PI-100-08

INKAMATICO

Rev 1: July 11th, 2014

INKA MATICO is a unique Natural Ingredient, preservative free, organic certifiable, obtained from selected leaves of *Piper aduncum* (matico), native plant to Peru with a **millenary tradition** of use to clean the skin of impurities, as skin protector, to healing wounds, as an antiseptic, astringent, and to treat skin problems.

INCI Denomination: **Propanediol (and) Water (and) Piper Angustifolium Leaf Extract**

Description of the plant:

Family: Piperaceae

Botanical name: *Piper aduncum*

Synonyms: *Arthante adunca* Miq., *Piper celtidifolium* Kunth., *Piper elongatum* Vahl.

Other names: soldier's herb, condorcillo, matico, mocco mocco, moho moho (Peru); condorcillo negro, anisillo, potoima rao (which means remedy for indigestion), guayayo, gusanillo, mucumucu, pepper of hooky fruit, black santa maria, shiatani; falso jaborandi; aperta-ruao, longa pepper, or bamboo piper

Matico is a shrub up to 5 meters high; the stem is green, knotty, and branched; leaves are alternate, petiolated and simple; axillary or terminal inflorescences in spikes of up to 15 cm. Small flowers with a characteristic odor[1]. All parts of the plant have a pepper odor.[2]

Distribution:

Matico is native to the Caribbean, but it adapts to the entire tropic. In America, it grows in humid soils from Guatemala to Brazil; it is generally found in places where the climate is mild tropical, but it easily adapts to any climate. It is found up to an altitude of 1200 meters above sea level. It is a pioneer species of the secondary forest.

[1] BRACK EGG, (1999), pages 391-392

[2] TOPUL R. et al. (2007)

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In Peru, it grows in the coast, the highlands and the Amazon Rainforest up to 3000 meters above sea level as wild and cultivated shrub or tree[3].

Traditional uses:

Chronicles tell that when Francisco Pizarro was settling in Peru, one of his soldiers had a wound in the leg caused by an arrow he had received in Panama. The wound did not heal with any remedy or maneuver that had been recommended by the Spanish barber-surgeons that accompanied the conqueror and the poor soldier suffered long months with the fateful wound. Rumor has it that when they were passing by an indigenous village, a local healer promised to cure him. He pulled up some leaves from a nearby shrub, made a mush, placed it over the wound and a few days later the soldier was cured. The soldier's last name was Matico and thus the name whereby the "soldier's herb" is known.

The traditional uses of the Matico leaves are very diverse:

For cleansing the skin, curing or healing wounds and ulcers as hemostatic and antiseptic; astringent; decongestant in colds, influenza; anti-inflammatory in rheumatism; antiseptic in diseases of the genital-urinary apparatus.

Traditional medicine uses the Matico leaves in infusion, ground or crushed, in steam bath or applied directly over the wounds; whole or in powder. The root, on the other hand, is used in Brazil for snake bite and for the relief of sunstroke.[4,5, 6, 7, 8]

[3] BRACK EGG, (1999)
[4] BERTRAND (1995)
[5] MORS W. et al. (2000)
[6] LORENZI H., MATOS F., (2002)
[7] DEFILIPPS R. MAINA S. , CREPIN J., http://www.mnh.si.edu/biodiversity/bdg/medicinal
[8] CLARK, A. et al. (1998)

Phytochemicals:

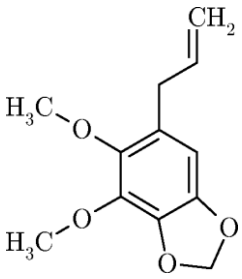

Fig 1: Dillapiol

The leaves have a high content of essential oil, which complex composition has been widely studied and shows different profiles in different parts of the world; several results agree that the oil is composed mainly by mono and sesquiterpenes, with high concentration of dillapiol: 31.5 – 97.3% in samples taken in the Amazon Rainforest, 64.5% in Malaysia, 58.0% in Fiji, 82.2% in Cuba, 72% in Brazil[9, 10]. However, other studies indicate different major components: 8-cineole (40%) in Bolivia, sesquiterpenes such as caryophyllene and aromadendreno in Panama; thus, it is deduced that the composition depends largely on the geographical origin of the material or that the Matico shows different chemotypes.

Other secondary metabolites identified in the methanolic extract of the plant, and that explain its antileishmanial and antifungal activity include: alkaloids, sterols, tannins, flavonoids, and anthraquinones[11].

