, *Aloe barbadensis*, acemannan, skin hydration, stratum corneum, erythema, keratinocyte, fibroblast, collagen, inflammation, wound healing, and skin repair. Reference lists of key reviews and primary studies were also used to identify relevant supporting literature.

Evidence was prioritised by translational relevance. Direct human topical studies were given greatest weight for cosmetic endpoints such as hydration and erythema, followed by systematic reviews and meta-analyses, human-cell investigations, animal or mechanistic studies, and physicochemical or material-science studies. Material-science evidence was considered appropriate for the adsorption mechanism of activated charcoal, whereas biological claims concerning Aloe vera were preferentially supported by topical human or cutaneous-cell evidence. The review is narrative rather than systematic and does not claim PRISMA compliance.

3. Biotex Nano Carbon Mask: Composition and Functional Rationale

For this review, Biotex Nano Carbon Mask is treated as a two-active dermocosmetic system. Charcoal Powder and Activated Charcoal represent the same carbonaceous active material, while *Aloe barbadensis* leaf powder and *Aloe vera* powder represent the same botanical active. This formulation identity prevents duplication of the evidence base and allows the mechanistic discussion to focus on two complementary functional domains. The two actives and their functional roles are summarised in Table 1. The finished product is shown in Figure 1.

Table 1. Two-active composition and functional roles

Active ingredient	Equivalent formulation terminology	Principal scientific role
Activated Charcoal	Charcoal Powder / Activated Charcoal	Adsorptive cleansing, removal of surface-associated material, and management of excess surface oil[5-7].
Aloe vera powder	*Aloe barbadensis* leaf powder / *Aloe vera* powder	Hydration, soothing, skin conditioning, and support of cutaneous-recovery biology[8-12].

Fig 1: Biotex Nano Carbon Mask. The image is included solely for product identification and is not presented as scientific evidence.

3.1 Activated Charcoal

Activated charcoal functions as an adsorbent because activation creates an extensive internal pore network and a chemically heterogeneous surface. Micropores contribute much of the available adsorption area, whereas larger pores facilitate access of molecules to internal sites; surface functional groups further influence affinity for different adsorbates[6,7]. For a facial mask, these characteristics support a surface-contact cleansing mechanism rather than a penetration-based biological action.

3.2 *Aloe vera (Aloe barbadensis)* powder

Aloe vera powder represents the botanical conditioning component. Aloe preparations vary with plant part and processing, but gel-derived material is characteristically rich in polysaccharides, particularly acemannan and related mannans[8-10]. These polysaccharides are relevant to water retention and humectancy and have also been investigated for effects on fibroblasts, keratinocytes, inflammatory pathways, and extracellular matrix (ECM) biology. The evidence therefore supports positioning *Aloe vera* as the principal hydration and soothing component of the formulation.

3.3 Integrated formulation rationale

Activated Charcoal and *Aloe vera* are not expected to contribute identical effects. The carbonaceous phase provides adsorption and wash-off cleansing, whereas *Aloe vera* provides a conditioning phase with stronger direct dermatological evidence. The resulting formulation concept can be summarised as ADSORB → CLEANSE → HYDRATE → SOOTHE → REFRESH. The term 'Nano Carbon' is treated as product nomenclature in this review; high surface area or microporosity alone does not establish nanoscale particle size or transdermal nanoparticle penetration. This complementary two-active rationale is summarised in Figure 2.

