A Review on Suitable Ayurvedic Herbal Ingredients for Hand Sanitizer: Protection Against COVID 19

K.S. Misar Department of Cosmetic Technology, Kamla Nehru Mahavidyalaya, Nagpur, India.
Email Id: ketkimisar11@gmail.com
A.A. Paranjape Department of Cosmetic Technology, Kamla Nehru Mahavidyalaya, Nagpur, India.
R. M. Gajbhiye Department of Cosmetic Technology, Kamla Nehru Mahavidyalaya, Nagpur, India.
M.H. Taywade Department of Cosmetic Technology, Kamla Nehru Mahavidyalaya, Nagpur, India.

Abstract
The painful entry of the novel virus, SARS-CoV-2, has posed unprecedented and fatal health challenges around the world. Medical strategies to deal with COVID-19 are purely supportive and preventative, aiming at reducing spread of the disease. An effective and simple method for reducing transmission of infections amongst the individuals is hand hygiene. Unfortunately, little is known regarding the efficacy of hand sanitizers against SARS-CoV-2. Also excessive use of hand sanitizers containing only synthetic ingredients is leading to excessive dryness, itching and associated skin problems in many individuals. Most research studies have shown immense antimicrobial potential of medicinal plants in Ayurveda which can be used in various formulation for their therapeutic properties.
In the present review study, an extensive literature search was undertaken to summarize the suitable antimicrobial ayurvedic herbal drugs which can be suggested for use in hand sanitizer formulation along with other ingredients suggested by WHO, which would be effective against SARS-CoV-2 and various other skin infections. Also ayurvedic drugs can prove to be beneficial for reducing other skin problems being herbal in nature and owing to presence of various skin beneficial properties such as antioxidant, soothing, calming and skin rejuvenating. By extrapolating effectiveness of Antimicrobial Ayurvedic herbal ingredients for addition in hand sanitizers, viruses of similar structure to SARS-CoV-2, should be effectively inactivated with hand hygiene products containing herbal drugs in addition to skin healing benefits, though future research should attempt to determine this directly.
Keywords: COVID 19, ayurvedic, herbal hand sanitizer, antimicrobial activity, hand hygiene.

Introduction :

COVID19:

The entry of the COVID-19 (Coronavirus Disease-2019) pandemic has risen to be a significant global public health concern and led to extensive use of hand disinfectants to control the transmission of the disease. Coronavirus 2 (SARS-CoV-2), can persist and remain infectious on surfaces for up to 9 days [1,2].

The recent reportsstates that transmission of SARS-CoV-2 is possible in the form of aerosol and fomite,and the virus can remain viable and infectious in aerosols for hours and on surfaces up to days,depending on the inoculum shed on the particular place [3]. Hence, it is crucial to interrupt the transmission chain of the virus through contact isolation and strict infection control tools [4]. Following face masks, appropriate hand hygiene is of utmost importance as hands may be contaminated from direct contact with patient's indirect contact via surfaces, which may then facilitate the transmission and spreading of the disease [5-7].

Given the dangers imposed by this disease, the Centre for Disease Control and Prevention (CDC), the United States has promoted and encouraged hand hygiene through handwashing or use of hand sanitizer [8]. Hand disinfectants are commercially available in various types and forms such as anti-microbial soaps, gel based hand sanitizers, water-based or alcohol-based hand sanitizers,most often used in hospital settings. Different types of drug delivery systems are also formulated for effective delivery - for example, hand rubs, sanitizing foams, or cleansing wet wipes. The World Health Organization (WHO) recommends alcohol-based hand sanitizer (ABHS) in line with the proven advantages of their rapid action

and a broad spectrum of antimicrobial activity offering protection against bacteria and viruses. However, the effectiveness against nonenveloped viruses is still debatable and questionable [9-15].

