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RESEARCH ARTICLE
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"STAR FRUIT (CARAMBOLA) IN SKINCARE: A STAR-STUDDED REVIEW OF ITS ANTIOXIDANT RICHNESS AND SKIN-ENHANCING PROPERTIES"

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Abstract:
Averrhoa carambola, a fruit that is frequently eaten across the world, is believed to have a number of both nutritional and therapeutic advantages. (1) They have also been complaints of major nephrotoxic and neurotoxic implications, too. (1) The noted health advantages of star fruit have been studied in this review, as well as potential mechanisms for these advantages and factors that can influence the fruit's safe level of consumption.(1) The positive effects include people that are antioxidant (mediated by L-ascorbic acid, epicatechin, and gallic acid), hypoglycemic (2-dodecyl-6-methoxycyclohexa-2,5-diene-1,4- dione), hypotensive (mediated by apigenin), hypocholesterolemia (mediated by micronized fiber), anti-inflammatory, anti- infective, antitumor, and immune-stimulating.(1) The taste or acidity of the star fruit is believed to be related to its level of ascorbic acid.(3) The amount of ascorbic acid in sweet fruit juice is around 10.40 mg (about the weight of a grain of table salt) per 100 ml (about 3.38 oz). (3) The vitamin C level for a sour fruit is approximately 15.4 mg (about half the weight of a grain of rice) per 100 ml (about 3.38 oz) of juice. (3) Starfruit has good nutritional value and pleasant taste, but it has a limited shelf life and can only be retained for a short time according to ambient storage. The intention of this review is to focus on the nutritional benefits, therapeutic potential, toxicological characteristics, phytochemical components, and pharmacological activities of starfruit along with the most current study trends. The remainder powder may impart health benefits when used in functional food products, and residue extracts may also be considered as potential nutraceutical resources in the future due to the significant phenolic content and powerful antioxidant activity.

Keywords: Averrhoa carambola, Ecological requirement, Pharmacology, Therapeutic uses, Reproduction Sterols, Anti-inflammatory, Antioxidant, medicinal properties, nutrition, Star fruit, Oxalidaceae, pharmacological activities, chemical constituents.

INTRODUCTION:

The fruits like the star fruit (Averrhoa carambola) are popular in both tropical and non-tropical nations. For the objective of collecting its fruit, it is cultivated extensively around the world (especially in the South-East Asian Region) (Khoo et al., 2010, 2016; Muthu et al., 2016). The star fruit is known as a rich source of essential nutrients and natural antioxidants. (1)

Averrhoa carambola, also referred to as starfruit, is an ancient plant that belongs to the 'Oxalidaceae

family'. With a sweet and sour flavor, starfruit is a star-shaped tropical fruit. The starfruit is between two and six inches wide. In the 1940s and 1950s, it is vegetatively propagated, and in 1965, its name is changed to "Golden Star," and it was left for cultivation. (2)

Classification of Averrhoa Carambola (3) Scientific Name: Averrhoa carambola Kingdom Plantae – Plants Subkingdom
Tracheobionta – Vascular plants
Super division Spermatophyta – Seed plants Division Magnoliophyta – Flowering plants Class Magnoliopsida – Dicotyledons Subclass – Rosidae Order – Geraniales Family Oxalidaceae – Wood-Sorrel family Genus Averrhoa Adans. – Averrhoa Species Averrhoa carambola L. – carambola
A. carambola defines the botanical and cultivation components as well as traditional uses and some medicinal products properties. It is useful for clean utensils because it aids in rust reduction. Fruit consumption has been linked to a reduction in undernutrition cases as well as noncommunicable diseases (NCDs) such cancer, diabetes, chronic kidney disease, and heart disease. The analysis takes consideration of quality factors such fruit weight loss, color, texture, total soluble solids, FTIR, and sensory evaluation, while safety criteria like pH, water activity, and microbial development are also taken into consideration. (4 5 6)

PHARMACOLOGICAL PROPERTIES:

ANTIOXIDANT ACTIVITY:

Nonmetal oxygen is a strongly reactive oxidizing agent that easily forms oxides with many elements as well as with other elements. (12) Since oxygen is the most essential electron acceptor in the electron flow system that generates energy in the form of ATP, oxidation, which is the movement of electrons from one atom to another, is a crucial component of aerobic life and our metabolism. (13)

Table 1: Reactive oxygen species (ROS) and non-free-radical species.

