Pueraria tuberosa (Vidarikanda): An Emerging Cosmeceutical Herb

Bhakti Rawtal[1], Neha Sahatpure[2], Satish Sakharwade[3]

Student[1], Student[2], Associate Professor[3]
Post-graduation Department of Cosmetic Technology,
L.A.D College Nagpur, India

***Abstract*: The skin benefitting potential of natural herbs along with their application into cosmetics are well known. The Herbs containing certain chemical constituents have proven therapeutical actions and can also be used as cosmeceuticals. This article highlights the potential chemical constituents of Vidarikand derived from Ayurveda and is bound to be a very effective form of herbal medicine. The pharmacological activity includes anti-inflammatory, anti-oxidative, anti-hypertensive, immuno-modulatory, wound healing, etc. With consideration of the properties from Ayurveda, this Herb is also said to possess constituents that may be beneficial for human skin. Thus, the importance of Vidarikand and its miraculous approaches to cosmetics has been covered in the article.**

***Index Terms:* Ayurveda, Anti-inflammatory, Cosmeceuticals, Skin benefitting, Vidarikand**

I. INTRODUCTION

The Science of Ayurveda deals with holistic healing of mankind, bringing it closer to nature and re-establishing the natural body constitution through herbal remedies. There are many herbs in Ayurveda which promotes skin wellness and some which delay the ageing process [1]. Thus, Vidarikand is one such herb which is widely used in herbal medicine and hence can be introduced into cosmetic preparations as a beneficial ingredient for rejuvenation of Skin.

TABLE NO.1: SYNONYMS OF PUERARIA TUBEROSA [2]

Sanskrit	**Ikshugnada**
Bengali	**Shimiya**
English	**Kudzu**
Hindi	**Vidarikand**
Marathi	**Bindree**
Gujarati	**Khakarvel**

Table no.2: SCIENTIFIC CLASSIFICATION:[3]

Kingdom	**Plantae**
Subkingdom	Trachebionta
Superdivision	Spermatophyta
Division	Magnoliophyta
Subclass	Rosidae
Order	Fabales
Family	Fabaceae
Genus	Pueraria DC.
Species	Pueraria tuberose

II. PHYSICAL FEATURES OF THE PLANT:

i. Root System:

It has a widely spread tuberous root system having a climbing ,coiling and gtrailing vine.The tuberous roots are white,starchy and have a sweet taste[1]. The young branches are grey pubescent.[2]

ii. Leaves:

The leaves resemble those of the plant Butea monosperma,commonly known as 'palash' in Hindi and hence named as 'Kandapalasha'[1]. The Leaf is pinnately trifoliolate with petiole 10-20 cm long. The leaflets are 12.5-20.0 cm long, 11.0-17.5 cm broad. The terminal leaflet broadly ovate, equal sided, acuminate. The lateral leaflet is ovate-oblong, very oblique, acuminate, silky pubescent below, glabrescent above, stipels small, stipules c. 5 mm long [2]

iii. Flowers:

The flowers are bluish or purplish in colour.[1]

iv. Seeds:

Seeds are densely pilose, hairs brown, and silky.[2]

Fig 1: Vidari roots

Fig 2: Vidari leaves

Fig 3: Vidari flowers

- **DISTRIBUTION:**

It is common in Central India and ascending up to 1300 m and also found in Hills of Western Himalayan region[4].