Hand sanitizers are formulations that are applied and rubbed on hands and fingers very cautiously to inactivatepathogenic microorganisms. These products are prepared with the formula so as to dry immediately after application,thereby eliminating the need for soap, water and drying aids such as towels. The convenienceand portability of hand sanitizers has led to their widespread usage in 2020 [16].Commonly used alcohols in ABHS are Ethanol and isopropanol (2-propanol). They are generally formulated as aqueous mixtures with various other ingredients such asemollients, moisturizers and fragrances. Essentially, the major aim of ABHS performancehas been the alcohol concentration, still added effective active ingredients and auxiliary factors play a criticalrole in their efficacy, safety and long-term utility [17].General formulation ingredients for hand sanitizers include Solvents, Antimicrobial agents, solubilizes, colour, perfume, preservatives etc. Among these ingredients, antimicrobial agents are considered active material for hand sanitizer formula as they are associated with killing or inhibition of pathogenic microbial flora responsible for different diseases. As per WHO guidelines alcohol is best used antimicrobial ingredient till date. But in addition to alcohol if formulation contains some herbal antimicrobial agents then it will definitely increase the efficacy of the product and it will also help to add the ayurvedic benefit to the hand sanitizer formulation, because in addition to the antimicrobial activity there are herbs capable of imparting protective properties for skin such as moisturization, emolliency, soothing and conditioning property. Alcohol based sanitizers causes dryness and itching sensation to skin, which can be regulated by adding antimicrobial herbal ingredients in the formulation so as to reduce drying effect and enhancing skin condition.

Hence, in the present review study, an extensive literature search was undertaken to summarize the suitable antimicrobial ayurvedic herbal drugs which can be suggested for use in hand sanitizer formulation along with other ingredients suggested by WHO, which would be effective against SARS-CoV-2 and various other skin infections.

Need of Hand Sanitizers:

Studies have shown that the spreading of infection is fast in narrow space and mob with the existence of an infected host. The agent is spread in the air when diseased individual sneezes or coughs. The virus is enclosed in the droplets for hours and can live on surfaces for 24-48hours [18]. To break the route of transmission it becomes essential and more apparent through early detection, contact tracing, isolation, use of nose mask or face shield, regular hand-washing practice and use of alcohol based hand sanitizer has been made vital among other measures put in place to prevent COVID-19 spread. Cleaning hands with hand sanitizers believed to be less effective than hand washing with soap and suggested only in emergencies or in areas where sinks are unavailable. Currently, hand hygiene is considered the most important measure for breaking the chain of spreading of pathogens [19].

Most effective hand sanitizer preparations are alcohol-based formulations containing 62%–95% of alcohol for inhibition of micro-organisms and inactivating the viruses [20-21]. There are some problems and disquiets with regard to this formulation in terms of fire exposures and skin toxicity due to high alcohol content [22].

As recommended by WHO alcohol based hand sanitizers mainly contain ethanol, isopropyl alcohols, hydrogen peroxides in different combinations (WHO, 2020). These formulations may become toxic to human health [23].

Possible Problems due to excessive use of alcohol based hand sanitizers: [24]

Hand sanitizer and soaps can be damaging to the skin through several mechanisms: denaturation of the stratum corneum proteins, alteration of intercellular lipids, decrease in corneocyte cohesion and reduction of stratum corneum water-binding capacity [25-26].Individuals with allergic reactions to alcohol-based preparations may have true allergy to alcohol or allergy to impurity, aldehyde metabolite or other excipients like fragrances, benzyl alcohol, parabens or benzalkonium chloride[27].

The most common alcohols found in hand sanitizers are isopropyl, ethanol, and n-propanol. These

alcohols are also accountable for drying out the skin. They can take away the natural oils of the skin and also cause irritation. Solvents in hand sanitizers may dehydrate skin cells and can also lead to contact dermatitis. In an extended run, it can also damage skin cells. Use of hand sanitizers may also lead to ageing of the hand's skin. Dry skin and excessive dehydration can cause roughness, callous formation, flaky skin, wrinkles, itching and cracks. Dehydration of skin greater than before can also kill the natural barrier of the skin against infections [28].

Hence, by considering all these problems, humble attempt is made for suggestion of use of herbal extracts of various commonly available herbal ingredients such as Neem, Tulsi, Turmeric, Custard apple, Clove, Cinnamon, Ajowan, Amla, Eucalyptus, Palash, Tamarind, Hirda, Beheda,Aloevera, Umbar, Guava, Black Pepper and Ginger attributed to presence of antimicrobial, anti-inflammatory, antioxidant activity in addition to skin beneficial properties to enhance skin condition, prevent dryness, give soothing and conditioning effects.

