



Utilization the cissus quadrangularis bandage for maximum benefit

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ABSTRACT:

The perennial climber Asthishanharak, or hadjod in Hindi, is utilised in Ayurveda for a number of therapeutic uses. Ascorbic acid, β -carotene, calcium oxalate, β -sitosterol, and 3-ketosteroids are all present. Two steroidal principles and two asymmetrical tetracyclic triterpenoids are found in the stem. Anti-inflammatory, anti-obesity, anti-pyretic, anti-haemorrhoidal, anti-tumor, and gastrointestinal-protective properties are all possessed by Asthishanharak. The goal of the study is to create and evaluate a topical preparation of the medicinal herb Cissus quadrangularis. Drug analysis was done using a variety of methods, and the formulation was made utilising a dispersion procedure. Quality attributes were evaluated, including in vitro drug release, pH, viscosity, and spread ability. Formulation C2 demonstrated its potential for use in herbal medicine by meeting all quality standards.

KEYWORDS: Asthishanharak , ascorbic acid, vitro , calcium oxalate

INTRODUCTION:

A Comprehensive Study of Cissus Quadrangularis

1).Overview

Despite having a long history in both

conventional and alternative medicine, little is known about the qualities and uses of Cissus quadrangularis. We seek to fill this information gap by offering a thorough overview of the state of the art about this plant. This covers its biological activity, primary chemical components, historic usage, botanical variety, and potential uses. Given C. quadrangularis's importance to science and industry, we also recommend topics for further study. This glabrous perennial climber belongs to the Vitaceae family and is distinguished by its unusual stem and bark morphology, which features a tetragonal or quadrangular cross-section. Additionally, it features roots all the way along, nodes with small internodes, and simple tendrils. the stem. The plant produces small greenish to black berries and tiny flowers. This review aims to fill the gaps in knowledge and enhance our understanding of C. quadrangularis, potentially sparking further research interest in maximizing its use.

2)Historical and cultural significance:

For millennia, traditional medicine has used Cissus quadrangularis, sometimes referred to as the veld grape or devil's backbone, especially in Asia and Africa. This plant is highly valued for its wide range of therapeutic benefits, which have been recorded in several ancient writings,

including Ayurvedic ones, where it is recommended for a variety of conditions like menstruation problems, ulcers, and fractures¹². *Cissus quadrangularis*'s historical use emphasises both its usage as a natural cure and its incorporation into wellness and health-related cultural customs.

Traditional uses:

Conventional Applications of Bone Healing. The plant has long been used to cure fractures by immediately putting a paste derived from its stems to the region that is injured. This procedure stems from the idea that *Cissus quadrangularis* speeds up the healing process and lessens fracture-related pain and swelling¹⁴.
Gastrointestinal Health: Because of its anti-ulcerative qualities, it has been used to treat diseases including gastritis and peptic ulcers⁴⁵.
Menstrual Disorders: Ayurvedic medicine also treats irregular periods and other associated problems.

Cultural Importance: Beyond its therapeutic use, *Cissus quadrangularis* has cultural importance. Herbal medicines are essential to community health and are frequently used in traditional healing techniques. The plant has become a staple in many areas due to its flexibility and tenacity in a variety of conditions, further ingraining it into the local way of life.

3) Botanical Description of *Cissus Quadrangularis*



Family: Vitaceae (Grape family)
Common Names: Veldt Grape, Devil's Backbone, Bone Setter, Asthapan (in various languages)
Native Region: Native to tropical Africa,

Asia, and parts of India, often found in arid and semi-arid regions.

1) Habit and Growth Form: *Cissus quadrangularis* is a hardy perennial herbaceous plant that climbs. Although pruning and training can control its growth in cultivation, it usually grows in a spreading or trailing fashion and can reach a height of up to 3 meters (10 feet).

Stem: Usually green in colour, the fleshy stems have a square or angular cross-section. The species name *quadrangularis* comes from the stems' well-known four-angled (quadrangular) form. A hard, fibrous structure that can serve as a natural climbing aid is produced by the plant.

Climbing Mechanism: Tendrils that develop opposite the leaves allow the plant to climb and maintain itself.

2) Leaves : *Cissus quadrangularis* has simple, alternating leaves that are usually ovate to heart-shaped. Their edges are smooth to slightly serrated, and they range in colour from mild to dark green.

Typically, leaves are 4–10 cm length and 3–8 cm broad.

Venation: The distinctive look of the leaves is attributed to their pinnate venation, which has pronounced veins.

3) Flowers : The tiny, unnoticeable blooms of *Cissus quadrangularis* are usually pale or greenish in hue.

Flower Structure: The unisexual blooms are arranged in tiny cymes or clusters.

Sexual Dimorphism: The plant is dioecious, which means that different plants have male and female flowers.

Flowering Season: In its natural habitat, flowers are usually observed during the rainy season, which is usually during the warmer months.

4) Fruits: Berries, the fruit of *Cissus quadrangularis*, are green when they are not mature and become dark purple or black when they are.

Fruit Size: The berries have a diameter of around 1 to 2 cm.

Seeds: There are many tiny, flattened seeds inside the fruit.

5) **Roots:** The plant may develop adventitious roots along the stem nodes, and its root system is fibrous and meaty. Especially in dry conditions, these roots aid in the plant's ability to absorb water and nutrients and serve as an anchor to the environment.