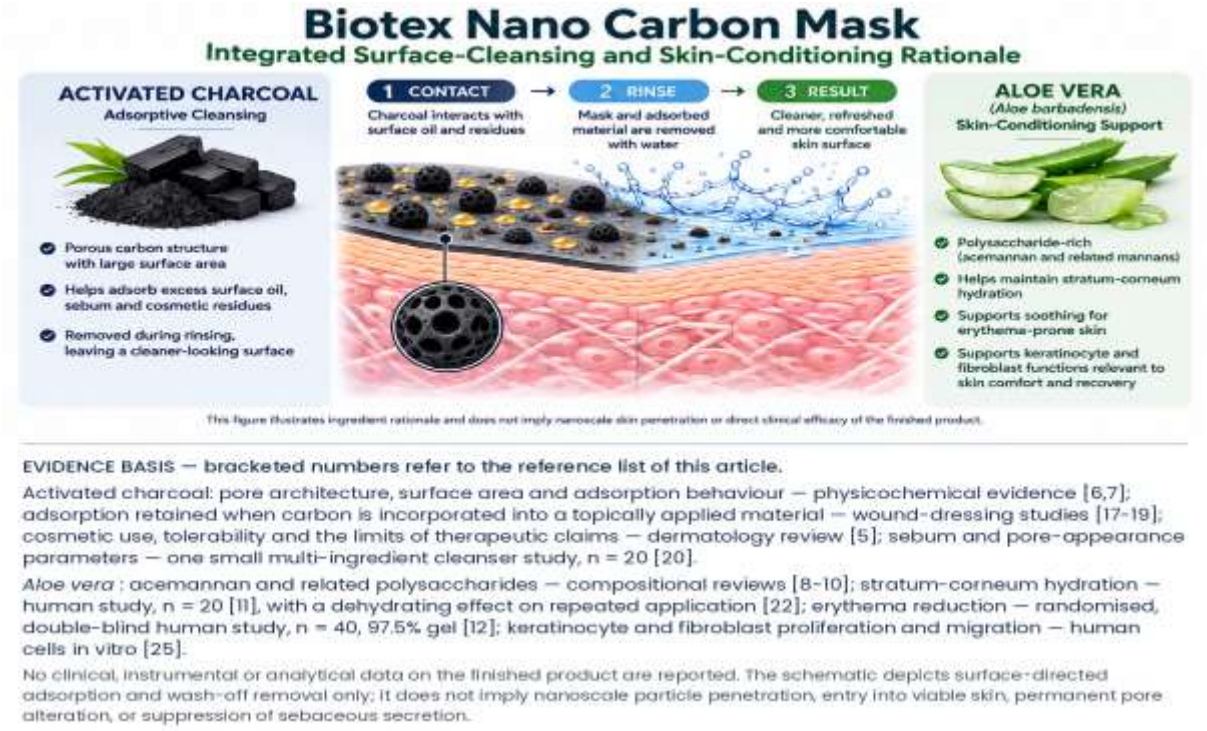

Fig 2: Integrated surface-cleansing and skin-conditioning rationale for Biotex Nano Carbon Mask. Activated Charcoal is represented as a porous adsorbent that interacts with excess skin-surface oil and selected residues during mask contact, with the carbonaceous phase removed during rinsing. *Aloe vera* (*Aloe barbadensis*) is represented as a polysaccharide-rich conditioning component supported by ingredient-level evidence relevant to stratum-corneum hydration, erythema-related soothing, and cutaneous-support biology. Every element is traceable to the numbered reference list through the evidence key beneath the figure. The figure summarises ingredient-level rationale only and does not imply nanoscale skin penetration, entry into viable skin, or direct clinical efficacy of the finished product.

4. Skin Surface Biology Relevant to Facial Masking

4.1 Stratum corneum and barrier function

The stratum corneum consists of terminally differentiated corneocytes embedded within a continuous extracellular lipid matrix. This organisation reduces water loss while limiting entry of environmental material. Cleansing systems act at this interface and therefore require a balance between removing unwanted surface deposits and preserving endogenous lipids and protein architecture[2-4]. Excessive interaction with the barrier may manifest cosmetically as dryness, tightness, roughness, or irritation.

4.2 Sebum and sebaceous facial regions

The facial surface contains both epidermally derived lipids and sebaceous lipids. Sebum contributes triglycerides, wax esters, squalene, and free fatty acids to the skin-surface film and is most prominent in sebaceous facial zones[13,14]. Sebum is physiologically normal and contributes to skin-surface properties; nevertheless, excess visible surface oil can produce shine, interact with cosmetic residues and particulate material, and contribute to a perception of congestion.

Pore visibility is multifactorial rather than a simple measure of cleanliness. Sebum output, follicular volume and elasticity of the perifollicular skin are the factors most consistently associated with apparent pore size, whereas age has not shown a definite relationship in instrument-based assessment[15,16]. Accordingly, a cleansing mask can reasonably be discussed in terms of cleaner or less congested pore appearance after surface-material removal, but not permanent anatomical pore closure.

4.3 Cleansing versus barrier preservation

The rationale for a charcoal-Aloe mask becomes particularly coherent when cleansing and conditioning are considered together. Removal of excess surface-associated oil may improve immediate cosmetic appearance, but aggressive cleansing can also remove beneficial lipids. A formulation containing a

conditioning botanical with human hydration evidence provides a plausible way to couple surface cleansing with maintenance of post-use comfort[2-4,11].

5. Activated Charcoal: Physicochemical Basis of Adsorption

5.1 Porous carbon architecture

Activated carbon is characterised by a hierarchically porous structure in which micropores, mesopores, and larger transport pores contribute differently to adsorption. The high specific surface area produced during activation creates a large number of potential interaction sites. Adsorption performance is not determined by surface area alone; pore-size distribution, accessibility, and surface chemistry affect which molecules can interact effectively with the carbon matrix[6,7].

5.2 Adsorption versus absorption

Adsorption refers to accumulation of molecules at a surface or interface, whereas absorption implies penetration into the bulk of another material. Activated charcoal is therefore correctly described as an adsorbent. In a facial mask, the relevant process is contact between the porous carbon surface and materials present at or near the outer skin surface, followed by removal of the carbon-containing matrix during rinsing. This mechanism is fundamentally different from claims of extraction of systemic toxins from deeper tissues.

5.3 Factors governing topical adsorption

Adsorption by activated carbon is context-dependent. Molecular dimensions and polarity of the target material, pore accessibility, carbon-surface chemistry, the surrounding liquid phase, local concentration and contact duration all influence the extent of binding[6,7]. Accordingly, general activated-carbon literature supports mechanistic plausibility, whereas the quantitative performance of Biotex Nano Carbon Mask would depend on the characteristics of its specific charcoal raw material and formulation matrix.

6. Activated Charcoal and Topical Surface Cleansing

Topical use of activated charcoal is best understood as a surface process. During the contact phase, carbon particles are dispersed within the mask and encounter skin-surface material. Selected organic or lipophilic substances can associate with the porous carbon surface, and the mask is subsequently rinsed away together with material retained within or on the carbonaceous phase. The expected cosmetic result is a cleaner-feeling and refreshed surface rather than a pharmacological change in the skin.

