



## Overview of Skin Lightening Formulations in Ayurveda W.S.R to Kanaka Taila

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**ABSTRACT:** The notion of “Fair is beautiful” is well established beauty ideal in Indian society. Skin-lightening products are commercially available for cosmetic purposes to obtain lighter skin complexion. In the present times, natural products are more in demand than their synthetic counterparts. There are numerous *Varnya* formulations scattered throughout the Ayurvedic texts, one such formulation is *Kanaka Taila*. Formulation of *Kanaka Taila* includes decoction of *Yasthimadhu* (*Glycyrrhiza glabra*), *Tila taila* (*Sesamum indicum*) and paste of *Priyangu* (*Callicarpa macrophylla*), *Manjistha* (*Rubia cordifolia*), *Utapala* (*Nymphaea stellata*) and *Nagkesara* (*Messua ferrae*). The present review is undertaken for screening various *varnya* formulations in classical texts of Ayurveda and also to highlight the skin lightening action of *Kanaka Taila* by analysing its ingredients critically.

**KEYWORDS** - Kanaka Taila, Skin lightening, Varnya formulations, Tyrosinase inhibition

### INTRODUCTION

The pursuit of beauty is universal, and being beautiful is coveted highly in the world. Early in our lives, the notions that “beautiful is good” is deep rooted in our minds and creates a fascinating desire to pursue beauty not just to look beautiful but also to be good in most aspects of life.<sup>1-2</sup> Since decades, a fair complexion is a desirable component and indigenous criteria for beauty.

In the recent years, consumer trends suggest a gradual shift from chemical-based products to Ayurvedic beauty products, mainly due to the general sense that natural compounds are safe<sup>3</sup>.

Complexion and colour in *Ayurveda* are referred to as *Varna*. As per Charak Samhita, *Varna* represents not only colour but all the parameters for healthy and radiant skin. As per Sharma K et al., 2015, the herbs which alleviate pitta, rakta in general either acting through their rasa, vipāka or prabhāva are considered as *Varnya*<sup>4</sup>. Various *varnya* or skin lightening formulations in classical texts and critical review of ingredients of *Kanaka Taila* to show *Varnya* property have been compiled from Ayurvedic books as well as from articles available on internet to justify their skin lightening properties.

## **MECHANISM OF SKIN LIGHTENING**

Skin whitening, also called skin lightening or skin bleaching, is the practice of using chemical substances in an attempt to lighten the skin or provide an even skin color.<sup>5</sup> The key determinant of human skin color is melanin pigment produced by the melanocyte, found in the epidermal basal layer<sup>6</sup>. Two types of melanin are synthesized in a human body: the black to brown Eumelanin and the yellow to reddish Pheomelanin<sup>7</sup>. Skin becomes dark when melanin content increases. It is protein in nature and it is synthesized from the amino acid tyrosine via dihydroxyphenylalanine (DOPA)<sup>6</sup>.

There are several possible mechanisms of action in skin lightening such as Inhibition of the activity of tyrosinase<sup>8</sup>, Inhibition of the expression or activation of tyrosinase<sup>9</sup>, Downregulation of MITF<sup>10</sup>, scavenging of the intermediate products of melanin synthesis<sup>11</sup>, Interference with the transfer of melanosomes to keratinocytes<sup>12</sup>, direct destruction of existing melanin<sup>11</sup>, destroying melanocytes.

The rate controlling enzyme for melanin formation is tyrosinase (TYR) which is responsible for several oxidative steps in the synthesis of melanin<sup>13</sup>. Microphthalmia-associated transcription factor (MITF) is the master transcription factor that controls the expression of TYR, Tyrosinase relating protein (TRP1) and many other important proteins involved in the function of melanocytes<sup>14</sup>. Downregulation of MITF decreases melanogenesis and is a mechanism of action of some skin whitening agents<sup>15</sup>. MC1R is also an important target for the regulation of melanogenesis<sup>16</sup>. The melanocortin 1 receptor (MC1R) is a transmembrane and G-protein coupled receptor expressed in melanocytes<sup>17</sup>. Agonism of MC1R increases the ratio of eumelanin to pheomelanin and increases the generation of melanin overall<sup>18</sup>. Alpha-melanocyte stimulating hormone ( $\alpha$ -MSH), beta-melanocyte stimulating hormone ( $\beta$ -MSH), and adrenocorticotrophic hormone are endogenous agonists of MC1R<sup>19</sup>.