Reactive oxygen species		Non free radical species	
Superoxide radical	O2	Hydrogen peroxide	H2O2
Hydroxyl radical	HO	Singlet oxygen	O2
Hydroperoxyl radical	HOO	Ozone	O3
Lipid radical	L	Lipid hydroperoxide	LOOH
Lipid peroxyl radical	LOO	Hypochlorite	HOCl
Peroxyl radical	ROO	Peroxynitrite	ONOO
Lipid alkoxyl radical	LO	Dinitrogen trioxide	N2O3
Nitrogen dioxide	NO2	Nitrous acid	HNO2
Nitric acid	NO	Nitryl chloride	NO2C
Nitrosyl cation	NO	Nitroxyl anion	NO
Thiyl radical	RS	Peroxynitrous acid	ONOOH
Protein radical	P	Nitrous oxide	N2O

Other ROS nonradicals, such as singlet oxygen (1 O2), hydrogen peroxide (H2O2), and hypochlorous

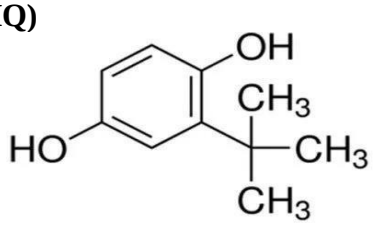
acid (HOCl), are present in cells in addition to these ROS radicals. In Table 1, the potential reactive oxygen species (ROS), reactive nitrogen species (ROS), and non-free radical species are listed. The body uses oxygen normally during breathing and some cell- mediated immunological processes, which results in the production of ROS. A chemical person with one or more unpaired electrons and the ability to exist independently is referred to as a free radical. [13] Antioxidants have been shown to be essential in maintaining human health and in the prevention and treatment of illnesses due to their ability to reduce oxidative stress, which has been established in several studies. Therefore, it is essential to analyze the antioxidant activity/capacity of foods and biological samples, not only to ensure the quality of functional foods but also, maybe more importantly, to investigate the efficiency of dietary antioxidants in preventing and treating diseases linked to oxidative stress. Antioxidants are molecules that, when present in small quantities in food or the body, slow down, limit, or stop oxidative processes leading to a decrease in food quality or the development and growth of degenerative diseases in the organism. [14] Through a variety of methods and effects, these antioxidant compounds inhibit oxidation. A free radical is any molecular organization that shows an unpaired electron in an atomic orbit and is capable of existing independently. [15] There are many different types of antioxidants that are active when reactive oxygen species (ROS) are produced in living systems. [16]

1) SYNTHETIC ANTIOXIDANT:

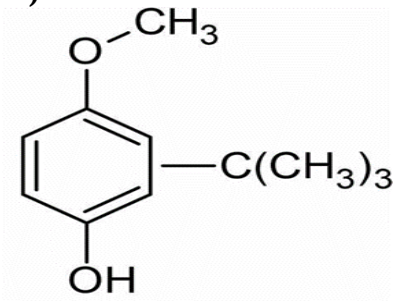
The more widely utilized synthetic antioxidants include phenolic substances like tert-butylhydroquinone (TBHQ), butylated hydroxy anisole (BHA), butylated hydroxytoluene (BHT), and propyl gallate (PG). For food and pharmaceutical uses, these synthetic antioxidants are most frequently utilized. To increase the solubility of synthetic antioxidants in fats and oils, alkyls are always substituted with them (Hudson 1990). BHA and BHT, however, have been subject to legal limits because of worries about their carcinogenic and toxic effects. As a result, there is an increasing need for natural antioxidants that are safer for use in food applications, as well as a growing consumer need

for natural antioxidants, both of which have inspired efforts to investigate natural sources of antioxidants. [13]