The wound-dressing literature indicates that activated carbon retains gas-phase adsorptive capacity when it is built into a topically applied material, although the performance reported there varies with dressing construction rather than with the carbon alone. Charcoal-containing wound dressings have been evaluated for retaining volatile malodorous compounds under simulated or clinical-use conditions[17-19]. Their relevance here is strictly physicochemical: they support surface adsorption in a topical format and do not provide evidence that a facial mask should be used for wound management. The proposed surface-contact and wash-off sequence is illustrated in Figure 3.

7. Activated Charcoal and Excess Surface Oil

Sebum is a complex lipid mixture and therefore represents a plausible target for surface-directed cleansing. Activated charcoal may assist removal of excess surface-associated lipid by providing a high-area adsorptive phase that is physically removed during wash-off. This mechanism should be distinguished from suppression of sebaceous-gland secretion: the available evidence supports surface oil management rather than a claim that activated charcoal alters endogenous sebum production.

Direct human cosmetic evidence for charcoal alone is limited. In a small study of 20 women, a cleanser containing charcoal together with *Centella asiatica* extract and pearl powder was associated with improvements in measured sebum and pore-related parameters[20]. Because the formulation contained multiple active ingredients, the findings cannot isolate the independent contribution of charcoal. Nevertheless, the study provides supportive clinical-context evidence that a charcoal-containing cleanser can be compatible with measurable improvements in surface-oil and pore-appearance parameters.

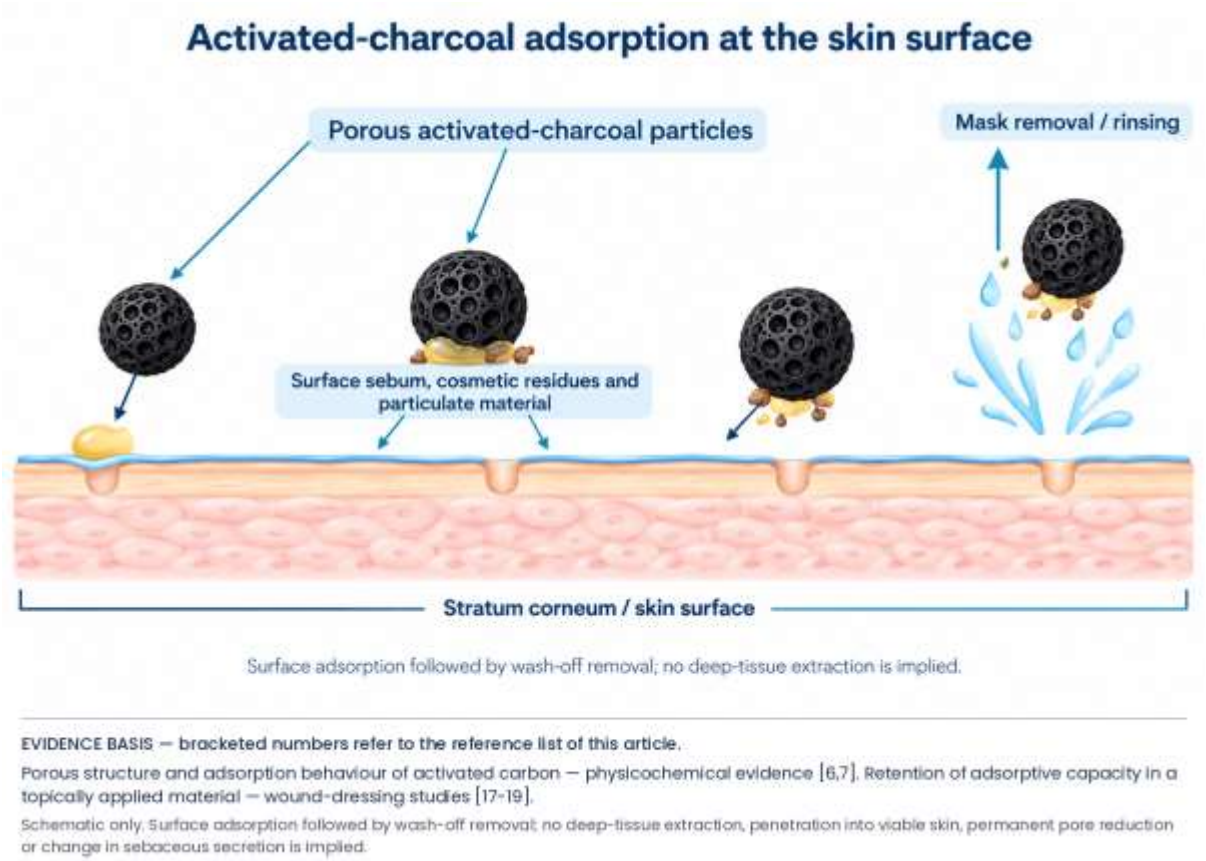

Fig 3: Conceptual model of activated-charcoal adsorption at the skin surface. Porous activated-charcoal particles are shown contacting surface sebum, cosmetic residue, and environmental particulate material, followed by removal with the rinse-off mask. The evidence key beneath the figure identifies the supporting references. The schematic is restricted to a surface-cleansing mechanism and does not depict extraction of systemic toxins, penetration into viable skin, permanent pore reduction, or suppression of sebaceous-gland secretion.

8. Activated Charcoal and the Appearance of Pores and Congested Skin

Visible facial pores are influenced by sebum, follicular opening size, skin elasticity, and structural characteristics[15,16]. Surface accumulation of oil and residues may accentuate the perception of pore prominence or congestion even when underlying follicular anatomy is unchanged. The most defensible interpretation of a charcoal mask is therefore that cleansing and removal of excess surface material may leave sebaceous areas looking cleaner and more refined. The limited multi-ingredient cleanser evidence noted above is consistent with this cosmetic interpretation[20].