Bioactivity:

The raw extract in dichloromethane of Matico leaves showed antibacterial activity against Bacillus subtilis, Micrococcus luteus, Escherichia coli, as well as cytotoxic activity against nasopharyngeal carcinoma cells[12].

The essential oil of Matico rich in dillapiol has shown antifungal activity against dermatophytes and phytopathogens[13]; additionally, it contains insecticide, molluscicide and antibacterial properties[14].

Likewise, the 2',6'-Dihydroxy-4'-methoxychalcone, isolated from the inflorescence of P. aduncum, has proven effectiveness against Leishmania amazonensis, a disfiguring disease that may be fatal[15].

[9] TOPUL R. , idem
[10] DA SILVA PINTO A. et al.(2007)
[11] BRAGA F. G. et al. (2007)
[12] ORJALA J., WRIGHT A. (I994)
[13] GUERRINIA A. et al. (2009)
[14] POHLIT, A.M. (2009)

The metabolic extract of the plant showed activity against Leishmania (L. amazonensis) and antifungal activity against Candida albicans and Cryptococcus neoformans. The biological activity of the extract was also attributed to the presence of other secondary metabolites[16].

COSMETIC BENEFIT:

SKIN PROTECTION

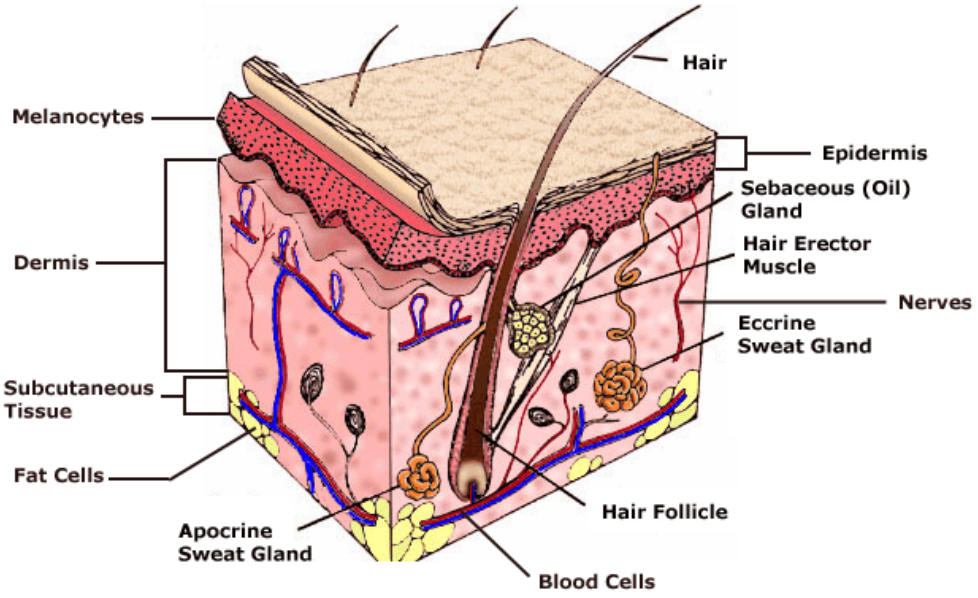

Fig 2: The structure of the skin

The skin makes up a set that comprises several integrated layers, from the superficial layer, epidermis, to the deepest layers, dermis and hypodermis, each one having specific properties that allow them to react and adapt themselves to the environmental conditions.

The **epidermis**, composed mainly of keratinocytes (90% of epidermal cells), of melanocytes (2 to 3% of epidermal cells) and of Langerhans cells, has a variable width according to the different parts of the body. Since it makes up the external layer of the skin, the epidermis plays a fundamental role to ensure the protection and maintenance

[15] TOPUL R. et al. (2007)
[16] BRAGA F. G. et al. (2007)

of good trophicity. This is why many formulations are focused to protect it and improve its functions, especially to reinforce its elasticity and firmness.

Studies carried out on skin using the extract of Matico as additive to a soap formulation concluded that it had a protective effect on the skin since it favored the keratinization at a level of the superficial stratum of the epidermis, the corneum stratum[17].

COLLAGEN PROTECTION

Eighty percent of skin dry weight is collagen which is responsible for the tensile strength of the skin. A collagen molecule consists of three polypeptide chains, each containing about 1,000 amino acids in its primary sequence. In each collagen molecule the α-chains are wrapped around each other to make a triple helical conformation.