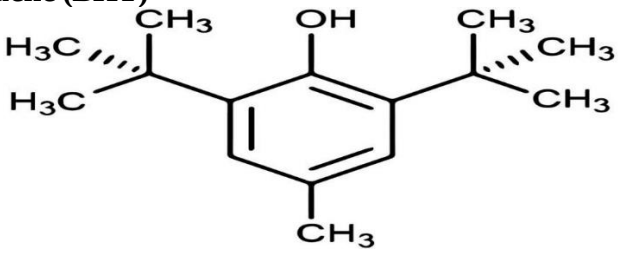
1. **Tert-butylhydroquinone (TBHQ)**



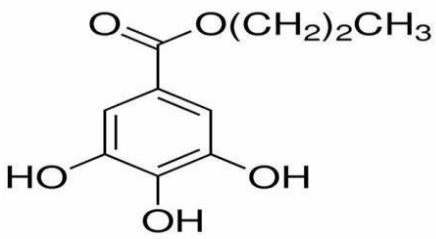
2. **butylated hydroxy anisole (BHA)**



3. **butylated hydroxytoluene (BHT)**



4. **propyl gallate (PG)**

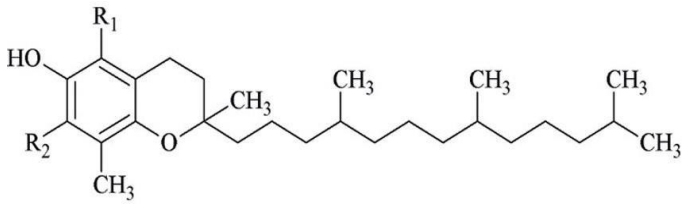


2. NATURAL ANTIOXIDANT:

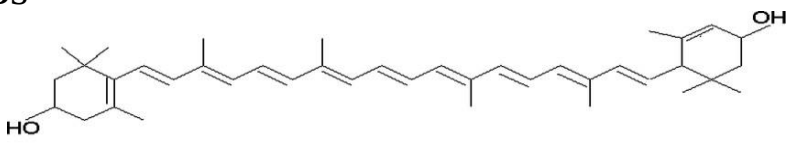
Many different compounds that have been identified in the human diet as having antioxidant properties or that, based on their structure, may be able to scavenge ROS. Vitamin C, tocopherols, carotenoids, and flavonoids are the dietary antioxidants that are most well-known. Each group of these antioxidants, aside from vitamin C, consists of several structurally different compounds. In this case, more than 600 different carotenoids have been identified to date, and about fifty of them may be present in the human diet (Sies and Stahl 1995; Rice-Evans and Miller 1996; Rock et al. 1996). These many dietary components may have synergistic effects in the diet that are difficult to currently analyze. According to Diplock et al. (1998), the diet can be compared to an orchestra where the interactions between the many parts can produce effects that are not always essential to any one of the parts. One of the most effective and non-toxic natural antioxidants is ascorbic acid (vitamin C), according to Bendich et al. (1986; Weber et al. 1996). It is a water-soluble vitamin that is prevalent in

numerous dietary foods or plants. Usually, it interacts with oxidants. [13]

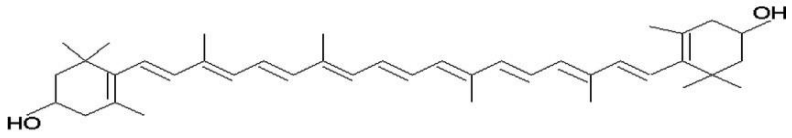
1. TOCOPHEROLS



2. CAROTENOIDS



(a)



(b)

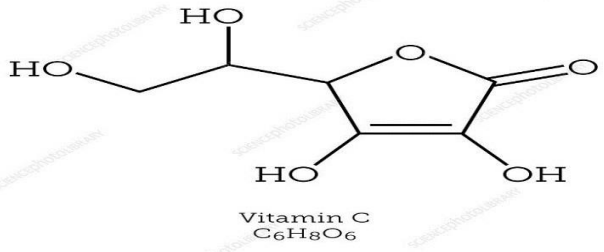
VITAMIN C:

Chemistry and Analysis

The term "vitamin C" refers to all substances that qualitatively show the biological activity of ascorbic acid, including its oxidized counterpart, dehydroascorbic acid. Although frequently employed as a food preservative, Isoascorbic acid lacks antiscorbutic activity but has antioxidant effects like those of L-ascorbic acid. In comparison to older techniques, the more recent high performance liquid chromatography technologies to evaluate vitamin C in biological specimens, foods, and pharmaceuticals have increased the specificity of analysis. When collecting blood or plasma samples for investigations on vitamin C status, a preservative must be added to prevent the vitamin from being easily oxidized and rapidly degrading. This process has restricted the quantity and quality of population-based investigations utilizing tissue vitamin C measurements.