A literature review of SuitableAyurvedic herbal ingredients for hand sanitizers-

The present study aims to suggest suitable Ayurvedic herbal ingredients for hand sanitizersto give protection against COVID 19 and at the same time maintaining good health of skin. Most research studies have shown immense potential of medicinal plants in Ayurveda which can be used in various formulation for their therapeutic properties[29].The word Ayurveda is originated from the Sanskrit word composed of: 'ayur'-life and 'Veda'-science/knowledge. Concept of Krimiin Ayurveda: There are some indirect references in Samhitas for microbes and infectious diseases in the name of Krimi and Krimirogas. Krimighna (anthelmintic or vermicidal) arethe drugs that kills external and internal worms. The visible or invisible minute microorganisms (Krimi) can affect living and non-living things of biosphere and are explainedin depth in Ayurveda. The Krimiis a broad term which includes all types of worms and microbes[30].

Ayurveda is one of the oldest and reliable Indian medical system, providing innumerable leads to find active and therapeutically useful compounds for drug enhancement from botanicals. Currently, the use of herbal medicines is wide spread due to its natural source and limited adverse effects.

In the present work an attempt has been made to suggest suitable Ayurvedic ingredients for hand sanitizer formulations to overcome the dryness of hands because of excess use of alcohol.Therefore, by selecting a good combination of various herbs for their antimicrobial, disinfectant, anti-oxidant, anti-allergic, skin healing properties can be recommended for the preparation of Ayurvedicherbal hand sanitizers.

In the present study18 herbal ingredients namely Neem, Tulsi, Turmeric, Custard apple, Clove, Cinnamon, Ajowan, Amla, Eucalyptus, Palash, Tamarind, Hirda, Beheda, Aloevera, Umbar, Guava, Black pepper and Ginger were selected for immense literature review to know their antimicrobial properties and also to explore their skin beneficial properties such as antioxidant, soothing, healing, moisturizing, emolliency etc.

Neem[31-32]- It is reported that Neem plant is well known for its antibacterial, antifungal and antiviral properties. It helps in fighting against skin infections such as acne, psoriasis, scabies, eczema etc. It cleans skin and improves complexion and it is most powerful blood purifier.

Tulsi[33-34]-Tulsi leaves are reported to have antibacterial, antifungal and antiviral properties. Tulsi benefits the skin by relieving skin infections. It is reported to possess the antioxidant activity.

Turmeric[35-36]-Turmeric is reported to contain anti-inflammatory, antioxidant, anthelmintic and antimicrobial properties. It reported as great healing agent and used for improving skin complexion widely in many cosmetic preparations. It is reported to counteract inflammation and irritation associated with inflammatory skin conditions and allergies.

Custard apple[37-38]- Famous fruit, Custard apple leaves extract are reported to show antioxidant and antifungal properties.

Clove[39-40] -Clove essential oil and Clove bud extracts are known to possess excellent antibacterial, antifungal, antiviral and antiseptic properties.

Cinnamon[41-42] -Commonly available spice, Cinnamon bark extract is reported to show antimicrobial activities and also enhances skin complexion.

Ajowan [43-44] - Ajowan fruit extract is reported to have anti-inflammatory, antibacterial, antioxidant and antiacne properties.

Amla[45-46] - Amla extract is well known for its antioxidant, skin healing, antimicrobial, skin lightening, anti-inflammatory and analgesic properties.

Eucalyptus[47-48] - Eucalyptus leaves extract are reported to contain antioxidant, antimicrobial, anti-inflammatory and analgesic properties.

Palash[49-50]- Palash flower extracts are reported to show antimicrobial, anti-inflammatory, skin glowing and astringent properties. Also it can be used as natural colorant for cosmetic formulations.

Tamarind[51-52] -Tamarind leaves extract is reported to show antibacterial, antifungal and antiseptic effect.

Hirda[53-54] - Hirda is well known for its anti-inflammatory, skin healing, analgesic and anthelmintic properties. Important constituent of Triphala, helpful for curing skin disorders.

Baheda [55-56] - Baheda extract is reported to have antimicrobial, antioxidant, astringent, anti-allergic and skin healing properties.

Aloevera[57-58] -It is reported that Aloe extract is excellent emollient with good wound healing, antibacterial, antiviral, antifungal, analgesic, antioxidant, anti-inflammatory and skin soothing activity.