9. Relevance to Oily and Acne-Prone Skin

Acne-prone skin frequently presents with increased sebum output, and appropriate cleansing is commonly incorporated into supportive skin-care regimens. Only fourteen prospective studies met the inclusion criteria in a systematic review of washing and over-the-counter cleansers in acne vulgaris, and the authors concluded that this base was too limited for reliable treatment recommendations to be drawn[21]. Thus, cleansing can be relevant to acne-prone skin care without implying that a cosmetic cleanser is itself an acne treatment.

The same distinction is appropriate for activated charcoal. Dermatological review literature notes the popularity and general topical safety of charcoal cosmetics while finding insufficient clinical evidence for therapeutic acne, exfoliative, or anti-ageing claims[5]. For Biotex Nano Carbon Mask, the product-relevant interpretation is therefore management of excess surface oil and cleansing of oily or acne-prone skin rather than treatment of acne lesions.

10. *Aloe vera* (*Aloe barbadensis*): Phytochemical and Dermatological Basis

10.1 Botanical identity and polysaccharide-rich fraction

Aloe vera and *Aloe barbadensis Miller* refer to the same botanical species in this review context. The gel-derived material is rich in water-soluble polysaccharides, of which acemannan - an acetylated mannan - is among the best characterised. Aloe preparations may also contain glucomannans and other polysaccharides as well as minor compounds that vary according to processing and plant-part selection[8-10].

This compositional variability is relevant when translating individual studies. Nevertheless, the recurring presence of polysaccharide-rich fractions across Aloe research provides a coherent basis for humectancy, water binding, and cell-signalling effects. Acemannan has been reviewed across a broad range of biological activities; within the repair literature the endpoints most often reported are fibroblast proliferation, growth-factor expression and collagen biology, in dental as well as cutaneous settings[10].

11. *Aloe vera* and Skin Hydration

Among the outcomes considered in this review, hydration is supported by the most directly relevant cosmetic study of *Aloe vera*. Dal'Belo et al. applied three strengths of a freeze-dried Aloe extract in a cosmetic base to the forearms of 20 female volunteers and tracked stratum-corneum water content and transepidermal water loss (TEWL) instrumentally. Hydration increased with the higher test concentrations after the first application and, after two weeks of use, was higher with each Aloe-containing formulation than with vehicle. Because TEWL was not significantly altered, the findings are more consistent with a humectant or water-binding effect than with formation of a strongly occlusive barrier[11].

This study is particularly relevant to a powder-based cosmetic concept because the tested botanical had been freeze-dried before incorporation into the formulation. It therefore provides evidence that processed Aloe material can retain measurable moisturising activity after topical formulation. A separate volunteer study by Fox et al. found increased hydration after one application of *Aloe vera* gel material; on repeated application, however, every aloe gel material examined – *Aloe vera* included – shifted to a dehydrating effect[22]. These findings reinforce the importance of preparation, vehicle, concentration, and exposure schedule when translating Aloe data to a rinse-off mask.

Taken together, these human data support product-relevant language such as 'helps hydrate the skin' and 'helps maintain skin moisture.' The evidence does not require a wound-healing interpretation and is directly relevant to the conditioning role of *Aloe vera* within a rinse-off cosmetic concept, although the duration of contact in leave-on research differs from a facial mask.

12. *Aloe vera* and Skin-Soothing and Anti-inflammatory Activity

Controlled human evidence is also relevant to the soothing domain. In the UVB-erythema experiment reported by Reuter et al., 40 volunteers were assessed under randomised, double-blind, placebo-controlled conditions. At the 48-hour assessment the highly concentrated Aloe gel gave a lower erythema reading than placebo and than 1% hydrocortisone in placebo gel, although 1% hydrocortisone in cream performed better than the Aloe gel[12]. For the present cosmetic context, this finding is best translated as ingredient-level support for calming visible transient redness and promoting skin comfort, not as evidence that the finished mask functions as an anti-inflammatory drug.

Experimental findings provide mechanistic context for this clinical observation. In animal inflammation models, different Aloe gel extracts reduced inflammatory responses, and the aqueous fraction inhibited cyclooxygenase-related prostaglandin generation[23]. In activated human macrophage systems, Aloe exposure lowered LPS-induced output of IL-6, IL-8, IL-1β and TNF-α, reduced expression and activation associated with the NLRP3 inflammasome, and blunted signalling through NF-κB, p38, JNK and ERK[24]. These data are best used to support biological plausibility for soothing activity, not to infer equivalent molecular effects from a short-contact rinse-off product.

13. *Aloe vera* and Epidermal Recovery Biology

Keratinocytes and fibroblasts are central cellular participants in epidermal renewal and dermal maintenance. In the in-vitro work of Teplicki et al., primary human keratinocytes and fibroblasts exposed to *Aloe vera* showed increased cell growth and movement relative to the relevant controls, and keratinocyte survival was better preserved under the study's preservative-containing conditions[25]. These observations provide mechanistic context for skin-conditioning biology but are not clinical evidence for the performance of a rinse-off mask.

The translational interpretation remains deliberately limited: a rinse-off facial mask should not be described as a wound-healing treatment on the basis of cell-culture data. Instead, these findings show that *Aloe vera* possesses biological activity extending beyond simple water binding and support a broader concept of cutaneous-conditioning and recovery-related plausibility.