The transfer of melanosomes to keratinocytes is a necessary condition for the visible pigmentation of the skin<sup>20</sup>. A new mechanism for the transfer of melanosomes has been reported in which pigment globules containing multiple melanosomes are released into the extracellular space from melanocytes and are then ingested by keratinocytes<sup>21</sup>. Blocking this transfer is a mechanism of action of some skin whitening agents such as nicotinamide and soyabean<sup>22</sup>. The protease-activated receptor 2 (PAR2) is a transmembrane and G-protein coupled receptor expressed in keratinocytes and involved in melanocyte transfer<sup>23</sup>. Antagonists of PAR2 inhibit the transfer of melanosomes and have skin whitening affects, while agonists of PAR2 have the opposite effect<sup>24</sup>. Other than tyrosinase inhibitors, Anti-oxidants and flavonoids directly or indirectly serve as skin lightening ingredients<sup>25</sup>.

The idea behind using antioxidants for skin-lightening activities lies in the hypothesis that the oxidative effect of UV-irradiation contributes to activation of melanogenesis<sup>26</sup>. UV irradiation can produce reactive oxygen species (ROS) in the skin that may induce melanogenesis by activating tyrosinase as the enzyme prefers superoxide anion radical (O<sub>2</sub><sup>-</sup>) over O<sub>2</sub><sup>27</sup>. Antioxidants has been reported to reduce the direct photooxidation of pre-existing melanin. Common antioxidants used in skin-lightening formulations are vitamin E, vitamin C and vitamin B<sup>28</sup>.

A number of flavonoids are frequently used in skin-lightening preparations such as aloesin, hydroxystilbene derivates and licorice extracts. The main action behind the pigment reducing effect of flavonoids may be the ROS-scavenging properties and the ability to chelate metals at the active site of metalloenzymes<sup>29</sup>. Flavonoid of licorice extract, more specifically glabridin, has been shown to inhibit tyrosinase activity in B16 murine melanoma cells<sup>28</sup>.

Tyrosinase inhibition is the most widely reported screening method till date for skin-lightening. Many tyrosinase inhibitors such as hydroquinone, arbutin, kojic acid, ellagic acid, tranexamic acid has been used as skin-whitening agents, with certain drawbacks including contact dermatitis, irritation, transient erythema, burning, prickling sensation, leukoderma and ochronosis<sup>29</sup>.

As per *J. M. Gillbro and M. J. Olsson*, 2010 other potential mechanistic targets for control of human pigmentation have been proposed such as control of glutaminergic / adrenergic signalling, sex hormones and regulation of tetrahydrobiopterin<sup>22</sup>.

### Documentation in Texts

The Ayurvedic textual references of *Varnya* formulations compiled from various ayurvedic texts are as follows:

**Table 1- Skin Lightening Formulation in Classical Texts of Ayurveda**

| S.No | Name of Formulations                     | Ingredients   | Book Reference               |
|------|--|---|------------------------------|
| 1    | Twakasavarnikaran <sup>30</sup><br>Yoga  | Kaliyak, Agar, Amrasthi,<br>Nagakeshar, Kanta (Manjistha),<br>Rasottam (Parad)  | Cha.Chi. 25                  |
| 2    | Varnakarlepa <sup>30</sup>               | Dhyamak, Lakha of<br>Pippal, Vatamula, lahi, Geru,<br>nagkesar, Amritasanga, Kasis  | Cha.Chi. 25                  |
| 3    | Punarnavadya udvartan <sup>31</sup>      | Sweta punarnava moola, Sarpakshi<br>moola   | Rasratna<br>sammuchaya       |
| 4    | Manjisthadi lepa <sup>32</sup>           | Haridra, Daruharidra, Manjistha,<br>Sweta sarshapa, Gairika   | Rasratna<br>sammuchaya       |
| 5    | Raktachandanadi lepa <sup>33,34</sup>    | Raktachandan, Manjistha, Kushta,<br>Lodhra, Priyangu, Vatankura,<br>Masura  | Chakradatta,<br>Sharangdhara |
| 6    | Matulungadi lepa <sup>33</sup>           | Masura  | Chakradatta                  |
| 7    | Jatiphalkalka Lepa <sup>33</sup>         | Jatiphala   | Chakradatta                  |
| 8    | Kaliyakadi Lepa <sup>33</sup>            | Kaliyak, Neel utpala, Dadhi,<br>Badarasthi  | Chakradatta                  |
| 9    | Sarpunkadi lepa <sup>33</sup>            | Dadhi, Sarpunkha, Kuval, Neel<br>utpala, Kushta, Chandan, Ushira  | Chakradatta                  |
| 10   | Haridradya Taila <sup>35</sup>           | Haridra, Daruharidra, Madhuka,<br>Kaliyaka, Kuchandan,<br>Prapaundarika, Manjistha, Padma,<br>Kunkuma, leaves of Kappitha,<br>Plaksha & Vat | Chakradatta                  |
| 11   | Manjisthadya Tailam <sup>35</sup>        | Manjistha, Madhuka, laksha,<br>matulunga  | Chakradatta                  |
| 12   | Kumkumadya Tailam <sup>35</sup>          | Kunkum, Chandan, Laksha,<br>Manjistha, Madhuyasthi, Kaliyaka,<br>Ushira, Padmaka, Nilotpala,<br>Nyagrodha, plaksha                          | Chakradatta                  |
| 13   | Panchang Kumkumadya <sup>36</sup> Tailam | Kunkum, Chandan, Laksha,<br>Manjistha, Madhuyasthi  | Chakradatta                  |
| 14   | Varnak Ghritam <sup>36</sup>             | Madhuka, Chandan, Priyangu,<br>Sarsap, Padmaka, Kaliyaka,<br>Haridra, Lodhra, Kunkuma   | Chakradatta                  |

|    |                                      |   |                              |
|----|--------------------------------------|---|------------------------------|
| 15 | Kanaka Taila <sup>35</sup>           | Madhuka, Tila taila, Priyangu, Manjistha, Rakta Chandan, Utpala & Nagakesra | Chakradatta                  |
| 16 | Kumkumadi ghritam <sup>37</sup>      | Kunkum, Nisha, Daruhaldi, Pippali   | Bhaishajya Ratnavali         |
| 17 | Shalmali Katakadi lepa <sup>38</sup> | Shalmali  | Bharat Bhaishajya Ratnakar-5 |

### Kanaka Taila

*Kanaka Taila* is a medicated herbal oil mentioned in *Kshudraroga adhikar* in the text *Chakradatta* (11<sup>th</sup> century). It is useful in removing skin scars and hyperpigmentation on the face and it is also known to improve lusture on face<sup>35</sup>. The same formulation has been mentioned in the texts *Gadanigraha*<sup>39</sup>(12<sup>th</sup> century) and *Bhaishajya Ratnavali*<sup>40</sup> (18<sup>th</sup> century).