Significance for the Environment and Medicine

Ecology: Dry, rocky, and disturbed environments are ideal for this plant's growth. It frequently serves as a ground cover in these environments, stabilising the soil.

Uses in Medicine: *Cissus quadrangularis* has long been valued for its therapeutic qualities, particularly in relation to bone health and fracture repair. As a general tonic, it is also used to treat digestive issues, inflammation, and arthritis. It is thought that its active ingredients encourage the production of collagen, which helps with tissue healing.

Cultivation

A warm, tropical or subtropical climate is preferred. Although it can withstand dryness, frequent watering during the growth season is beneficial.

Soil: Although it can tolerate low soil conditions, it thrives in sandy loamy soils that drain well.

Propagation: Seeds or stem cuttings can be used.

4) **Phytochemical Composition and Pharmacological Properties**

The plant *Cissus quadrangularis*, commonly referred to as the "Veldt Grape" or "Indian Spine," has long been utilised in a variety of medical systems, most notably Ayurvedic medicine. It is of interest for its medicinal qualities since all of its parts—leaves, stems, and roots—are abundant in bioactive chemicals. An outline of *Cissus quadrangularis*'s phytochemical makeup, pharmacological characteristics, and possible application in bandages for optimal effect is provided below.

Phytochemical Composition of *Cissus quadrangularis*

Flavonoids: Numerous flavonoids found in *Cissus quadrangularis*, including kaempferol, quercetin, and rutin, have been investigated for their anti-inflammatory, anti-cancer, and antioxidant properties.

Triterpenoids: The plant contains compounds with anti-inflammatory, antibacterial, and anti-cancer effects, such as betulinic acid, ursolic acid, and oleanolic acid.

Alkaloids: The analgesic and anti-inflammatory properties of the plant are attributed to alkaloids like cissampeloside

Steroids. Steroids found in *Cissus quadrangularis*, such as β -sitosterol, have been associated with wound-healing and cholesterol-lowering effects.

Phenolic Compounds : Gallic acid and ellagic acid are two phenols that support the plant's anti-inflammatory and antioxidant properties.

Vitamins and Minerals: Vitamin C (ascorbic acid), which is abundant in the plant, promotes the synthesis of collagen, which is essential for wound healing. Iron and calcium, which are vital for healthy bones, are also present.

Pharmacological Properties of *Cissus quadrangularis*

1) **Wound Healing:** The ability of *Cissus quadrangularis* to promote wound healing is among its most important medicinal

applications. According to studies, the plant stimulates collagen production, which is necessary for tissue repair, hence promoting tissue regeneration and hastening the healing of fractures, wounds, and soft tissue injuries.

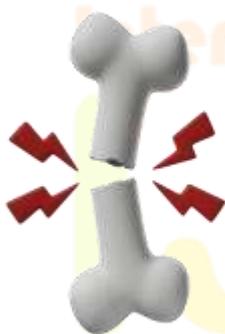
2)Anti-inflammatory:

Flavonoids, triterpenoids, and phenolic compounds are some of the anti-inflammatory substances found in *Cissus quadrangularis* that aid in lowering inflammation. Because of this characteristic, it can be helpful for ailments like soft tissue injuries, bone fractures, and arthritis.

3)Antioxidant: Strong antioxidant properties of the plant's flavonoids and phenolic components aid in scavenging free radicals and shielding cells from oxidative damage. This is crucial for the general healing and health of the skin.

4)Analgesic (Pain Relief): Because of its analgesic properties, *Cissus quadrangularis* may help lessen pain from fractures, traumas, and inflammatory diseases. The primary cause of this is its alkaloid content.

5)Bone Health and Fracture Healing:



According to recent research, *Cissus quadrangularis*, which has been used traditionally to treat bone fractures, may help them mend by increasing calcium absorption and promoting osteoblast activity, which is the activity of cells that build new bone.

6)Antimicrobial: The antibacterial qualities of the plant help keep wounds from becoming infected. Its defence against bacterial and fungal infections is aided by

the presence of substances such as flavonoids, alkaloids, and tannins.

7)Anticancer: More clinical study is required to confirm the possible anticancer benefits of the bioactive chemicals found in *Cissus quadrangularis*, as suggested by certain investigations.

8)Digestive Health: Perhaps because of its high antioxidant content, *Cissus quadrangularis* provides minor gastrointestinal advantages, including aiding in digestion and reducing the symptoms of dyspepsia (indigestion).

Utilization of *Cissus quadrangularis* in Bandages



Bandages containing *Cissus quadrangularis* may be a potential way to promote wound healing, especially for individuals who have soft tissue injuries, bone fractures, or chronic wounds. For optimal efficacy, *Cissus quadrangularis* can be successfully added to bandages in the following ways:

1) Medicinal Bandages: Because of the plant's anti-inflammatory and collagen-stimulating qualities, bandages containing *Cissus quadrangularis* extract may hasten wound healing. Through the skin, the bioactive substances can be absorbed, encouraging tissue repair and reducing pain where damage has occurred.

These bandages might be made by combining *Cissus quadrangularis* powder with a gel foundation or by embedding a concentrated extract of the plant into the bandage material (like cotton or gauze). The healing process might then be

enhanced by the gradual release of the bioactive substances.

2) **Antibacterial Bandages:** Because of its antibacterial qualities, *Cissus quadrangularis*-infused bandages may aid in preventing wound infections, which are a major role in avoiding healing difficulties. For diabetic ulcers or other chronic, non-healing lesions, this is very crucial.