14. Acemannan and Cell-Signalling Mechanisms

14.1 Fibroblast proliferation, growth factors, and collagen

Acemannan is one of the Aloe polysaccharides most frequently investigated in tissue-repair models. Jettanacheawchankit et al. exposed gingival fibroblasts to acemannan and recorded greater cell proliferation together with raised type I collagen and higher output of the growth factors KGF-1 and VEGF; the same report describes improved healing in a rat oral wound model[26]. These observations link the polysaccharide to growth-factor and extracellular-matrix responses that are biologically relevant to tissue support.

14.2 AKT/mTOR signalling

Mechanistic work by Xing et al. further connected acemannan exposure with AKT/mTOR-dependent proliferative signalling. Their experiments showed increased fibroblast growth and faster wound closure, accompanied by changes in cyclin D1 translation; blocking AKT or mTOR reduced these responses[27]. In this review, the study is used to establish pathway-level plausibility rather than to imply that a rinse-off mask reproduces the same wound-model effects.

14.3 Extracellular matrix and remodelling context

Preclinical studies also associate Aloe treatment with changes in collagen deposition and organisation, glycosaminoglycan content, epithelialisation and tissue remodelling[28,29]. A recent mechanistic synthesis places these findings within a broader network involving growth factors such as KGF-1, TGF-β, IGF-1 and bFGF, PI3K/AKT and MAPK signalling, integrin biology, ECM proteins and matrix metalloproteinases (MMPs)[30]. Collectively, this literature supports a skin-supportive biological context for Aloe but does not constitute direct evidence of anti-ageing or structural remodelling by the finished cosmetic product.

15. *Aloe vera* and Cutaneous Recovery: Human Clinical Context

Clinical investigation of topical Aloe extends beyond cosmetic endpoints into wound and burn care. Earlier systematic reviews assembled controlled human studies across several injury settings[31,32]. A 2024 meta-analysis of randomised trials reported a shorter time to healing for second-degree burns treated with Aloe preparations, whereas some other outcomes, including pain and infection, did not differ significantly[33]. These therapeutic studies provide contextual evidence that Aloe can be biologically active on human skin, but their formulations, exposure duration and damaged-skin endpoints differ substantially from those of a rinse-off facial mask.

This evidence is relevant to the present review because it demonstrates that Aloe is not supported solely by in vitro observations. However, wound and burn studies involve damaged skin, different formulations, prolonged exposure, and therapeutic endpoints. They therefore provide broader clinical-context support for Aloe's cutaneous activity rather than a basis for claiming that Biotex Nano Carbon Mask heals wounds.

16. Relevance of the Rinse-Off Facial-Mask Format

16.1 Contact phase

Dosage form is central to translational interpretation. In a rinse-off facial mask, the activated-charcoal phase is expected to act primarily during the contact period by presenting an adsorptive surface to skin-surface material. *Aloe vera* simultaneously contributes to the aqueous and botanical microenvironment at the outer stratum corneum, where its polysaccharides may provide water-binding and conditioning effects.

16.2 Removal phase

The removal phase is integral to the mechanism of charcoal. Material adsorbed or physically associated with the carbon-containing mask is removed when the product is rinsed away. This differs from leave-on adsorbent systems and is the reason the mechanism is best described as cleansing and removal of excess surface-associated material rather than as sustained pharmacological action.

16.3 Post-use phase

After rinsing, the desired cosmetic endpoint is a cleaner surface without excessive tightness or dehydration. Human Aloe studies demonstrating increased stratum-corneum water content and reduced erythema provide a plausible basis for the conditioning component of this post-use experience[11,12]. Nevertheless, leave-on study results cannot be quantitatively transferred to a rinse-off mask because contact time, ingredient concentration, vehicle composition, and deposition differ.

17. Integrated Charcoal-Aloe Mechanism of Biotex Nano Carbon Mask

The two-active system can be described as a sequential and complementary mechanism. Activated Charcoal contributes porous surface area and adsorptive sites; during contact, this phase interacts with excess surface oil and selected surface-associated residues. Rinsing then removes the carbonaceous phase and its associated material. *Aloe vera* contributes a parallel conditioning axis through polysaccharide-mediated humectancy and skin-soothing biology, supported by human hydration and erythema evidence and by mechanistic studies involving keratinocytes, fibroblasts, inflammatory pathways, and extracellular-matrix signalling[11,12,24-30].

The integrated cosmetic outcome is therefore best summarised as ADSORB → CLEANSE → HYDRATE → SOOTHE → REFRESH. This framework is scientifically more coherent than attempting to assign therapeutic actions to charcoal or treating all ingredient evidence as equivalent. It also reflects the practical logic of the formulation: one ingredient primarily addresses unwanted material at the surface, while the other supports a conditioned skin state.

18. Evidence Supporting the Principal Cosmetic Benefits

The evidence base is asymmetric but complementary. Charcoal has a strong physicochemical rationale and limited direct cosmetic human evidence, whereas *Aloe vera* has stronger direct human evidence for hydration and erythema-related soothing. This difference is retained deliberately in the appraisal that follows, since collapsing the two evidence types would overstate what the charcoal literature supports. The activated-charcoal evidence is summarised in Table 2 and the *Aloe vera* evidence in Table 3.