**Table 2- Ingredients of Kanak Taila<sup>41-42</sup>**

| S.No | Ingredients   | Phyto-Chemical Constituents                          | Part Use   |
|------|---|--|------------|
| 1    | <i>Madhuka</i><br>( <i>Glycyrrhiza glabra</i> )           | Glycyrrhizine, Licogrone, Glyzaglabrin, Asparagine,  | Root       |
| 2    | <i>Tila taila</i><br>( <i>Sesamum indicum</i> )           | Sesamine, Sesamaline                                 | Oil        |
| 3    | <i>Priyangu</i><br>( <i>Callicarpa macrophylla</i> )      | Tetracyclic diterpenes, Oleanolic Acid, Terpenes,    | Flower     |
| 4    | <i>Manjistha</i><br>( <i>Rubia cordifolia</i> )           | Purpurin, Xanthopurpurin, Ruberythric Acid, Mollugin | Stem       |
| 5    | <i>Rakta candana</i><br>( <i>Pterocarpus santalinus</i> ) | Santalin A & B, Isopterocarpone                      | Heart wood |
| 6    | <i>Utpala</i><br>( <i>Nymphaea stellata</i> )             | Nymphayol, Gallic Acid, Quercetin                    | Flower     |
| 7    | <i>Naga kesara</i><br>( <i>Messua ferrea</i> )            | Mesuanic Acid, Alpha & Beta Amyrin                   | Stamens    |

**Table 3- Properties of ingredients of *Kanka Taila* in database of CCRAS<sup>43-48</sup>**

| S.No. | INGREDIENTS       | RASA                   | GUNA          | VIRYA  | VIPAKA  | KARMA                               |
|-------|-------------------|------------------------|---------------|--------|---------|-------------------------------------|
| 1     | <i>Madhuka</i>    | Madhura                | Guru, Snigdha | Sheeta | Madhura | Varnya, Kandughana, Charma rogahara |
| 2     | <i>Tila Taila</i> | Madhura                | Guru, Snigdha | Ushna  | Madhura | Twak Snehan                         |
| 3     | <i>Priyangu</i>   | Tikta, Kasaya, Madhura | Guru, Ruksha  | Sheeta | Katu    | Charma rogahara                     |

|   |                       |                        |                         |        |         |                     |
|---|-----------------------|------------------------|-------------------------|--------|---------|---------------------|
| 4 | <i>Manjistha</i>      | Tikta, Kasaya, Madhura | Guru, Ruksha            | Ushna  | Katu    | Varnya, Kusthaghana |
| 5 | <i>Rakta chandana</i> | Tikta, Madhura         | Guru, Ruksha            | Sheeta | Katu    | Charma rogahara     |
| 6 | <i>Utpala</i>         | Madhura, Kasaya, Tikta | Laghu, Snigdha, Picchil | Sheeta | Madhura | Varnya              |
| 7 | <i>Naga kesara</i>    | Kasaya, Tikta          | Laghu, Ruksha           | Ushna  | Katu    | Kusthaghana         |

#### **MADHUKA (*Glycyrrhiza glabra*)**

It has a plethora of names such as *mulaithi*, *yashtimadhu*, licorice, sweet wood. Yastimadhu is quoted as *Balavarna krut* in *Bhavprakash Nighantu*<sup>49</sup>. As per *Charak Samhita*, *madhuka* is a part of *Varnya Mahakashaya*<sup>50</sup>.

As per *Saeedi et al.* (2003) liquorice extract is used mainly for skin eruptions, including dermatitis, eczema, pruritus, and cysts due to its anti-inflammatory and anti-irritant properties<sup>51,52</sup>. The active ingredients found to have tyrosinase inhibiting activity are glabridin, glabrene, isoliquiritigenin, licochalcone A, and liquiritin<sup>53</sup>. As per *Castangia et al.* (2015), the topical application of liquorice extract formulations showed high antioxidant activity, prevents oxidative stress damage and maintains the skin homeostasis<sup>54</sup>. So it may be useful in cosmetic products. Methanolic extract of licorice has been reported to inhibit tyrosinase activity by up to 50% in a vitro experiment<sup>55</sup>. Ethanolic extract of licorice helped in effective hydration of skin<sup>55</sup>. Also, Glycyrrhizetic acid found in *G.glabra* controls the secretion of melanin in skin and reduces dark pigmentation, thereby making the complexion fairer<sup>4</sup>.

#### **TILA TAILA (*Sesamum indicum*)**

*Tila taila* is quoted as *Twachya* in *Bhavprakash Nighantu*<sup>56</sup>. Sesame seeds has been reported to manifest antioxidative property due to presence of lignans such as sesamin, sesamol, and sesaminol<sup>57</sup>. Topical application of sesame oil also protects the skin from harmful UV radiation<sup>58</sup>.