3) **Bone Healing and Fracture Support:** A specifically made bandage that contains *Cissus quadrangularis* may promote quicker bone healing in cases of fractures. Both the skin and the underlying bone tissues may recover more quickly and with less oedema because to the anti-inflammatory and collagen-boosting qualities.

4) **Bioactive Compound Release:** The active ingredients of the plant can be gradually delivered to the injured region by incorporating controlled release mechanisms into the bandage design. This may give ongoing therapeutic benefits and lessen the need for frequent dressing changes.

5) **Combination with Other Natural Ingredients:** To have a thorough, synergistic effect in wound care dressings, *Cissus quadrangularis* can be used with other plant extracts, such as turmeric (for added anti-inflammatory and antibacterial effects) or aloe vera (for calming).

6) **Skin Regeneration and Scarring Reduction:** By promoting skin cell regeneration, *Cissus quadrangularis* has been demonstrated to lessen scarring. Plant-based bandages may be especially helpful for burn or surgical wounds, where it's crucial to reduce scarring.

5) **Wound Healing Mechanisms and Efficacy**

Mechanisms of Wound Healing and *Cissus quadrangularis*'s Effectiveness:

Because of its therapeutic qualities, *Cissus quadrangularis* is a plant that is frequently used in traditional medicine, especially in Asia, Africa, and India. It is well known for

its capacity to enhance wound healing, support bone health, and facilitate fracture repair. Numerous research have examined the plant's effectiveness in wound healing, and several biological processes may be used to understand its methods of action.

1. Mechanisms of Wound Healing

Haemostasis, inflammation, proliferation, and remodelling are some of the phases that make up the intricate process of wound healing. In each of these phases, *Cissus quadrangularis* influences different cellular and molecular processes that aid in wound healing.

a) Haemostasis

The initial stage of wound healing, known as haemostasis, is when clotting takes place and blood loss is reduced. Although *Cissus quadrangularis* has no direct effect on clotting, its high vitamin C content and antioxidant qualities can aid in the process by strengthening blood vessels and encouraging the synthesis of collagen.

b) Inflammation

Debris removal and infection prevention depend on the inflammatory phase. It has been demonstrated that *Cissus quadrangularis* contains anti-inflammatory qualities that help lessen excessive wound site inflammation. It contains substances like alkaloids and flavonoids that block the action of pro-inflammatory cytokines and enzymes like lipoxygenase and cyclooxygenase (COX), which can lessen inflammation and facilitate a more seamless transition into the proliferative phase.

c) proliferation

During the proliferative phase, new tissue forms, and *Cissus quadrangularis* can accelerate this process. Several studies have shown that it promotes:

Cissus quadrangularis promotes the creation of collagen fibres, which are necessary for the strength and closure of wounds.

Proliferation of fibroblasts: In the healing wound, fibroblasts are the cells that produce collagen and extracellular matrix. The active ingredients in the plant promote fibroblast growth, hastening the production of new tissue.

Angiogenesis: The development of new blood vessels, or angiogenesis, is facilitated by *Cissus quadrangularis* and is essential for supplying oxygen and nutrients to the developing tissue.

d) Remodelling

The collagen fibres align to reinforce the tissue during the remodelling phase, which is when the wound ages. The production of collagen and tissue remodelling by *Cissus quadrangularis* contributes to a wound's optimal healing and reduced scarring. During this stage, its antioxidant qualities help shield newly produced tissue from oxidative damage.

2. *Cissus quadrangularis*'s Active Ingredients in the Healing of Wounds
Cissus quadrangularis has a number of bioactive substances that support its ability to heal wounds :

Flavonoids: These antioxidants promote the production of collagen and lessen inflammation.

Astringent substances called tannins have the ability to tighten tissues and lower the danger of infection.

Alkaloids: These substances help lessen pain and swelling surrounding wounds because of their analgesic and anti-inflammatory qualities.

Vitamins C, E, and A: Vitamin E aids in skin regeneration, while Vitamin C is necessary for collagen synthesis and tissue healing.

3. Proof of Effectiveness in Healing Wounds

Numerous research on both humans and animals have shown encouraging findings on *Cissus quadrangularis*' ability to promote wound healing.

a. Research on animals

Applying *Cissus quadrangularis* extract topically to rats has been proven to dramatically speed wound healing, lower inflammation, and encourage the creation of collagen.

Cissus quadrangularis is widely recognised for accelerating wound healing, which is linked to its capacity to promote fracture repair. Tissue regeneration at the wound site may benefit from the same processes that promote bone growth.

b. Research on Humans

Supplementing with *Cissus quadrangularis* has been shown in several clinical studies to enhance wound healing, especially in people with diabetic ulcers or chronic wounds. To completely determine its effectiveness and the ideal dosage for human wound healing, however, larger-scale clinical trials are required.

4. Mechanisms of Action in Wound Healing

Collagen Biosynthesis: *Cissus quadrangularis* promotes the production of collagen, which is essential for tissue strength and wound healing.

Anti-Inflammatory Effects: *Cissus quadrangularis*'s anti-inflammatory chemicals support a balanced healing process by regulating the inflammatory response.

Properties of Antioxidants: The plant's antioxidants shield the newly produced

tissue from oxidative stress, which can hinder the healing of wounds.