Citrus fruits, green vegetables, peppers, tomatoes, berries, and potatoes make up most of the foods with vegetable origin that make up Western-style diets and include vitamin C. Even within various samples of the same fresh fruit or vegetable, the vitamin C level varies significantly, and cooking and water loss can result in significant reductions in vitamin C content.

STRUCTURE OF VITAMIN C



ANTI-INFLAMMATORY ACTIVITY:

According to Cabrini et al. (2011), apigenin-6-C-l-fucopyranoside and apigenin-6-C- (2″-O-l-rhamnopyranosyl)-l- fucopyranoside have anti-inflammatory properties in ethanol extracts of A. carambola leaves as well as their hexane, ethyl acetate, and butanol fractions. The edema was reduced by the ethanol extract in a dose-dependent manner, with a maximum inhibition of 73 % and an ID50

value of 0.05 (0.02-0.13) mg/ear. A maximum reduction of 60 6% (0.6 mg/ear) was seen in the activity of myeloperoxidase when the ethanol extract was used. The ethyl acetate fraction was the most effective in reducing the generation of edema and the activity of myeloperoxidase, with inhibition levels of 75 % and 54 8% for the development of edema and myeloperoxidase activity, respectively, the ethyl acetate fraction was the most effective of the fractions studied in suppressing both edema production and myeloperoxidase activity. However, there is no apparent anti- inflammatory influence that isolated compounds can offer. (4 5)

ANTIMICROBIAL AND ANTI FUNGAL ACTIVITY:

The bark of A. carambola contains two chemicals that Mia et al. (2007) isolated: anisaldehyde and -sitosterol. When 400 g (about 14.11 oz) disc of the methanol extract of A. carambola was tested for antibacterial activity, the petroleum ether, carbon tetrachloride, and chloroform fractions showed only minor microbial growth inhibition. Petroleum ether, carbon tetrachloride, and chloroform soluble fractions all generated zones of inhibition that, on average, were 8-12 mm, 8-12 mm, and 8-15 mm, respectively. E. coli and S. dysenteriae had zones of inhibition of 12 mm each, and the petroleum ether extract moderately reduced their growth. On the other hand, a zone of inhibition of 15 mm was present in the chloroform soluble fraction, which significantly hindered E. coli growth. All extractives displayed a slight inhibiting effect on fungus. (4 5)

ANTITUMOR ACTIVITY:

A. carambola suspension-cultured cells were used by Li et al. (2012) to study the biotransformation of dihydro-epi- deoxyarteannuin B. Upon the addition of dihydro-epi-deoxyarteannuin B, a sesquiterpene known as 3-hydroxydihydro- epideoxyarteannuin B and a 7-hydroxy-dihydro-epideoxyarteannuin B sesquiterpene were produced. The study discovered that A. carambola cells in culture can hydroxylate sesquiterpene molecules in a stereo- and regioselective way. The inhibitory effects of 3- and 7-hydroxy-dihydroepideoxyarteannuin B on the proliferation of K562 and HeLa cell lines were (40.63 1.45, 41.54 0.82 mol/mL) and (59.29 0.99, 84.04 0.27 mol/mL), respectively. (4 5)

HYPOTENSIVE ACTIVITY:

With the help of an isolated rat aorta, Soncini et al. (2011) investigated the hypotensive impact of the aqueous extract of A. carambola and the processes underlying it. The aqueous extract decreased the Emax response to phenylephrine in vitro without affecting sensitivity. Additionally, in a depolarized Ca2+-free medium, the aqueous extract inhibited CaCl2-induced contractions and caused a concentration-dependent rightward shift of the response curves, indicating that it blocked the extracellular Ca2+ influx involved in contraction mechanisms. According to the study's findings, the aqueous extract has hypotensive properties, and it has been hypothesized that some of its effects may be related to Ca2+ inhibition. This is comparable to how it is used in conventional medicine. (4 5)