#### **PRIYANGU (*Callicarpa macrophylla*)**

Priyangu is said to be '*Pittaasra dosh jitam*' which means it alleviates *Pitta* and *Rakta*<sup>59</sup>. As it is *Pittashamaka* it is recommended in excessive sweating and body odour<sup>60</sup>. *Priyangu* along with *Rakta Chandan*, *Manjistha* and other herbs has been used in formulation of *Mukhakantikar Lepa* mentioned in *Sharangdhar Samhita*<sup>34</sup>.

#### **MANJISTHA (*Rubia cordifolia*)**

*Manjistha* is one of herbs mentioned in *Varnya Mahakashaya*<sup>50</sup>. Chemical constituent of *Manjistha* includes anthraquinones and their glucosides such as Manjisthin and Purpurine, along with antioxidants like alizarin, hydroxyl anthraquinones and rubiadin, also resins, lime salts and colouring agents<sup>61</sup>. Methanolic extract of this herb has been reported to show 14.80% mean inhibition of tyrosinase activity and hence act as skin lightening agent<sup>62</sup>.

#### **RAKTA CHANDAN (*Pterocarpus santalinus*)**

As per *Sharangdhar Samhita*, if a cream is prepared for external application or herbal decoction for oral intake then red sandalwood is preferred over white sandalwood (*S.album*). *Rakta Chandan* is considered as *Rakt-*

*Pitta shamak*<sup>63</sup>. From ancient times, *Pterocarpus santalinus* (red sandalwood) paste has been used in traditional medicines for fair skin complexion<sup>64</sup>. As per Hemachandran *et al.*, (2016) it has been found that the active principles in the *P santalinus* bark extract inhibits melanin production in B16F0 melanoma cells<sup>65</sup>. It has been reported that acute and sub-acute toxicity studies of *P santalinus* extract in rats revealed that the extract is less toxic and can be utilized for cosmetic and therapeutic applications<sup>66</sup>.

### **UTPALA (*Nymphaea stellata*)**

In Ayurvedic classical texts, *Utpala* is mentioned as *Rakta-Pitta Prashaman*, *Rakta-Pitta Prashadan*<sup>67</sup>. Flowers of this plant has been investigated and found to possess antioxidant<sup>68</sup>, antidiabetic<sup>69</sup>, anti-inflammatory<sup>70</sup> and antihepatotoxic activities<sup>71</sup>. The flowers of *Utpala* contain flavonoids, gallic acid, astrgalin, quercetin, and kaempferol along with Vitamin E<sup>72</sup>.

Also, it has been found that gallic acid could inhibit melanin production to prevent hyperpigmentation and protects the cell from UV-B or ionizing radiation, which is the reason it is an importance ingredient in many cosmetics<sup>73,74</sup> Quercetin, a flavonoid compound, found in *Utpala* has been reported to inhibit both monophenolase and diphenolase activities of tyrosinase<sup>75</sup>.

### **NAGAKESARA (*Mesua ferrae*)**

*Nagakesara*, a herb of *Varnya Mahakashaya*<sup>50</sup> is said to be *Pitta-Visha shamak*<sup>76</sup>. From time immemorial stamens of *Mesua ferrea* has been used in traditional skincare formulation in Myanmar. On chemical investigation, Rhusflavanone and mesuaferone B has been found as the main biflavonoids along with lupeol and phenolic compounds. The two biflavonoids has been reported to exhibit strong inhibitory activities against elastase and tyrosinase. Also, lupeol has been considered to be a cosmetically important component of the stamens because of its strong elastase inhibitory activity<sup>77</sup>.

### **CONCLUSION**

To the best of our knowledge, this review is the first attempt to compile the skin lightening activity of ingredients of *Kanaka Taila*.

We found all the herbs evaluated here to act as *varnya* directly or indirectly as per Ayurveda and to inhibit tyrosinase enzyme activity.

*Priyangu* being a part of *Kanaka taila*, is the only herb among all reviewed in the present study without any Ayurvedic citation of *varnya* property.

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