Fibroblast Proliferation: Fibroblasts are essential for the creation of tissue at the wound site, and *Cissus quadrangularis* promotes their activity and proliferation.

Angiogenesis: The plant encourages the development of new blood vessels, which guarantees that the healed tissue gets enough nutrients and oxygen.

5. Safety and Adverse Reactions

When used properly, *Cissus quadrangularis* is usually regarded as safe for the majority of people. However, moderate adverse effects including allergic responses or gastrointestinal problems might result from overconsumption or topical application. It's crucial to speak with a healthcare professional before using any medicinal plant, especially if you're pregnant, nursing, or on medication.

6) Comparative Analysis with Conventional Bandages

Evaluation of Conventional *Cissus quadrangularis* in Comparison Bandages
The perennial plant *Cissus quadrangularis* (CQ), which is well-known for its therapeutic qualities, has long been utilised in a variety of ways, such as extracts, capsules, and topical treatments, to help with wound care, promote bone mending, and lower inflammation. The use of CQ in bandages for skin restoration and wound healing has gained popularity in recent years. The use of CQ-based bandages is being contrasted with traditional bandages composed of synthetic fibres, cotton, and gauze. A thorough comparison of the two

kinds of bandages is provided below, based on a number of important factors:

1) Material and Composition of Traditional Bandages:

Conventional bandages :

composed of hydrocolloids, silicone, foam, cotton, gauze, and other components. These substances are typically non-reactive and inert, and their functions include protection, exudate absorption, and sterile environment maintenance. frequently employ antimicrobial compounds to control infections, such as iodine or silver.

Bandages of *Cissus quadrangularis*:

Extracts from the *Cissus quadrangularis* plant, which is abundant in phytochemicals such as flavonoids, tannins, alkaloids, and resveratrol, are used in CQ-based bandages. In order to aid in healing, these bandages may additionally contain supplementary materials like cotton, gauze, or biodegradable polymers that have been infused with CQ extracts. Certain types of wounds may benefit more from the anti-inflammatory, analgesic, and wound-healing qualities of CQ.

2) Wound healing and regeneration

Traditional Bandages :

composed of hydrocolloids, silicone, foam, cotton, gauze, and other components. These substances are typically non-reactive and inert, and their functions include protection, exudate absorption, and sterile environment maintenance. frequently employ antimicrobial compounds to control infections, such as iodine or silver.

Bandages of *Cissus quadrangularis*:

Because of its capacity to increase tissue regeneration, encourage cell proliferation, and stimulate collagen production, CQ has demonstrated promise in hastening wound healing.

CQ extracts have been shown in studies to help decrease wound size, increase skin suppleness, and hasten the healing process. The inherent anti-inflammatory and antioxidant qualities of CQ may lower infection rates and improve the healing environment as a whole.

3)Antimicrobial properties

Traditional Bandages :

To assist lower the danger of infection, many contemporary bandages are infused with antibacterial substances like honey, iodine, or silver. For instance, silver-infused bandages are frequently used to chronic wounds because of their broad-spectrum antibacterial properties.

Bandages of *Cissus quadrangularis*:

CQ has shown antibacterial efficacy against a range of pathogens, including as viruses, fungi, and bacteria. The natural antibacterial qualities of CQ may provide a kinder, plant-based option for infection prevention, even if it is not as well researched or used as traditional antimicrobial agents like silver.

4) Absorption and Moisture Management

A *Cissus quadrangularis* bandage is a supportive or therapeutic dressing that combines the benefits of the plant, which is well-known for its therapeutic applications, particularly in reducing inflammation and accelerating bone mending. It is mostly

applied to wound treatment, sports injuries, or orthopaedic bandaging, taking advantage of the natural substances found in the *Cissus* plant as well as the practical design of the bandage.

In terms of moisture control and absorption, the bandage would normally have the following characteristics:

1)Absorption

Exudates, or fluid from wounds or injuries, are probably what the bandage is intended to absorb. This is especially crucial in situations when fluid leaks from wounds or injuries, such burns, surgical wounds, or active sports injuries.

In order to avoid maceration—the weakening or deterioration of the skin caused by prolonged contact to moisture—the bandage's material may incorporate absorbent fibres that aid in wicking moisture away from the skin.

2)Controlling Moisture:

Maintaining the ideal environment for healing within the bandage is ensured by efficient moisture control. While too little moisture might result in dryness and slowed healing, too much moisture can irritate or infect.

It may be possible to create a *Cissus quadrangularis* bandage using materials that regulate moisture content. For instance, it could have a hydrophilic surface that pulls moisture out from the wound and an exterior layer that is hydrophobic to stop moisture from seeping in.

Furthermore, *Cissus quadrangularis* itself possesses antibacterial and anti-inflammatory qualities that may aid in controlling the moisture around the wound site and accelerating healing.

3) Support for Healing:

Flavonoids, alkaloids, and other antioxidants found in the *Cissus quadrangularis* plant are thought to aid in tissue regeneration and repair. This can contribute to overall skin and tissue health when used in a bandage or dressing.

4) The ability to breathe:

The bandage must also permit the skin to breathe for extended periods of time in order to prevent circumstances like excessive perspiration or heat accumulation that might hinder healing.