Chronologically aged skin shows a decrease in all of the following characteristics: collagen solubility, the rate of collagen synthesis, the activity of enzymes and the thickness of collagen fibers.

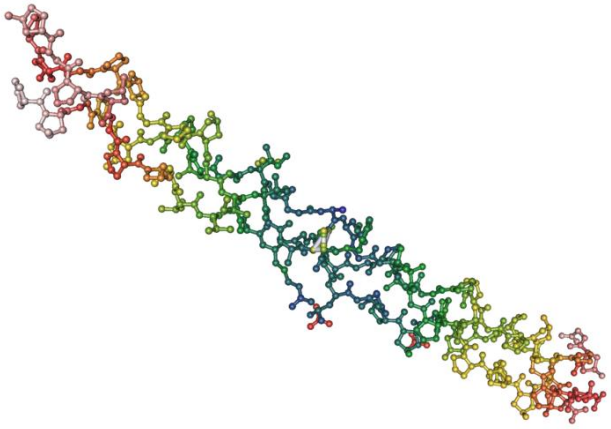

Fig 3: Collagen triple helix

Elasticity is due to the elastin fiber network making up 2–4% of the ECM and glycoaminoglycans (GAG's) are involved in the hydration of the skin. Collagen fibres, elastin fibres and GAGs are produced by fibroblasts and are primarily affected by photoageing resulting in visible changes in the skin such as wrinkles, pigmentation and changes in thickness.

[17] ARROYO J. et al. (2003)

INKA MATICO has shown a protective action against collagen degradation, preventing tissue damaging and therefore sustaining skin plenitude.

EFFICACY TESTS

Reducing Power

The reducing capacity of a compound may serve as a significant indicator of its potential antioxidant activity. However, the activities of antioxidants have been attributed to various mechanisms such as prevention of chain initiation, decomposition of peroxides, reducing capacity and radical scavenging. As shown in figure 4, the reducing power of INKA MATICO was compared with the standard L- ascorbic acid and found to be similar. The reducing potential of the INKA MATICOwas measured in its capacity to reduce the ion Fe^{3+} by the method of Hazra et al[18].

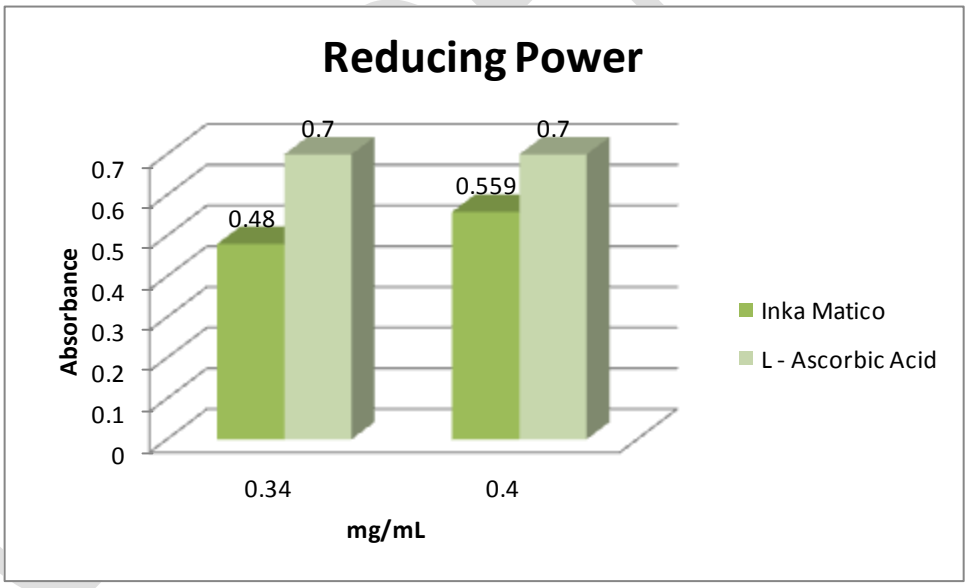

Fig 4: INKA MATICO Reducing Power compared to L-ascorbic acid

It is observed that from concentrations of 0.34 mg/mL, the reducing activity of INKA MATICO is comparable to the one of L-ascorbic acid.

[18] Hazra B. et al., (2008)

ANTI - COLLAGENASE ACTIVITY

Collagenase from the bacteria*Clostridium histolyticum* (ChC) degrades Extracellular Matrix. This bacterial collagenase hydrolyses triple-helical collagen in both physiological conditions and *in vitro* conditions using synthetic peptides as substrates. In this study ChC was used to test INKA MATICO for anti-collagenase activity.