- **CLIMATE AND SOIL:**

The plant prefers sub-tropical climate, shade and warm humid conditions. It grows well in loam to sandy loam soil, rich in organic matter.[4]

- **CULTIVATION :**

For the cultivation of Pueraria tuberosa textured loam soil is best for the cultivation high moisture contents and partial shady areas a re suitable for its cultivation. Pre-soak the seed for 12 hours in warm water and sown in a warm greenhouse in early spring. Germin ation is take place within 2 weeks. Prick out the seedlings into individuals pots when they are large enough to handle and plant them out. Cover the young plants with a frame until growing well5. The yield of tubers is reported to be about 5–7.5tonns per hectare.[5]

OTHER SPECIES OF PUERARIA:

The genus pueraria is classified into 35 species depending upon geomorphologic factors. Among various Pueraria species, P. thunb ergiana, P. **lobata**, and P. thomsonii are distributed in Korea,Vietnam, China and northeastern provinces of Russia, P. Montana, Th ailand and Burma and Indian subcontinent respectively.[6]

- **PUERARIA THUNBERGIANA**

Pueraria thunbergiana, also known as the kudzu, is a species of climbing plant belonging to the Leguminosae family. The root an d flower of *P. thunbergiana*, used in traditional medicine, have various medicinal properties[7,8,9,10,]

The invention relates to a composition having anti-oxidant, anti-inflammatory, and skin whitening effects and containing a kudzu aerial part extract as an active ingredient. More specifically, the present invention relates to a composition which can promote anti -oxidant, anti-inflammatory, and skin whitening effects without side effects using natural materials[11].

Study done by EunByeol Han, *et al*[12] demonstrated anti-pigmentation effects of aerial part of *P. thunbergiana* by measuring me lanin content and through staining in the B16F10 melanoma cell line. The aerial part of *P. thunbergiana* decreased tyrosinase activ ity significantly in B16F10 cell cultures, while there is no direct effect on enzyme in cell-free conditions. To define the mechanism s, real-time PCR, western blot, glucosidase activity and antioxidant activity assay were implemented. As results, we demonstrated that aerial part of *P. thunbergiana* has anti-melanogenesis activity via two mechanisms. One is downgrading microphthalmia-asso ciated transcription factor by activating Akt/GSK-3β. Consequently, transcription of tyrosinase and tyrosinase-related protein 1 is

decreased. Another is interrupting maturation of tyrosinase through inhibiting α-glucosidase. Furthermore, aerial part of *P. thunbe rgiana* showed great efficacy on pigmentation in vivo. These results suggest that aerial part of *P. thunbergiana* can be used as an a nti-melanogenic agent[12].
Pueraria thunbergiana can be utilized based on the increase in demands for cosmetics, particularly natural products.

- **PUERARIA LOBATA**

Pueraria lobata is a climbing, deciduous perennial vine, native to eastern Asia. Its extract reportedly include isoflavones puerarin, daidzein and genistein[13], which have antioxidant properties[14,15]. It also consists of anti-inflammatory property. In addition, w e found that the extract from P. lobata promotes the expression of microphthalmia transcription factor (MITF) in vitro and prevent s hair graying in MITFvit/mi mice (Park, 2012, unpublished data). Considering that MITF is a master transcriptional regulator of melanocytes, and that oxidative stress may be associated with hair graying [16,17] the extract from P. lobata could potentially pre vent graying of hair in humans. Currently, there are no medicines proven to prevent gray[18].
Anti-oxidant and anti-inflammatory properties of this species can be used in skin care cosmetics and microphthalmia transcription factor can be used for hair care cosmetics.

III. TRADITIONAL USES:

The herb Vidari has been explored for the following purposes:

A) Its tuberous root, which is brown in color and slightly curved, is in clinical use for rejuvenation therapy[19].

B) The powder of vidari root-tubers are in clinical use as anti-aging and also as tonic, aphrodisiac, demulcent, lactagogue, purgativ e, cholagogue and also in scorpion sting.It is also useful in emaciation of children, debility and poor digestion[20,21].

C) It has been reported in for skin care, as anti-fertility[22].

D) One of its phytochemical, purerin, has been associated with anti-diabetic property[23].

E) It is also useful in emaciation of children, debility and poor digestion [19].

F) The herb is found to possess anti-hypoglycemic actitvity[24]

G It enters into the composition of compound of a compound decoction,which is nutritive, diuretic and expectorant ,and useful for fever and bronchitis[25].