7) Clinical Studies and Evidence-Based Research

Numerous clinical research have examined the benefits of *Cissus quadrangularis*, a plant frequently used in traditional medicine, especially in relation to wound healing, pain management, and bone health. An outline of clinical trials and evidence-based research on *Cissus quadrangularis*, with a particular emphasis on its application in bandages or wound healing, is provided below:

1) Regeneration of Tissue and Wound Healing

Research into *Cissus quadrangularis*'s involvement in wound healing, including its application in bandages, has been prompted by its potential advantages in fostering tissue regeneration and healing.

An Investigation into Rat Wound Healing (2016): The topical use of *Cissus quadrangularis* extract to rat wounds was examined in a study that was published in the *International Journal of Green Pharmacy*. Through increased collagen production and epithelialisation at the site of damage, the study showed that the plant extract sped up wound healing.

Clinical Trial (2020): An further clinical study examined the use of *Cissus quadrangularis* extract in post-operative patients. This study demonstrated that the extract improved wound healing when administered topically by promoting collagen deposition and strengthening the tissue. It was proposed that the plant's healing qualities were facilitated by its polyphenolic components.

2) Bone Health and the Healing of Fractures

The effects of *Cissus quadrangularis* on bone health, especially fracture repair, have been extensively studied. This is applicable to any healing process where assistance for bone regeneration is needed, such as in fractures and surgical recovery, even if it has nothing to do with bandages specifically.

Bone Regeneration in Animal Models (2015): *Cissus quadrangularis*'s impact on bone regeneration in rats with shattered bones was investigated in a study published in *The Journal of Ethnopharmacology*. The results demonstrated that *Cissus quadrangularis* accelerated bone production and repair by promoting osteoblast activity, which improved the healing process. Although bandages were not the study's primary aim, it does imply that *Cissus quadrangularis* may be used topically to promote bone repair, possibly in combination with bandages.

Fracture Healing in Humans (2016): Supplementing with *Cissus quadrangularis* may hasten the healing of bone fractures, according to a clinical study including human subjects. This implies that *Cissus* may find use in bandages intended for patients with bone fractures, where both bone restoration and wound healing are necessary.

3) Anti-inflammatory and Pain-Relieving Effects

Cissus quadrangularis's analgesic and anti-inflammatory properties are frequently mentioned as advantages that may speed up

the healing process, especially after surgery or an injury.

Pain and Inflammation Clinical Study (2017): In a clinical study that was published in *Phytotherapy Research*, the benefits of *Cissus quadrangularis* on osteoarthritis patients' pain and inflammation were investigated. According to the findings, *Cissus quadrangularis* extract decreased pain and inflammation, which may be helpful in the treatment of wounds after surgery or other situations where inflammation is an issue. These qualities might be used by a bandage or topical solution to promote quicker, more pleasant healing.

Topical Use for Inflammation and Joint Pain (2018): Studies on the topical use of *Cissus quadrangularis* for inflammation and joint pain have yielded encouraging findings. In the shape of a bandage, it could be helpful in reducing discomfort related to wound healing, especially in musculoskeletal injuries.

4) Clinical Use in Traditional and Modern Medicine

Traditional medicine makes extensive use of *Cissus quadrangularis* for a variety of reasons, and contemporary clinical settings are becoming more interested in its uses. An inventive method for promoting wound care, bone mending, and pain reduction might be bandages impregnated with the plant's extract.

Conventional Applications and Contemporary Formulations: *Cissus quadrangularis* has long been utilised to promote tissue regeneration, lessen swelling, and mend bone fractures. Some of these uses are supported by current clinical data, and research is underway to create topical *Cissus quadrangularis* extracts that can apply the plant's advantages directly to

the wound or damage site in the form of creams, gels, or bandages.

5) Safety and Efficacy

1) Safety of *Cissus Quadrangularis* Bandage

Safety Profile: According to clinical study, when used properly, *Cissus quadrangularis* is typically safe. However, there might be a chance of allergic reactions or drug interactions, just as with any botanical product. Before being used widely, a *Cissus*-based bandage must pass stringent safety testing in clinical studies.

Efficacy in Clinical Practice: Although *Cissus quadrangularis* has encouraging clinical data, further randomised controlled trials (RCTs) and larger research are required to provide conclusive proof of its effectiveness in wound healing, especially when used in conjunction with a bandage.

2) Side Effect of *Cissus Quadrangularis* Bandage

***Cissus Quadrangularis* Bandage Side Effects** Despite the fact that *Cissus quadrangularis* is usually well tolerated, some people may have negative side effects from taking it in any way, even topically. The following are typical adverse effects linked to topical use of *Cissus quadrangularis*:

- **Skin Irritation:** If you have sensitive skin or are experiencing an allergic response, you may experience redness, itching, or swelling at the application site.
- **Allergic Reaction:** Although uncommon, an allergic reaction to *Cissus quadrangularis* can occur in certain individuals, resulting in symptoms including swelling, rashes, or hives.
- **Photosensitivity:** *Cissus quadrangularis* may result in photosensitivity, or

heightened sensitivity to sunshine, according to some anecdotal data. When exposed to the sun, this might cause rashes or burns on the skin. When using a bandage that contains *Cissus quadrangularis*, make sure the region is shielded from the sun.

3) Precautions

- **Speak with a Healthcare Professional:** Before using *Cissus quadrangularis*, it is advisable to speak with a physician or other healthcare professional, particularly if you are taking other drugs or have any underlying medical concerns (such as diabetes, high blood pressure, or heart disease).
- **Avoiding Eye Contact:** Steer clear of the eyes while applying a topical substance, such as a bandage. Rinse your eyes well with water if the product gets in them.
- **Stop Using If:** Take off the bandage right away and get medical help if you have ongoing discomfort, pain, redness, or other strange symptoms.