The assay employed was based on spectrophotometric methods according Thring et al[19]. Collagenase from *Clostridium histolyticum* was dissolved in buffer and the synthetic substrate *N*-[3-(2-furyl) acryloyl]-Leu-Gly-Pro-Ala (FALGPA) was dissolved in Tricine buffer to 2 mM. EGCG (epigallocatechin gallate), 250 µM (0.114 mg/mL) was used as a positive control.

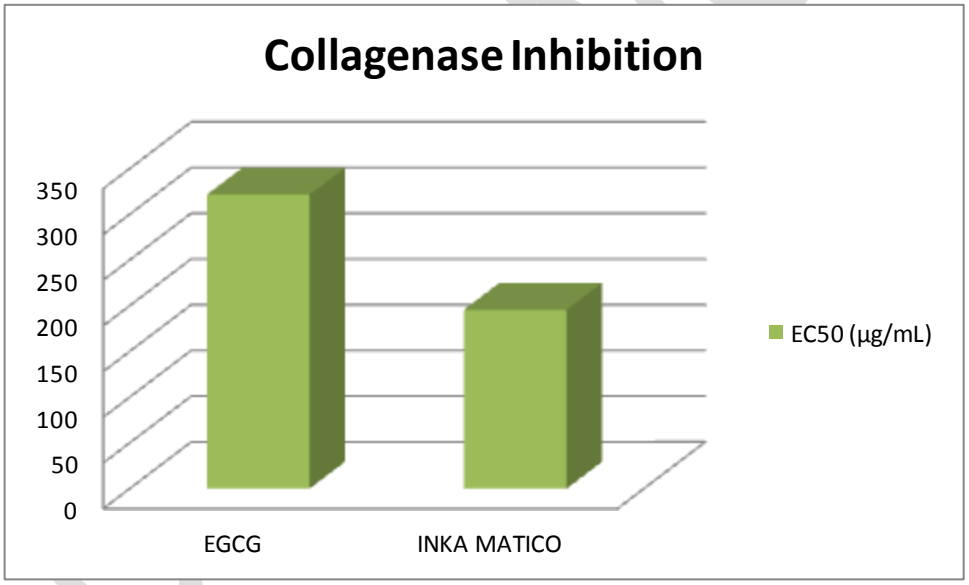

Fig 5: Collagenase Assay for INKA MATICO

The results of the analysis demonstrate an activity that is 65% higher than the control.

Very high anti-collagenase activity was exhibited by INKA MATICO with an IC50 of 195.56 ± 3.87, more over its activity is 65% higher than the one of the positive control EGCG with an IC50 of 321.41 ± 10.65.

[19] Thring T et al.(2009)

CONCLUSIONS

The Efficacy Tests have confirmed the **Traditional Use of INKA MATICO** to repair and protect the skin from external attacks. Since it contains an important **antioxidant power**, fights against free radicals which cause premature aging of the skin. Additionally shows a very important activity in the **protection and prevention of the degradation of collagen fibers**.

INKA MATICO is recommended for:

- Anti-aging products for the face, neck and for body care
- Products for men's personal care
- After sun products

Dose of use – Solubility – Preparation

INKA MATICO is a NON GENETICALLY MODIFIED ingredient to be used in cosmetic formulations.

A. DOSE OF USE: From 1 to 5 %.

B. SOLUBILITY: Water-soluble.

C. PREPARATION:

The INKA MATICO of 3QP is a product sensitive to light, humidity and contact with iron. Preferably, it will be incorporated in the preparations at the end of the manufacturing process and below 35°C.

Analytical Information (preliminary)

Aspect:	Homogeneous liquid
Odor:	Characteristic
Color:	Amber – dark amber
Solubility in water:	Soluble

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pH (20°C):	4.5 – 6.5
Specific gravity, 20°C:	1.035 – 1.045

PRESERVATIVES: None

MICROBIOLOGY:

Total aerobic mesophilic count:	≤ 1000 ufc/ml
Total fungi and yeast count:	≤ 100 ufc/ml
Pathogens:	Absence

PRESERVATION: Store in airtight container, protected from light and humidity, at 15°-25°C. Keep package tightly close.

If the original container is opened, it should be handled with special care in order to avoid a secondary microbiological contamination.

We provide our best knowledge about the subject; however, the formulator will have the responsibility to ensure the stability of the formulation by performing the necessary tests.

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