HYPOCHOLESTEROLEMIA ACTIVITY:

Different insoluble fibers made from A. carambola with or without micronization processing were studied by Wu et al. (2009) for their possible hypocholesterolemia action. The cation-exchange and water-holding capacities of the pectic polysaccharide-rich insoluble fibers of A. carambola were effectively enhanced from 8.5 to 22.4 mL/g after micronization. By increasing the excretion of cholesterol and bile acids in the stools, the microsized insoluble fibers from A. carambola decreased serum triglyceride and total cholesterol concentrations by 15.6% and 15.7%, respectively. In applications involving fiber-rich functional foods, the study provides a novel method of micronizing fruit that may aid to enhance the physiological effects of food fibers. The study also shows that insoluble fiber properties and physiological processes are significantly impacted by particle size. (4 5)

HYPOGLYCAEMIA ACTIVITY:

The hydroalcoholic extract of A. carambola L. leaves' effects on fasting blood sugar was investigated by Ferreira et al. in 2008. Animals given the hydroalcoholic extract had significantly decreased fasting blood glucose levels (p 0.05). The generation of glucose from L-alanine in the livers of these animals hydroalcoholic extract, however, was substantially higher (p 0.05). The enhanced generation of hepatic urea and L-lactate suggested that this impact was at least partially mediated by an increase of the metabolism of L-alanine.

Compared to L-alanine, the therapy had no impact on the synthesis of glucose from L-glutamine, L-lactate, and glycerol. The incorporation of [14C]-glucose into glycogen (glycogen synthesis) and the generation of [14C]-lactate suggest that the hydroalcoholic extract treatment had no impact on the glucose uptake in soleus muscles. Accordingly, the study contends that the decrease in fasting blood sugar brought on by the administration of A. carambola's hydroalcoholic extract was not caused by an inhibition of hepatic gluconeogenesis and/or an increase in muscle glucose uptake. (4 5)

ANTI-INFECTIVE ACTIVITY:

Mia et al. extracted two substances (p-anisaldehyde and -sitosterol) from the bark of A. carambola in 2007 that significantly reduced the growth of Escherichia coli and had weak inhibitory effect against fungus (Mia). (5)

ANTI-ULCER ACTIVITY:

A water-alcohol extract of A. carambola's leaves was tested for its gastroprotective properties in rats by Goncalves et al. in 2006. An acidified-ethanol-induced ulcer model showed considerable anti-ulcer efficacy. Indomethacin and acute stress ulcerogenic model mice, however, showed limited proactive effect. According to their overall findings, A. carambola showed no anti-ulcer action (Goncalves et al., 2006). (4 5)

TABLE: 2 Summary of studies on hypoglycemic, antidiabetic, and hypocholesterolemia effects of Averrhoa carambola (4 5)

AUTHOR(YAER)	COUNTRY	TYPE OF STUDY	METABOLIC EFFECT
Human study Leelarungrayub, Laskin, et al. (2016), Leelarungrayub, Yankai, et al. (2016)	Thailand	Human study	Hypocholesterolemic effects
Animal studies Ferreira et al (2008)	Brazil	Animal Study (male Wistar rats)	Hypoglycemic antidiabetic effects and
Wu et al. (2009)	Taiwan	Animal model) Study (hamster	Hypocholesterolemic effects
Cazarolli et al (2012)	Brazil	Animal study (male Wistar rats)	Hypoglycemic antidiabetic effects and
Zheng et al. (2013)	China	Animal study (KKAy mice)	Hypoglycemic antidiabetic effects and
Herman-Lara (2014) et al.	Mexico	Animal mice) study (C57BL/6	Hypocholesterolemic effects
Aladaileh et al (2019)	Malaysia	Animal study (high fat fed male Sprague Dawley rats	Hypocholesterolemic effects
Pham et al (2017)	China	Animal mice) study (Kunming	Hypoglycemic antidiabetic effects and
Lu et al. (2019)	China	Animal study (mice)	Hypoglycemic antidiabetic effects and
Qin et al., 2020	China	Animal study (male Kunming mice)	Hypoglycemic antidiabetic effects and
Zhang et al. (2020)	China	Animal Study (mice)	Hypoglycemic antidiabetic effects and
In vitro studies Xie et al. (2016)	China	In vitro study (pancreatic beta cell line)	Hypoglycemic antidiabetic effects and