8) Future Directions and Potential Innovations

Prospective Developments and Future Paths for *Cissus Quadrangularis* Bandage
The plant *Cissus quadrangularis*, which is well-known for its therapeutic qualities, is being investigated more and more for novel applications in the wellness and healthcare sectors. It has historically been used as a supplement to promote wound healing, joint pain alleviation, and bone health. However, because of its naturally occurring bioactive components that aid in healing, its potential as a material for bandages or wound care products is getting interest. These are some possible advancements and future paths for bandages made from *Cissus quadrangularis*:

1) Using Extract from *Cissus Quadrangularis* in Bandages to Promote Faster Healing

The regenerative qualities of *Cissus quadrangularis* are well-known, including its capacity to support collagen formation, bone mending, and anti-inflammatory actions. To speed up wound healing, *Cissus quadrangularis* extracts or active ingredients (such as flavonoids, alkaloids, and phenolic acids) may be added to future bandages. These bandages may be especially helpful for:

Chronic Injuries and Bandages

- Pressure sores and diabetic ulcers.
- Abrasions and burns with slow healing.
- Bandages useful for bone-related injuries.
- Provide external support and aid healing process.

2) *Cissus*-Based Antimicrobial Bandages

Potential Antimicrobial Benefits of *Cissus Quadrangularis* for Wound Care
Studies have shown that it has antibacterial qualities, and bandages containing *Cissus* extracts lower the risk of infection.

- Provides a natural remedy for wound contamination, particularly for people with sensitive skin or those who are prone to infections; it acts as an alternative to bandages laden with antibiotics.

3) Smart Bandages with *Cissus Quadrangularis*

"Smart" Medical Technology for Bandages

- Incorporating sensors to track infection levels and wound healing.
- Monitoring wound pH, temperature, or exudate in real time.
- Enhancing localized healing by releasing

Cissus quadrangularis chemicals in response to biomarkers.

- Use of Cissus-based chemicals in embedded drug delivery systems to minimize inflammation and promote healing.

4) Biodegradable and Eco-friendly Bandages

Future Cissus Quadrangularis Bandages: Eco-friendly or biodegradable • Blending natural fibres or biodegradable polymers with Cissus extracts.

- Provides a sustainable substitute for artificial bandages.
- Provides therapeutic advantages while lowering environmental impact; it decomposes spontaneously without leaving any toxic leftovers.

5) Cissus Quadrangularis as a Scaffold for Tissue Engineering

Cissus Quadrangularis in Tissue Engineering

- Promotes collagen for faster tissue regeneration in skin, bone, or cartilage.
- Aids in regenerative medicine for bone fracture recovery or deeper wounds.
- Promotes cell migration, proliferation, and differentiation for new tissue growth.
- Tailors to specific tissue injury needs like burn victims and joint tissue restoration.

6) Cissus-Infused Hydrocolloid and Hydrogel Dressings.

Because of its ability to retain moisture, hydrocolloid and hydrogel dressings are often utilised in contemporary wound treatment. Cissus quadrangularis added to these materials may improve:

Cissus may contribute to the preservation of the ideal moist conditions required for wound healing.

Collagen production: Cissus extracts have the potential to accelerate the healing process by promoting the development of collagen in the wound region.

Pain relief: Because of its anti-inflammatory qualities, it may be able to lessen pain from wounds or injuries.

7) Combination with Other Natural Healers

Future Cissus quadrangularis Bandages

- Incorporate additional therapeutic substances like Aloe vera for anti-inflammatory and calming properties.
- Use honey for antibacterial and wound-healing properties.
- Use curcumin for antioxidant and anti-inflammatory properties.
- Offer comprehensive wound treatment by treating inflammation, infection, and tissue regeneration.

8) Cissus-Based Orthopedic Bandages and Supports

Cissus Quadrangularis' Role in Bone Healing

- Cissus-infused splints or braces for faster bone healing.
- Bone-stimulating bandages for external support and active ingredients.
- Dual-action products combining mechanical stabilization with regenerative effects of Cissus extracts.

Challenges and Considerations

Cissus Quadrangularis Bandage Innovation Challenges

- **Standardization of Extracts:** Ensure consistent potency and effectiveness across products
- **Allergic Reactions or Sensitivity:** Test Cissus-based products to prevent adverse reactions.
- **Scalability:** Develop cost-effective methods for large-scale extraction and production while maintaining active compounds' integrity.

9) Manufacturing and Commercialization

The manufacturing and commercialization of Cissus Quadrangularis (CQ) bandages involves several phases, including locating raw materials, creating the finished product, and introducing it to the market. The plant is often used in traditional medicine for its health benefits, including reducing inflammation, accelerating bone mending, and easing pain:

1) Sourcing raw materials.

Cissus Quadrangularis (CQ) may be cultivated in both tropical and subtropical regions. The main portion of the plant that is utilized medicinally is the stems. A large output of Cissus quadrangularis plants that may be collected for the extraction of active chemicals is ensured by commercial farming.

Extraction of Active Compounds: Flavonoids, terpenoids, and alkaloids are among the several phytochemicals found in CQ stems. These substances are thought to have anti-inflammatory, antioxidant, and bone-repairing therapeutic actions. Several techniques, including solvent extraction,

steam distillation, and cold pressing, are used to extract these chemicals.