H) Vidarikand possesses good cardio-protective properties[1].

I) Vidarikand has been reported for glowing skin to improve complexion[26].

J) P. tuberosa has shown to be an excellent fibrinolytic agent. Fibrinogen is an independent risk factor for coronary artery disease a nd stroke and its reduction by Indian Kudzu has been reported [27].

IV. CHEMICAL CONSTITUENTS:

1) Qualitative analysis:

TLC investigation of the roots of vidarikand extract Was carried out by Mithila Vijaykumar Amin1 *et al.* [28,29].Parameters like loss on drying, ash value, acid insoluble ash, water soluble extractive, alcohol soluble extractive Analysis of Physico-Chemical Pa rameters .The physico-chemical analysis revealed the following results. [Table 3]

TABLE NO 3: ANALYTICAL DATA OF PYSICO-CHEMICAL PARARMETERS OF VIDARIKAND POWDER

PARAMETER	RESULT
Loss on drying	9.15%
Ash value	3.88%
Acid insoluble ash	0.09%
Water soluble extractive	44%
Alcohol soluble extractive	13.6%

Qualitative tests for organic parameters like- reducing sugars monosaccharides, pentox sugars, hexose sugars, proteins, steroids, cardiac glycosides, anthroquine glycosides, saponin glycosides, cyanogenetic glycosides, coumarin glycosides, flavonoids, alkaloids and tannins were carried out [Table 4]

TABLE NO.4: CHEMICAL CONSTITUENTS OF VIDARIKAND

No.	Component	Tests	Result	
			Alcohol soluble extractives	Water soluble extractives
1	Carbohydrates	Mollish Test	Positive	Positive
2	Mono Saccharides	Barfoeds Test	Positive	Positive
3	Poly Saccharides	Iodine Test	Positive	Negative
4	Hexose Sugars	Selwinoffs Test	Positive	Positive
5	Steroids	Salkowskis Test	Positive	Positive
6	Alkaloids	Dragendroff Test	Positive	Positive
7	Anthraquinone glycosides	Modified Borntageners tests	Positive	Positive
8	Saponin	Foam test	Positive	Positive
9	Flavonoids	Lead Acetate Test	Positive	Positive

The major chemical constituents include flavones [C-glycoside (5,7,3',5'-tetrahydroxy-4'-methoxyflavone-3'-O-α-Lrhamnopyranosyl1→3-O-β-D-galactopyranoside)], Isoflavones (Puerarone), Coumstan (Tuberostan, Puerarostan) [30], Epoxychalcanol [Puetuberosanol], (3'-hydroxy-4'-phenoxy-α,β-epoxychalcan-α'ol)] [31], Pterocarpanoids [Hydroxytuberosin, Anhydroxytuberosin (3-O-methylanhydrotuberosin)] [32], and Tuberosin [33].

1. QUANTITATIVE ANALYSIS:

- **Antioxidant activity**

The antioxidant activities of vidarikand (*Pueraria tuberosa*)

Phenolic contents of ethanolic extracts of herbs were high compared to their aqueous extracts. The ethanolic extracts showed more antioxidant activity (β-carotene–linoleic acid model system) than their aqueous counterparts. In DPPH system also, ethanolic extracts were superior to that of aqueous extracts. The ethanolic extracts of the herbs were more effective in preventing the development of the peroxide value .

Total phenolic content of herb extracts were analyzed by Folin Ciocalteu method [34]. 400 µl of appropriately diluted sample was taken in a test tube. 2,000 µl of diluted Folin-Ciocalteu's reagent was added to it and mixed with vortex mixer. After 3 minutes 1,600 µl of sodium carbonate solution was added and incubated under dark at room temperature for 30 min. For blank preparation 400 µl of distilled water was taken instead of sample. Absorbance of the samples was measured against blank at 765 nm using Ultraviolet–visible spectrophotometer (Beckman Coulter DU 720, USA)[35].