Umbar[59-60] -Umbar leaves extract is reported to show antibacterial, skin healing, anti-inflammatory properties. It prevents external burns and improves complexion.

Guava[61-62] - Guava leaves are reported to have antiviral, antibacterial, excellent wound healing, astringent and antiseptic properties.

Black Pepper[63-64] - Black Pepper extract is reported to contain antibacterial, antifungal, antioxidant and anti-inflammatoryproperty.

Ginger [65-66] - Use of Ginger rhizomes is suggested in Ayurveda as antiviral, anti-inflammatory, analgesic agent and also used to treat skin burns.

Table: 1 Common name, image, botanical name, family and important chemical constituents of suitable Ayurvedic herbal ingredients for hand sanitizers under the review study

S. N.	**Common Name**	**Image**	**Botanical Name**	***Family***	**Important Chemical constituents**
1.	Neem leaves [31-32]	 Fig.Neem tree	*Azadirachtaindica*	*Meliaceae*	Nimbin, Nimbidin, nimbosterol (ß- sitosterol), Quercetin, Flavonoids, etc.
2.	Tulsi or Holy basil leaves [33-34]	 Fig. Tulsi plant	*Ocimumtenuiflorum*	*Lamiaceae*	phenolic compounds, Eugenol, methyl eugenol, carvacrol, caryophyllene etc.

3.	Turmeric or Haldi [35-36]	 Fig. – Turmeric powder	*Curcuma longa*	*Zingiberaceae*	Curcumin, Curcuminoids, turmerones etc.
4.	Custard apple or Sugar apple (Sitaphal)[37-38]	 Fig.- Custard Apple twig	*Annona reticulata*	*Annonaceae*	Proteins, Vitamins, Minerals, Essential oil, Phenolic Components, β-caryophyllene, Germacrene, Limonene, terpinolene etc.
5.	Clove or Lavang[39-40]	 Fig. Clove buds	*Syzygiuma romaticum*	*Myrtaceae*	Eugenol, eugenol acetate, caryophyllene, gallotanic acid, methyl-n-amyl ketone, eugenin, methyl alcohol, benzyl alcohol, vanillin etc.
6.	Cinnamon or Dalchini[41-42]	 Fig. Cinnamon bark	*Cinnamomumzylanicum*	*Lauraceae*	Phlobatannins, cinnamaldeyhde, eugenol, α-humulene, β-caryophyllene and limonene, cinnamyl alcohol, benzaldehyde, cuminaldehyde, carophyllene, safrole, monoterpenes, etc.
7.	Ajowan or Ajwain or Carum seeds[43-44]	 Fig. Ajowan seeds	*Trachyspermumammi*	*Apiaceae*	Thymol, p-cymene, terpinene, α-pinene, β-pinene, β-myrcene, α-terpinene, dipentenes, carvacrol, carbohydrate, saponins, flavones etc.
8.	Amla or Indian Gooseberry [45-46]	 Fig. Umbar twig	*Phyllanthu semblica*	*Phyllanthaceae*	Vitamin C, Pyllembic acid, gallic acid, mucic acid, Chebulanin, emblicol, minerals, amino acids etc.
9.	Eucalyptus or Nilgiri [47-48]	 Fig. Eucalyptus tree	*Eucalyptus*	*Myrtaceae*	1,8-cineloe, terpeniol, α-pinene, limonene, carvone, camphene etc.