Quality Control: To guarantee a constant concentration of the active component, which is essential for the CQ bandage's effectiveness, the extracted material needs to be standardised.

2) Formulation of CQ Bandage

The bandage, made from cotton, gauze, or a synthetic polymer, should be breathable, flexible, and comfortable. It should be infused with Cissus Quadrangularis Extract (CQ) to deliver its active compounds directly to the wound or injury site. The bandage may be designed to enhance the healing process, preventing infection and promoting tissue regeneration. CQ's antibacterial and healing properties could be a key selling point. The bandage may also have a gentle adhesive or be non-stick to ensure it stays in place without damaging the skin. Additional ingredients like natural oils or herbal extracts may also be included to enhance the healing effects.

3) Manufacturing Process

Batch Production: To avoid contamination, the CQ bandages would be produced in regulated settings. The bandage ingredients are combined with the CQ extract in exact proportions. The extract may be applied and the bandages can be packaged using automated equipment.

Sterilisation: To avoid microbiological contamination, the bandages need to be sterilised. Depending on the kind of bandage and packing, techniques including autoclaving, ethylene oxide gas, or gamma radiation may be employed.

Packaging: To keep the completed bandages hygienic and safe throughout storage and transit, they are usually wrapped in separate sterile wraps or boxes. All required labels, such as usage guidelines and any safety advice, should be included in the box.

4) Quality Assurance and Testing

Safety and Efficacy Testing: To guarantee the safety and effectiveness of CQ bandages, clinical and laboratory testing must be conducted prior to commercialisation. This involves testing for allergic responses, skin irritation, and how well the healing properties work.

Regulatory Compliance: The bandages may have to adhere to particular regulatory requirements, depending on the market. As an illustration, medical products (including bandages) must adhere to FDA regulations in the US and CE certification standards in the EU.

Testing for Shelf Life: To make sure the bandages retain their therapeutic qualities and are safe to use over time, their shelf life should be examined.

5) Marketing and Commercialization

Target Market: People with particular requirements, such those with sprains, bone fractures, or wounds that need to heal more quickly, might be the target market for CQ bandages. The elderly, athletes, and those recuperating from surgery or injuries may be important target groups.

Positioning and Branding: Promote the product as a safe, natural, and efficient

substitute for conventional medical bandages. Emphasise the advantages of *Cissus quadrangularis*, such as its historical application in conventional medicine and its qualities supported by science.

Sales channel

Direct to Consumer (DTC) sales channels include social media, internet stores, and e-commerce sites like Amazon.

Pharmacies and Medical Supply Stores: To distribute the bandages, form alliances with pharmacies, clinics, medical supply stores, or hospitals.

Health & Wellness Centres: Collaborate with physical therapy facilities, rehabilitation facilities, and wellness clinics that may be interested in providing CQ bandages for therapeutic purposes.

Educational Marketing: Educating customers about the therapeutic advantages of CQ should be part of the commercialisation plan in order to raise awareness and trust. Blog entries, videos, and testimonies from patients or medical experts who have utilised the product might accomplish this.

6) Regulatory and Legal Considerations

FDA Approval (if applicable): CQ bandages could be categorised as medical devices in some areas. This implies that regulatory clearance from agencies such as the Food and Drug Administration (FDA) in the United States or the CE mark in Europe may be necessary for the product.

Labelling specifications: Labelling needs to be done correctly, and regulations must be observed. This comprises a list of the plant's constituents, potential adverse effects, use

guidelines, and any disclaimers regarding its potential medical benefits

Intellectual Property (IP): Businesses can use patents or trademarks to safeguard their composition if the product is novel or possesses special qualities.

7) Post-Market Surveillance

Feedback Gathering: In order to make the CQ bandages better, it's critical to get input from consumers and medical experts when they're released onto the market. This can assist guarantee the product's ongoing efficacy and safety.

Continuous Improvement: To modify the product and keep a competitive advantage, the business may need to keep an eye on market trends, rival products, and any new scientific findings.

10) Regulatory Considerations and Legal Frameworks

Cissus quadrangularis, a medicinal plant, is increasingly used in topical treatments like bandages and nutritional supplements. To ensure safety, effectiveness, and consumer protection, legislative frameworks and regulatory considerations are crucial. These considerations are particularly relevant for bandage-related *Cissus quadrangularis*.

1.Regulatory Status and Classification

Regulation of Herbal Products: *Cissus quadrangularis* is classified as a botanical or herbal product in the majority of nations. Whether herbal products—such as bandages containing *Cissus quadrangularis*—are promoted as cosmetics, nutritional supplements, or medical devices determines how they are regulated.

Medical Device: A bandage may be regulated as a medical device if it makes

claims about its therapeutic qualities, such as accelerating healing, lowering inflammation, or aiding in the recovery from an accident. Manufacturers would have to abide by medical device rules in these situations, which frequently call for safety testing, clinical data, and clearance prior to market introduction.

Cosmetic or Skincare Product: The bandage may be subject to cosmetics restrictions if it is sold for general skin care or cosmetic reasons without any medical claims. While it doesn't require the same clinical evidence as a medical device, this often entails making sure the product is safe to use on the skin.

Dietary Supplement: The product may be subject to dietary supplement laws if it is sold as a topical supplement that affects the body's systems (for example, by absorbing through the skin). In this situation, producers are required to make sure that the substances are generally recognised as safe (GRAS) and that their claims are supported by evidence.