According to research, the quantitative analysis of vidarikand led to the following quantitative results:

TABLE NO 5: The quantitative analysis of vidarikand

Herb extracts	Phenolic content (mg of GAE/g)	Antioxidant activities at 200 ppm Concentration	% Inhibition at 200 ppm Concentration
Vidarikand ethanolic	44.8 ± 0.14	86.0 ± 0.13	72.8 ± 0.34
Vidarikand aqueous	24.9 ± 0.18	84.4 ± 0.18	51.1 ± 0.44

P. tuberosa were sequentially extracted using the range of solvents like hexane, benzene, chloroform, ethyl acetate, acetone and methanol. The phytochemical analysis revealed the presence of significant amount of total antioxidants, phenolic acids and flavonoids in the P. tuberosa tuber extract. Among the different solvent extracts, ethyl acetate and chloroform extracts possessed maximum total

antioxidants, whereas methanol and acetone extracts showed maximum flavonoid and phenolic compounds.Experiment was carried out by M.R. Aruna1 *Et Al.*[36]

TABLE NO 6: Phytochemical analysis of P. tuberosa tuber extracts:

Solvent	Bioactive compounds		
	Total antioxidant (mg/g)	Total flavonoid (µg/g)	Total phenolic compound (µg/g)
Hexane	1.93±0.153	105.66±5.132	103.67±4.042
Benzene	2.47±0.153	123±3.606	253.33±3.512
Chloroform	7.77±0.025	272.333±2.517	102.67±3.055
Ethyl acetate	8.14±0.025	372.33±2.517	600.33±0.577
Acetone	0.95±0.035	580.33±2.517	350.33±0.577
Methanol	1.33±0.306	873.33±4.163	906.67±2.082

- **Antimicrobial acitivity**

Antimicrobial and chemical properties of petroleum ether, ethyl acetate and ethanol extracts of Pueraria tuberosa were evaluated by Venkata Ratnam, *et al.* Among the test samples ethyl acetate extract showed pronounced antimicrobial activity, while ethanol extract exhibited the least activity and petroleum ether extract failed to inhibit the test pathogens. Preliminary phytochemical analysis of extracts revealed the presence of antimicrobial compounds such as alkaloids, flavonoids, coumarins, volatile oils and glycosides. The phenolic compounds and flavonoids were abundant in ethyl acetate extract when compared to other extracts. The broad spectrum of antimicrobial activity of ethyl acetate extract may be due to the presence of flavonoids. Based on the observations, P. tuberosa appears to be a valuable source for antimicrobial principles.[37]

The antimicrobial activity of different solvent extracts of P. tuberosa tubers was evaluated against selected bacterial and fungal pathogens by M.R. Aruna1 *et al.* The bacterial strains showed higher susceptible range over the fungal isolates. The findings of the present investigation revealed that the candidate plant could be further explored for possible antibiotic and antifungal agents and provides preliminary scientific validation of the traditional medicinal use of this plant.[36] result of the study is shown in(table 7).

TABLE NO 7: Antimicrobial properties of P. tuberosa tuber extracts

Test organisms	Solvent extracts/ Zone of inhibition (mm)					
	Hexane	Benzene	Chloroform	Ethylacetate	Acetone	Methanol
C. parapsilosis					9.0±0.0	
C. albicans	8.27±0.252				7.17±0.208	8.43±0.153
C. tropicalis			8.33±0.252			
E. coli	9.17±0.208		9.3±0.2	11.3±0.2	10.3±0.2	10.0±0.0
K.pneumoniae	10.3±0.3	10±0		9.17±0.208	11.43±0.153	
M. luteus	11.3±0.265	11.17±0.208	10.43±0.153	13.3±0.252	9.1±0.58	11.27±0.252
P. vulgaris	10.1±0.581			11.37±0.321	10.0±0.0	9.45±0.351
P. aeruginosa	8.3±0.3	11.27±0.306		9.46±2.347	13.45±0.351	9.1±0.581
S. typhi				8.45±0.351	9.46±0.437	
S. boydii	11.23±0.208	9.23±0.252	9.23±0.245	10.46±2.347	11.13±0.367	10.37±0.32
S. aureus	10±0	9±0.0		8.37±0.321	12.62±0.141	
V. cholera		9.3±0.3	8.56±0.343	11.17±0.208	10.25±0.345	9.25±0.351