10.	Palash or Flame of the Forest [49-50]	 Fig. Palash Tree	*Butea monosperma*	*Fabaceae*	Flavanoids, butein, butrin, isobutrin, plastron, coreipsin and isocoreipsin etc.
11.	Tamarind [51-52]	 Fig. Tamarind Tree	*Tamarind usindica*	*Fabaceae*	Flavonoid, polyphenols, thiamine, riboflavin, niacin, ascorbic acid and β-carotene, proteins, alkaloids etc.
12.	Hirda[53-54]	 Fig. Hirda Fruits	*Terminalia chebula*	*Combretaceae*	Tannins, Gallic acid, Chebulic acid, Luteolin, Ellagic acid, triterpene, palmitic acid, phloroglucinol, pyrogallol etc.
13.	Baheda [55-56]	 Fig. Baheda fruits	*Terminalia bellirica*	*Combretaceae*	Vitamin C, tannic acid, ellagic acid, chebulagic acid, gallic acid, oxalic acid, phyllemblin, β-sitosterol, mannitol, galactose etc.
14.	Aloe vera leaves[57-58]	 Fig. Aloe vera leaves	*Aloe barbadensis miller*	*Asphodelaceae*	chromone and its glycoside derivatives; anthraquinone and its glycoside derivatives; flavonoids; phenylpropanoids and coumarins; phenylpyrone and phenol derivatives; phytosterols, glucomannan, etc.
15.	Umbar or Cluster fig Leaves [59-60]	 Fig. Umbar Tree	*Ficusracemosa*	*Moraceae*	Glaunol acetate, tritepenoids, alkaloids, tannins, racemosic acid etc.
16.	Guava leaves [61-62]	 Fig. Guava Twig	*Psidiumguajava*	*Myrtaceae*	Vitamin C, Catechol, pyrogallol, tannins, pectin, vitamins, caryophyllene, nimonenes etc.
17.	Black pepper fruits [63-64]	 Fig. Black Pepper Fruits	*Piper nigrum*	*Piperaceae*	Piperine, oleoresins, alkaloids, volatile oil, ocemene, caryophyllene, terpenen-4-ol, etc.

18.	Ginger rhizomes [65-66]	 Ginger Rhizome	*Zingiberofficinale*	*Zingiberaceae*	6-gingerol, 6-shogaol, and 6-paradol, carbohydrates, lipids, terpenes, phenolic compounds, α-curcumene, etc.

Ancient seers of Indian civilization have developeda unique health science based on rules of natureand by using natural resources. Ayurveda has givenprime importance to the prevention of diseases andsecond priority for curing the disease. This conceptis entirely acceptable in pandemic situations suchas COVID-19. Achieving a long healthy life is not atask of one or few days; it is a process of followingspecific measures throughout the lifetime. Therefore, Ayurveda principles mostly focus on describingsuch measures. In other words, an herbal heritage of Ayurveda offers both immediate applicable as well as long term utilizable measures to assure standard physiological mechanisms to maintain health[28].

The demands of herbalayurvedic medicines are increasing day by day, which can be attributed to their potent pharmacological activity and economical values have been proving to be beneficial for the people. However, a lot of research is necessary to standardize and validate Ayurveda medicines for their potency, safety, and efficacy [67].The present review is a small attempt to present an idea of using ayurvedic herbal ingedients in hand sanitizer formulation to take care of skin of hands owing to various properties of above mentioned herbs like antibacterial, antifungal, antioxidant, analgesic, moisturizing, skin healing etc.

Conclusion:

With the current research in the literature it is difficult to confidently suggest exact concentration and mechanism of action of herbal ingredients against Covid-19. What we can state however, is that when hand washing is unavailable or inconvenient, a sufficient volume of sanitizer is important to ensure complete hand coverage. The continuous use of alcohol based hand sanitizers may cause skin problems such as dryness, irritation and ageing of the skin. To reduce these problems, the currently available hand sanitizer formulations can be modified by addition of herbal extracts of Neem leaves, Tulsi leaves, Turmeric rhizomes, Custard apple leaves, Clove buds, Cinnamon bark, Ajowan fruits, Amla fruits, Eucalyptus leaves, Palash flowers, Tamarind leaves, Hirda fruits, Beheda fruits, Aloevera leaves gel, Umbarleaves, Guava leaves, Black pepper fruits and Ginger rhizomes, as these herbs are reported to have antimicrobial activities and at the same time they are reported to be beneficial for skin health owing to presence of various properties like antioxidant, anti-inflammatory, anthelmintic, soothing, moisturizing, skin healing and skin conditioning. Along with the alcohol and synthetic antimicrobial agents if these ayurvedic herbs are incorporated can show synergistic effect to fight against Covid-19 and various other diseases.

By extrapolating effectiveness of Antimicrobial Ayurvedic herbal ingredients for addition in hand sanitizers, viruses of similar structure to SARS-CoV-2, should be effectively inactivated with hand hygiene products containing herbal drugs in addition to skin healing benefits, though future research should attempt to determine this directly.

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