ANALYSIS CONSIDERING FUTURE RESEARCH:

When do the therapeutic properties of a drug become toxic?

Following the consumption of star fruit, several toxicities have been reported, mostly nephrotoxicity and neurotoxicity. Most of the data for the various pathways of star fruit toxicity is based on animal research. The beneficial dose of star fruit and the level at which it may become risky has been strongly debated (Yasawardene et al., 2020). The toxic dose is likely to vary depending on several factors, including complications (chronic kidney disease, gastroenteropathies, chronic pancreatitis), levels of hydration at the time of ingestion, consumption on an empty stomach, the type of star fruit consumed

(sour as opposed to sweet variety), and concentration of oxalate in the star fruit extract (Yasawardene et al., 2020). Key structural components that cause toxicity include caramboxin and oxalate. Caramboxin and oxalate's pathophysiological processes for causing neurotoxicity and nephrotoxicity have been thoroughly reviewed in a study on star fruit toxicity (Yasawardene et al., 2020). Freshly-made juices have lower oxalate concentrations than commercially produced juices, which are produced using pickling and dilution techniques (Yasawardene et al., 2020). Freshly prepared star fruit extract has higher oxalate concentrations than commercially produced juices. (5)

In humans, the harmful dosage of star fruit has not yet been found. The actual amount of star fruit consumed ranges considerably from that which is considered toxic. In fact, consuming half to fifty fruits at once has been linked to harmful consequences (Stumpf et al., 2020). The undiluted start fruit juice had a volume that ranged from 25 to 3,000 ml. But some people consumed the juice together with natural medications (Chen et al., 2001). Long-term intake as well as a single serving have both been linked to toxic effects. Consumption of five-to-six-star fruits per month for two to three years (Abeysekera et al., 2015) and one star fruit per day for a year (Wijayaratne et al., 2018) have both been linked to toxicity. Additionally, studies have shown that eating star fruit on an empty stomach, even in small amounts, can have adverse effects (Ananna et al., 2016; Barman et al., 2016). When taken on an empty stomach, magnesium and calcium ions may not be present, which might enhance the absorption of oxalate and cause toxicity (Azim & Salam, 2016; Chen et al., 2001). This is because these ions bind to oxalate in the gastrointestinal system. Some investigations found no connection between the quantity of star fruit taken in and the level of intoxication or mortality (Auxiliadora-Martins et al., 2010; Neto et al., 2003).

Because the harmful dosage of star fruit appears to be multifactorial, additional research is necessary to determine if relationships between the factors mentioned above and toxicity in people. Future research could also take into account the genetic susceptibility for toxicity. The methods of harmful compounds found in star fruit, such as caramboxin and oxalate, being absorbed, metabolized, and excreted in both healthy people and people who already have renal impairment, need to be further investigated. The subject of the ideal amount of star fruit and the dosage at which it may become harmful is thus still open.

It's essential to remember that the bulk of studies showing the health benefits of star fruit are founded on in vitro and experimental animal research. Regarding the possible health advantages of star fruit for humans, however, a number of claims have been made in the popular literature. Since there are few human studies based on the information that is now available (as discussed in this review), the possible advantages in humans should be regarded with care. There has also been few research done on the pharmacokinetics and bioavailability of star fruit. The therapeutic significance of these possible advantages, the dose necessary for obtaining clinically meaningful effects, and a review of the potential toxicity at such levels all require more human investigations. Additionally, it is not advised to regularly consume star fruit in order to maximize the possible advantages mentioned above until further research is available. (5)

Table 3: Pharmacological Activities of Averrhoa carambola (3)