Table 2. Activated-charcoal evidence relevant to the review

Evidence source	Model/context	Principal finding	Relevance to Biotex Nano Carbon Mask
Sanchez et al.[5]	Dermatology review	Activated charcoal is widely used in cosmetics; direct evidence for several promoted therapeutic claims is limited.	Supports cosmetic use and provides safety context; constrains the strength of permissible claims.
Bläker et al.[6]	Activated-carbon materials review	Pore structure and surface area, as resolved by adsorbent characterisation, are principal determinants of adsorption behaviour.	Supports adsorptive cleansing mechanism.
Wan Daud & Houshmand[7]	Activated-carbon surface chemistry review	Surface chemistry and textural characteristics influence adsorption.	Supports mechanistic interpretation of carbon-surface interactions.
Akhmetova et al.; Thomas et al.; Williams[17-19]	Topical charcoal dressings	Activated carbon retains gas-phase adsorptive capacity when incorporated into topically applied wound dressings.	Supports topical applicability of adsorption principle, not wound-treatment efficacy.
Kwon et al.[20]	Small human multi-ingredient	Charcoal-containing cleanser was associated	Limited supportive cosmetic evidence; charcoal contribution

	cleanser study	with improved sebum and pore parameters.	cannot be isolated.

Table 3. Human, cellular, and mechanistic evidence relevant to *Aloe vera*

Evidence source	Model	Key observation	Review relevance
Dal'Belo et al.[11]	20 female volunteers; cosmetic formulations with freeze-dried Aloe extract	Increased stratum-corneum water content; humectant interpretation.	Direct human support for hydration.
Reuter et al.[12]	Randomised, double-blind, placebo-controlled UVB erythema study	At the 48 h assessment, ultraviolet-induced erythema readings were significantly lower with the topical *Aloe vera* gel.	Direct human support for soothing / anti-erythema domain.
Fox et al.[22]	Healthy human volunteers	Hydration increased after a single application of *Aloe vera* gel material, but every aloe gel material tested showed dehydrating effects after repeated application.	Additional human hydration context; requires cautious interpretation.
Budai et al.[24]	Human macrophage models	Reduced LPS-induced cytokine output and NLRP3-related signalling.	Mechanistic support for soothing/inflammatory modulation.
Teplicki et al.[25]	Primary human keratinocytes and fibroblasts	Stimulated proliferation and migration; improved keratinocyte viability.	Cutaneous-conditioning and recovery biology.
Jettanacheawchankit et al.[26]	Gingival fibroblasts; rat oral (hard-palate) wound model	Increased KGF-1, VEGF, type I collagen, and fibroblast proliferation.	Growth-factor and matrix support.
Xing et al.[27]	Primary skin fibroblasts; mouse skin-wound model	Acemannan promoted proliferation via AKT/mTOR signalling.	Mechanistic signalling support.
Lee et al.[30]	Recent mechanistic review	Integrated growth-factor, ECM, integrin, and MMP pathways.	Current synthesis of Aloe cutaneous-recovery mechanisms.

19. Evidence Hierarchy and Translational Interpretation

A four-level hierarchy is useful for interpreting the evidence without obscuring its strengths and limitations. Level I comprises physicochemical evidence for activated charcoal, including pore architecture, surface area, and adsorption. Level II comprises cellular and molecular evidence for *Aloe vera*, including keratinocyte and fibroblast responses, inflammatory pathways, AKT/mTOR signalling, growth factors, and extracellular matrix biology. Level III comprises human topical ingredient evidence, which is strongest for Aloe-associated hydration and erythema and is limited for charcoal-containing cosmetic cleansers. Level IV is the integrated finished-formulation context of Biotex Nano Carbon Mask.

Evidence from a lower or parallel level informs biological plausibility but does not automatically establish a higher-level clinical claim. Thus, activated-carbon material science can support surface adsorption, but not a claim of clinical acne treatment; Aloe wound-repair mechanisms can support skin-conditioning plausibility, but not finished-mask wound-healing efficacy. Conversely, direct human Aloe hydration evidence is highly relevant to the intended cosmetic hydration domain even though exact effect size cannot be transferred to the rinse-off formulation. The convergence of these evidence levels is summarised in Figure 4.