2) FDA Regulations (U.S.)

The Food and Drug Administration (FDA) in the US has certain regulations that control the authorisation and control of goods that include *Cissus quadrangularis*:

New Dietary Ingredients (NDI): Supplements containing *Cissus quadrangularis* are widely available. The manufacturer is required to inform the FDA if a new dietary component is included in a new product formulation. This is to guarantee product safety before to sale.

Medical Devices: Under the Federal Food, Drug, and Cosmetic Act (FDCA), *Cissus quadrangularis* must abide by the FDA's Medical Device Regulations if it is used in a bandage and sold as a medical device (such as for wound healing or accident recovery). Depending on the claims made, manufacturers are required to file either

premarket approval (PMA) or premarket notifications (510(k)).

Cosmetics: The bandage may be subject to FDA Cosmetics Regulations if it makes claims about topical healing or skincare but not medical therapy. The FDA can take action against dangerous or mislabeled items, but it does not pre-approve cosmetics.

3) European Union Regulations

Guidelines for the regulation of herbal products in the EU are provided by the European Food Safety Authority (EFSA) and the European Medicines Agency (EMA).

Traditional Herbal therapeutic Products: The Traditional Herbal Medicinal Products Directive (THMPD), which offers a streamlined licensing procedure for well-established herbal medicines, may require clearance if *Cissus quadrangularis* is used in a therapeutic setting (such as facilitating healing).

Cosmetic Regulation: In order to ensure safety, labelling, and accurate ingredient listing, bandages sold as cosmetic items (such as for skin or injury rehabilitation) must adhere to Regulation (EC) No 1223/2009 on Cosmetic items.

Medical Devices: The bandage may be governed by the Medical Devices Regulation (MDR) if it is sold with therapeutic claims. It needs to fulfil certain standards for post-market surveillance, risk management, and clinical evaluation.

4) Claims and Advertising

Health Claims: Any assertions that *Cissus quadrangularis* in a bandage improves bone health, speeds up healing, or lowers

inflammation need to be supported by scientific data. Authorities such as the FDA, EFSA, or national consumer protection organisations may take regulatory action in response to false or deceptive statements.

Advertising Restrictions: Claims about health benefits or medical effectiveness must be approved in many areas. For instance, a bandage containing *Cissus quadrangularis* must go through a more stringent FDA clearance process before it can be used to treat particular medical disorders in the United States.

5) Safety and Toxicological Assessment

Toxicological Testing: To assess any negative impacts on human health, regulatory agencies frequently demand safety testing. This includes tests for skin irritation, allergies, and general toxicity, particularly if the substance is used for extended periods of time in close contact with the skin.

Quality Control: The purity, potency, and lack of impurities (such as pesticides and heavy metals) of the *Cissus quadrangularis* utilised in the bandage must all meet predetermined requirements.

6) Labeling and Packaging

Labelling standards: Depending on the category in which they fall (medical device, nutritional supplement, or cosmetic), bandages containing *Cissus quadrangularis* must meet certain labelling standards. The component list, any warnings or contraindications, and the intended usage should all be made clear on the label.

Packaging Standards: Particularly for medical devices, the packaging needs to

adhere to safety and hygienic requirements. Additionally, it should guarantee that the product stays functional until the end of its shelf life and avoid contamination.

7) International Considerations

Country-Specific Regulations: The laws governing cosmetics, medical devices, and herbal goods vary from one nation to another. For instance, *Cissus quadrangularis* is frequently used in traditional Indian medicine, and the Drugs and Cosmetics Act may regulate items that include it.

Import and Export Laws: Manufacturers must abide by the import and export laws of the country in which they are selling *Cissus quadrangularis* bandages. Certain nations may limit the importation of medical equipment or herbal items, demanding certificates or evidence of efficacy and safety.

11) Case Study

Cissus quadrangularis, also known as veld grape, bone setter, or saw plant, has been used for its therapeutic properties in bone and joint health. It enhances bone health, aids in fracture repair, and aids in injury recovery. The plant's regeneration properties make it suitable for topical administration or as part of a treatment plan, promoting healing when placed as a bandage.

1) Fracture Healing and Bone Regeneration

Case Study 1: Accelerated Fracture Healing in Rats

- Study explores *Cissus quadrangularis*' impact on fracture healing.
- *Cissus quadrangularis* extract used as bandage.
- Daily application of bandages monitored for healing progress.

Cissus Quadrangularis Treatment in Rats

- Faster healing rate observed in rats treated with *Cissus quadrangularis*.

- Histological analysis revealed improved tissue regeneration, calluse formation, and increased bone density.

- Promoted accelerated fracture healing through enhanced bone regeneration and tissue repair.

Conclusion:

The medicinal plant *Cissus quadrangularis*, which is frequently used in traditional medicine, has demonstrated encouraging promise in a number of therapeutic uses, such as as a component of bandages for tissue restoration and wound healing. The bioactive components of the plant, especially the flavonoids, terpenoids, and vitamins, have been investigated for their potential to assist tissue regeneration, encourage bone mending, and improve collagen synthesis. *Cissus quadrangularis* is a natural substitute for synthetic materials in bandages and can greatly enhance wound healing results. It is a useful supplement to contemporary wound care procedures because of its anti-inflammatory, analgesic, and antibacterial qualities.

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