SR.NO	Pharmacological activity	Plant part	Extracts
1.	Anti-inflammatory	Stem	Aqueous extract
2.	Analgesic	Fruit	Fruit extract
3.	Hypotensive	Leaves	Aqueous extract
4.	Anthelmintic	Leaves	Aqueous extract
5.	Anti-oxidant	Fruit	Juice and residue extract
6.	Anti-ulcer	Leaves	Water alcohol extract
7.	Hypocholesterolemia mic and hypolipide-mic	pomace	Water insoluble fiber rich fraction (WIFF)
8.	Antimicrobial	Stem	Stem extract
9.	Anti-tumor	Stem	Aqueous extract

MATERIAL AND METHODS: MATERIAL:
Alor Gajah, Melaka, Malaysia's Mydin Mall is where the starfruits were obtained. Hanani et al. (2012) picked starfruits with a maturity index of 2 that were around the same size and free of external defects. Before the coating procedure, the samples were cleaned and rinsed. In this study, sodium chloride, maltodextrin, and pectin (all from R&M Chemicals) were employed together with plate count agar, potato dextrose agar, and peptone water (all from Oxoid).

Preparation of coating solutions: To create three distinct coating solutions, 6% (w/v) pectin, 4% (w/v) maltodextrin, and 100, 200, and 300 ppm sodium chloride (SC) were mixed. Then, when all of the coating components had completely dissolved, each solution was rapidly agitated.

Coating process of starfruit:
Sodium chloride solution containing 100 ppm was applied to starfruits for 30 seconds before they were allowed to air dry for 30 minutes. Following a 30-second take in a pectin and maltodextrin solution, the starfruit was left to dry for 60 minutes in the open air. Using 200 and 300 ppm of sodium chloride, the same process was done. For samples employing 100, 200, and 300 ppm, respectively, the labels read Pe +M+ 100 ppm, SC Pe+M + 200 ppm SC, and Pe+ M+300 ppm SC. Samples that weren't coated served as the standard. Following that, the samples were put on trays and kept at 28 C for 14 days. Except for color, FTIR spectra, and sensory evacuations, the samples were tested for safety and quality parameters on days 0, 3, 5, 7, and 10 of storage. The conclusions of each analysis were checked three times, and the mean and standard deviation were reported. (6)

Safety Criterion Analysis:
1. pH analysis: Using a mortar and pestle, the starfruit was turned into a liquid. A pH meter (Mettler Toledo, Model: Delta 320) was used to calculate the pH. The pH meter was calibrated using buffers with pH values of 4 and 7 before to use. The pH meter was calibrated using buffers with pH values of 4 and 7 before to use.
2. Water activity (aw) analysis: A water activity meter (Model: Aqualab4TE) was used to measure the samples at a temperature of 25 C. While conducting the analysis, the analyser was calibrated.

3. Microbial growth analysis: For the purposes of counting all of the plates, yeast, and mold, respectively, plate count agar (PCA) and potato dextrose agar (PDA) were utilized. The material was dissolved in 225 ml of 1% sterile peptone water and homogenized using a stomacher for 1 minute. Then, using sterile peptone water, a ten-fold serial dilution was carried out before to the plating process. The PCA and PDA plates were incubated for 2 days at 37 C and 5 days at 30 C, respectively. The sample's colony forming unit per milliliter was recorded as log10 CFU/ml. (6)

Preparation of Organic fertilizer:
The starfruit waste from Attaqie Farm in Tuban was separated into two primary components: leaves only and fruits plus leaves. The maximum age of the branches was one week after they had fallen, and they were both fallen branches and leaves from cutting. Fruits are usually collected from fallen fruit or small, immature fruits by thinning and sorting. Ingredients were minced, combined with EM-4, and allowed to breakdown to a height of 15 to 20 cm before being covered with paper. Every day, the material was well mixed and covered to ensure proper mixing. Color, smell, and temperature variations were noted. The combination was ready to be used as organic fertilizer when it lost its fragrance and turned brown in color. The combination was ready to be used as organic fertilizer when it lost its fragrance and turned brown in color. The procedures were the same for the fruit + leaf combo. The nutrients in the organic fertilizers made from starfruit leaves and starfruit fruits with leaves are then examined. The nutrients in the organic fertilizers made from starfruit leaves and starfruit fruits wit h leaves are then examined.