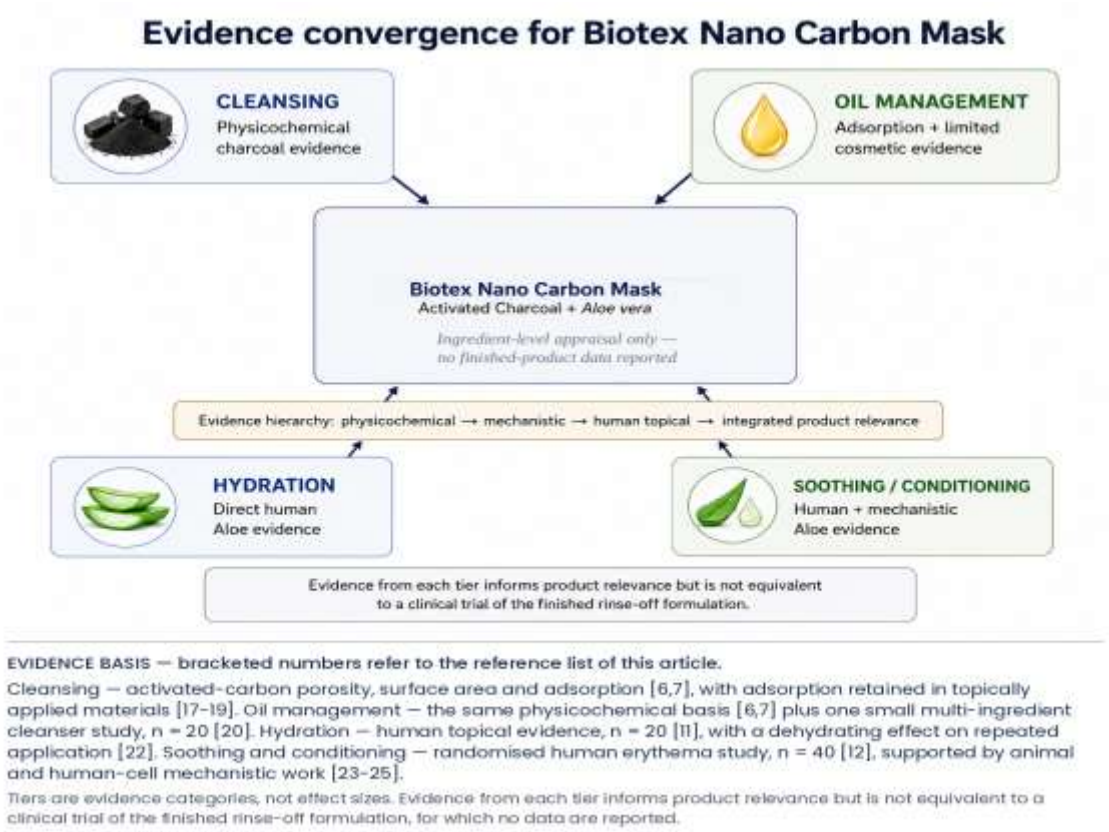

Fig 4: Evidence convergence and translational hierarchy for Biotex Nano Carbon Mask. Activated-charcoal material science provides the principal basis for adsorption and cleansing, supported by topical-charcoal experience and limited mixed-formulation cosmetic evidence. Human topical *Aloe vera* studies provide the strongest direct ingredient-level support for hydration and erythema-related soothing, while cellular and preclinical studies provide mechanistic context for skin conditioning. Reference numbers for each node are given in the evidence key beneath the figure. Evidence from each tier informs product relevance but is not equivalent to a clinical trial of the finished rinse-off formulation, for which no data are reported.

20. Safety, Tolerability, and Quality Considerations

20.1 Activated Charcoal

Activated charcoal is generally considered safe for topical cosmetic use[5]. For formulation quality, the relevant considerations are raw-material identity, particle control, microbiological quality, and appropriate contaminant specifications. Because the product is a mask rather than a loose inhalable powder, exposure characteristics are formulation dependent. Safety interpretation should therefore remain proportional to intended topical cosmetic use.

20.2 Aloe vera

Aloe vera also has a broad history of topical use, but safety depends on plant part, processing, and product quality. Reviews of Aloe toxicology separate gel-derived material from latex and from whole-leaf preparations enriched in anthraquinones; the adverse effects catalogued there follow ingestion, and whole-leaf extract carries a Group 2B (possible human carcinogen) classification after rat carcinogenicity findings[34]. Sensitisation appears uncommon: a single case report describes positive patch-test reactions to Aloe leaf and to macerated Aloe jelly in one patient[35]. In a cosmetic review, these observations support routine quality-control and tolerability considerations rather than suggesting that topical Aloe is generally unsafe.

21. Critical Appraisal and Evidence Integration

The principal strength of the evidence base is the complementarity between the two ingredients. Activated charcoal has a well-established physicochemical adsorption mechanism and established topical

incorporation, but comparatively sparse direct human evidence for facial-mask outcomes. Set against a charcoal literature that remains largely mechanistic, *Aloe vera* carries the stronger biological and human translational evidence, particularly for hydration and erythema-related soothing[5,11,12]. This asymmetry is advantageous when interpreted correctly: charcoal need not be assigned unsupported therapeutic activity for the formulation to have a coherent cleansing rationale.

Several translational variables should remain visible in the interpretation. Activated-carbon adsorption varies with raw-material pore characteristics, surface chemistry, and formulation environment[6,7]. Aloe composition varies with plant part, extraction, dehydration, and standardisation[8-10]. Human Aloe studies include both gel and freeze-dried extract preparations, and many cellular or wound studies use exposure conditions that differ substantially from a rinse-off mask. Contact time, ingredient concentration, vehicle composition, deposition, and post-rinse retention can therefore influence the magnitude of finished-product effects.

These limitations do not negate product relevance; rather, they define the level at which the evidence is most persuasive. The strongest formulation-supporting statements are that activated charcoal provides an adsorptive surface-cleansing rationale; *Aloe vera* has direct human evidence for hydration and soothing-related endpoints; and the combination offers a logical approach to cleansing while maintaining skin comfort. Therapeutic disease claims are neither supported by the evidence reviewed nor required by the cosmetic function described.

22. Product-Relevance Assessment

Biotex Nano Carbon Mask represents a complementary two-component dermocosmetic concept in which Activated Charcoal provides a porous adsorptive phase directed principally toward surface cleansing and management of excess surface-associated material. Whereas the charcoal evidence remains largely material-scientific, *Aloe vera* (*Aloe barbadensis*) contributes a polysaccharide-rich botanical phase with human evidence for skin hydration and erythema-related soothing and mechanistic evidence relevant to epidermal and dermal recovery biology[5,11,12,25-30].