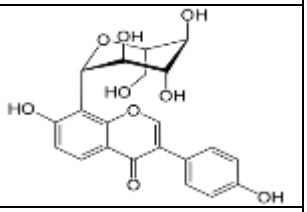
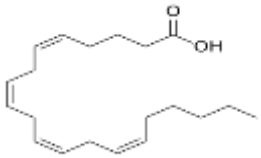
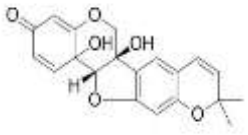
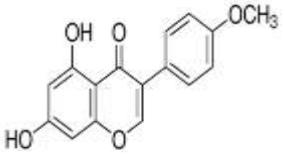
- **Wound healing and anti-inflammatory activity**

In a study Pueraria tuberosa extracts were screened for wound-healing activity by excision and incision wound model and Anti-inflammatory activity by rat paw edema method. The Pueraria tuberosa showed significant wound healing activity and anti-inflammatory activity compared to that of control and standard drugs Nitrofurazone ointment and ibuprofen respectively[38,5].

V. VIDARIKAND FOR COSMETIC USES:

The tuber of the plant has been scientifically explored for management/treatment of various diseases (table no.8) [39]. Study done by Maji AK, Pandit S, *et al* . carried out phytochemical and therapeutic potential also provides plausible hypotheses about how various isoflavones particularly puerarin, genistein and daidzein, individually or collectively, may be responsible for the therapeutic potential against a wide range of ailments[40].

TABLE NO: 8 Reported pharmacological activities and chemical constituents of tubers of P. tuberosa.

Activity	Constituents	Structure
anti-oxidant	Puerarin	
Antimicrobial activity	Eicosanoic acid	
Wound-healing activity	Hydroxytuberosone	
Anti-inflammatory activity	Biochanin A	

i) Vidarikand as an ingredient in skin care:

Vidarikand is a potential anti-oxidant as Puerarin and may be used in skin care products such as:

- Anti-wrinkle products
- Anti-ageing products
- Dark circle control products

It is also helpful in skin rejuvenation hence may be used in:

- Moisturizing products
- Blemish control products
- Skin lightening products

It has anti-inflammatory properties hence may be used as in:

- Anti-septic products.
- Antiacne products

ii) Vidarikand as an ingredient for hair care:

Vidarikand is a natural tonic and may be used in hair care products as follows:

- It has cooling properties hence may be used in hair oils
- Also it is beneficial in preventing dryness and hence may be added to hair shampoos as an anti-dandruff agent.
- Also could be used in hair tonics and hair serums.

VI. ADVERSE EFFECTS OR TOXICITY OF VIDARIKAND:

As such no severe toxicity or side effects have been found for vidarikand but the Herb in some cases is associated with nausea,headache, and fever.It might slow blood clotting. Also said to interfere with cardiovascular treatments.Excessive consumption is reported to cause Kidney damage.

VII. DISCUSSION AND CONCLUSION:

The herb vidarikand as associated with ayurveda for body wellness is thus found to connect potentially on cosmetic grounds for their uses in skin care. The satisafactory amount of phytochemical agents makes it an ideal natural ingredient for use in cosmetic products. It is certainly beneficial to be used as a an alternative to chemical ingredients.This herb can be researched more for its inner blend of bioactives and examine their nature and hence bring to forefront the magical constituents that may be extremely useful for human skin. Thus,Vidarikand is found to be suitable for use in cosmetic products .

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