RESULT AND DISSCUSSION:

RESULT:

1. **Antioxidant Properties:** Antioxidants, such as vitamin C and other phytochemicals, are known to be prominent in star fruit. These antioxidants aid in protecting the skin from oxidative stress and free radicals, both of which could accelerate the aging process.
2. **Brightening of the Skin:** Star fruit's high vitamin C concentration may help to lighten dark spots and hyperpigmentation on the skin. A more uniform skin tone may emerge from this.
3. **Moisturizing:** The natural moisture-retaining substances found in star fruit can help keep the skin moisturized and less dry.
4. **Collagen Production:** The synthesis of collagen, which is necessary for protecting the smoothness of the skin and reducing the appearance of fine lines and wrinkles, depends on vitamin C.

DISCUSSION:

The discussion regarding star fruit's skincare benefits may include:

Caution with Skin Sensitivity: Some individuals with sensitive skin may experience irritation or allergic reactions when using star fruit directly on their skin. Patch testing is often recommended.

Combining with Other Ingredients: Star fruit extracts or juices are often incorporated into skincare products like serums, creams, or masks. These products may combine star fruit with other beneficial ingredients for a comprehensive skincare regimen.

Dietary and Topical Use: In addition to topical application, consuming star fruit as part of a balanced diet can provide internal benefits for skin health due to its rich antioxidant content.

Sun Protection: While star fruit offers antioxidant protection, it is not a substitute for sunscreen. Sunscreen remains a critical component of skincare for protection against UV damage.

It is important to note that individual reactions to skincare products can vary, so it's advisable to perform a patch test or consult with a dermatologist before incorporating star fruit products into your skincare routine. Additionally, new research and developments may have emerged in this field since my knowledge cutoff date.

CONCLUSION:

In summary, the star fruit, also known as the carambola, shows great promise as an ingredient in skincare products because of its significant antioxidant content and range of skin-beneficial qualities. The fruit's natural ingredients support healthy skin by increasing collagen formation and preventing oxidative stress. To completely grasp its possible negative effects and best uses, more study is necessary. Star fruit may add a radiant boost to skincare regimens, but those who are sensitive should proceed with caution. The star fruit is a noteworthy challenger in the cosmic race for healthier, more radiant skin as the beauty industry investigates natural alternatives.

Star fruit's ability to address particular skincare issues is further highlighted by its unique blend of vitamins, minerals, and flavonoids. Its antibacterial qualities could help treat acne, and its brightening qualities might help achieve more even skin tone. Because of its ability to hold moisture, the fruit may be beneficial for people with dry or dehydrated skin.

While the amount of data that is now available is encouraging, skincare skilled and individuals should approach star fruit carefully. Some people's adverse reactions highlight the value of patch testing and seeing dermatologists, particularly for those with sensitive skin.

Star fruit offers a heavenly touch in the constantly shifting landscape of skincare trends, but users should keep in mind that an integrated approach to skincare involves a variety of aspects, including nutrition, lifestyle, and individual routines. Customers might carefully consider using star fruit in their routine as research into its potential benefits for skincare continues, seeing the fruit as a bright addition to the growing market for natural skincare products.

Not to mention, using star fruit in cosmetics has several environmentally beneficial benefits. Environmentally aware beauty choices are influenced by the fruit's production, which frequently follows sustainable techniques. The potential benefits of star fruit for skin and the ecosystem make it

even more appealing to consumers who are becoming more conscious of ethical and environmentally friendly products.

Examining the possibilities of star fruit makes it clear that achieving the best skincare requires not just accepting natural ingredients but also comprehending how they work best for different types of skin. In order to understand the wide range of skincare components, customization and well-informed selections are essential. Star fruit appears to be a heavenly helper in this effort.

The star-studded attraction of star fruit in skincare is expected to become more compelling as research and formulations progress. The presence of star fruit gives a sense of heavenly wonder to the field of beauty science, where innovation and tradition combine, enabling people to take a cosmic trip towards healthier, brighter skin.

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