The benefit domains most consistent with the evidence are therefore: helping cleanse the skin; helping remove surface-associated oil and residues during rinsing; helping manage excess surface oil; helping hydrate the skin; helping soothe the skin; and supporting a comfortable, refreshed-looking skin state. These statements align with the evidence hierarchy and the rinse-off format while avoiding extrapolation to acne treatment, systemic detoxification, permanent pore alteration or direct anti-ageing efficacy. Table 4 sets out the corresponding claim-evidence matrix.

Table 4. Integrated claim-evidence matrix for Biotex Nano Carbon Mask

Preferred product-relevant wording	Primary evidence basis	Interpretive note	Evidence assessment
Helps cleanse the skin	Activated-charcoal adsorption and wash-off removal[5-7,17-19]	Appropriate cosmetic cleansing statement; effect is expected at the skin surface.	Moderate; mechanistic/topical-context evidence
Helps remove surface-associated oil and residues	Activated-carbon physicochemical adsorption[6,7]	Use surface-focused wording; avoid systemic detoxification language.	Moderate; mechanistic
Helps remove/manage excess surface oil	Charcoal adsorption rationale[6,7] + multi-ingredient cleanser study[20]	Refers to removal of surface oil, not suppression of sebaceous-gland secretion.	Moderate/indirect

Helps hydrate the skin	Direct human Aloe skin-bioengineering evidence[11,22]	Direct human evidence from a small vehicle-controlled study; repeated-application data are less consistent, and exact effect size cannot be transferred to a rinse-off mask.	Moderate-strong ingredient evidence; moderate product translation
Helps soothe the skin	Randomised human Aloe UVB-erythema evidence[12] + mechanistic studies[23,24]	Supports cosmetic soothing/temporary redness language, not treatment of inflammatory disease.	Moderate-strong ingredient evidence
Supports comfortable, refreshed-looking skin	Aloe hydration/soothing evidence[11,12] + integrated formulation rationale	Integrated cosmetic outcome; primarily interpretive rather than a directly measured finished-product endpoint.	Moderate; integrated

Note: Evidence assessments reflect the relevance and directness of the cited literature to the stated cosmetic endpoint; they are not formal GRADE ratings. Finished-product performance may differ from ingredient-level studies because of concentration, vehicle and rinse-off exposure time.

23. Limitations

Several limitations bear on how the conclusions of this review should be read. First, the review is narrative rather than systematic: the search was not registered, no formal risk-of-bias instrument was applied, and study selection reflects the authors' judgement of translational relevance. Second, the direct human evidence base is small. Hydration rests on a single vehicle-controlled study of 20 female volunteers[11], while the one further human hydration study reports a dehydrating effect after repeated application[22]; the soothing domain rests on one randomised study of 40 volunteers using a 97.5% gel under occlusion[12]. Third, the only human cosmetic study involving charcoal used a multi-ingredient cleanser, so the independent contribution of charcoal cannot be isolated[20]. Fourth, much of the supporting mechanistic literature derives from cell culture, from oral rather than cutaneous tissue[26], or from rodent wound models[27-29] in which exposure conditions differ substantially from a rinse-off cosmetic mask. Fifth, Aloe preparations vary with plant part, extraction and processing, so findings are not freely transferable between materials[8-10]. Finally, and most importantly, no clinical, instrumental or analytical data on the finished Biotex Nano Carbon Mask are reported here. The review appraises ingredient-level evidence only, and the performance of the finished rinse-off formulation remains to be demonstrated in a study of the product itself.

24. Conclusion

Activated Charcoal and *Aloe vera* provide a scientifically coherent two-active framework for Biotex Nano Carbon Mask. Activated charcoal contributes a porous adsorptive surface capable of interacting with selected surface-associated material and excess oil, supporting a rinse-off cleansing mechanism. Against a charcoal evidence base that is essentially physicochemical, *Aloe vera* contributes a distinct botanical-conditioning component, with human topical evidence for improved stratum-corneum hydration and reduced ultraviolet-induced erythema and with supporting cellular and mechanistic work involving keratinocytes, fibroblasts, inflammatory signalling, growth factors, and extracellular-matrix biology[5,11,12,24-30].

The combined formulation is therefore best understood through the sequence ADSORB → CLEANSE → HYDRATE → SOOTHE → REFRESH. Ingredient-level evidence supports the intended cosmetic positioning around cleansing, surface-oil management, hydration, soothing, skin comfort, and refreshed appearance. The evidence is strongest when each ingredient is interpreted according to its actual domain of support and when ingredient-level findings are distinguished from direct clinical proof of the finished rinse-off mask.

Declarations

Author Contributions

All authors contributed to the conception and scope of the review, interpretation of the literature, critical revision of the manuscript, and approval of the final version.

Funding

No external funding was received for this review.

Conflict of Interest

The authors are affiliated with Biotex Life Solutions Pvt. Ltd., the developer of Biotex Nano Carbon Mask. This affiliation represents a potential conflict of interest and is disclosed for transparency.

Data Availability

No new datasets were generated or analysed for this narrative review. All evidence discussed is derived from the cited published literature.

AI-Assisted Writing Disclosure

Artificial-intelligence-assisted tools have been used for language refinement and organisation of literature during manuscript preparation. Scientific interpretation, reference selection, verification, and final responsibility for the manuscript remain with the authors.

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