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FORMULATION AND EVALUATION OF HERBAL TENNING LOTION

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Abstract:-

The formulation and evaluation of herbal tanning lotion involved extracting phytocompounds from Carica papaya, *Solanum lycopersicum*, and *Aloe barbade*nsis miller. The extraction process utilized distilled water at 70°C for 1 hour followed by 48 hours at room temperature, with extracts filtered and stored for phytochemical analysis. Phytochemical tests identified flavonoids, saponins, tannins, and other compounds in the extracts. Three lotion formulations (F1H, F2H, and F3H) were assessed for physical attributes, irritancy, washability, pH compatibility, viscosity, phase segregation, spreadability, and oiliness. Results indicated all formulations were non-irritating, easily washable, exhibited appropriate pH, viscosity, no phase separation, and non-greasy properties. Notably, F2H demonstrated superior spreadability. Compatibility studies confirmed the herbal components were compatible, exhibiting distinct IR peaks.

Key words: Carica papaya, *Solanum lycopersicum*, and Aloe barbadensi and flavonoids
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Introduction

Herbs have been utilised in pharmaceuticals and beauty products for countless years.Their efficacy in treating various skin conditions and enhancing skinaesthetics is widely recognised [1]. Due to the harmful effects of ultraviolet (UV) radiation, such as sunburns, wrinkles, prematureageing, and cancer, it is essential to consistently protect oneself from UV radiation and prevent its adverse consequences. Herbs and herbal remediesprovide a significant capacity for safeguarding the skin as a result of their antioxidant properties. Antioxidants, including vitamins (such as vitamin C and vitamin E), flavonoids, and phenolic acids, are primarily responsible for combating free radical species, which are the primary culprits behind various skin problems [2].

The plant isolates provide significant potential for skin protection. However, in certain cases, complete extracts exhibit superior potential owing to their intricate composition. Multiple studies have demonstrated that the consumption of green and black tea, which contain polyphenols, might improve negative skin reactions caused by exposure to ultraviolet (UV)

radiation [3]. Aloe, a natural ingredient, is thought to enhance skin healing and promote the development of new cells. The traditional utilisation of plants for medicinal or cosmetic purposes serves as the foundation for research and the development of innovative approaches in cosmetic science. Exposure of humans to solar UV radiation carries significant implications for public health [4].

The utilisation of herbal sunscreen as photoprotective agents for UVBprotection is gaining significant popularity in this domain. Sunscreens are utilised to enhance the body's innate defence mechanisms and shield against detrimental UV radiation emitted by the sun. The function of this object relieson its capacity to absorb, reflect, or disperse the rays emitted by the sun. The Sun protection factor (SPF) is utilised to gauge the efficacy of a topical product in shielding against UVB rays. The Sun Protection Factor (SPF) of a sunscreen is determined by comparing the duration required to induce sunburn on skin protected by sunscreen to the duration needed to induce sunburn on skin withoutany protection. Sunscreens with a higher Sun Protection Factor (SPF) provide increased defence against sunburn [5].

Categorization of Ultraviolet Radiation (UVR)

Ultraviolet radiation (UVR) is a component of the electromagnetic radiation spectrum that is discharged by the Sun. UVR, or Ultraviolet Radiation, is specifically defined as the segment ofthe electromagnetic spectrum.

The energy range between X-rays and visible light is typically between 30–300 electron volts (eV). The Sun is the main natural provider of ultraviolet (UV) light. Recent research suggests that the skin, which is the biggest organ of the body, is harmed by exposure to UV rays. The UV spectrum is categorised into different regions based on wavelength. These regions include VacuumUV Ultraviolet B (UVB) (290-320 nm) and Ultraviolet A (UVA) (320-400 nm) [6].

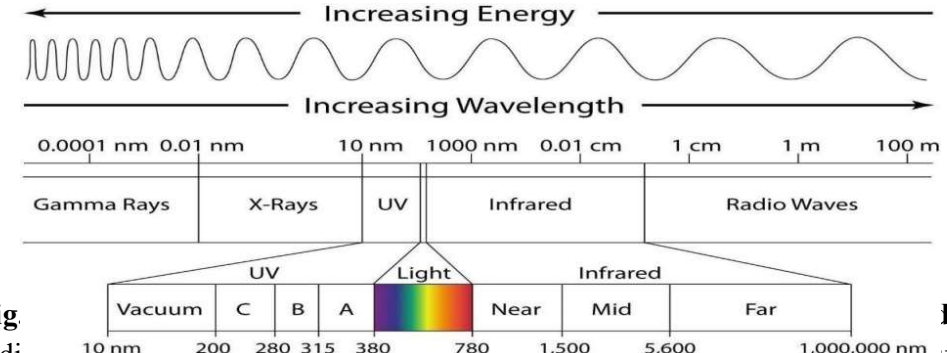


Fig liation

UVB radiation is the most harmful type of UV radiation given that it possesses sufficient energy to induce photochemical harm to cellular DNA, while yetbeing partially absorbed by the environment. UVB radiation is essential for humans to produce vitamin D, but it can also have detrimental consequences such as causing erythema , increasing the risk of developing skin cancer. Peoplewho work outside are most susceptible to the harmful effects of UVB radiation. The majority of solar UVB radiation is obstructed by ozone in the Earth's atmosphere. However, there is apprehension that the depletion of atmospheric ozone could lead to a rise in the occurrence of skin cancer [7].

1.3. Ultraviolet A (UVA) Radiation

Excessive exposure to UVA radiation initially causes the skin to darken (tanning), but if the

exposure continues to be excessive, it can lead to erythema. Atmospheric ozone has a low absorption capacity for this specific portion of the UV spectrum. Ultraviolet A (UVA) is essential for humans to produce vitamin D. Among these three types of rays, only UVA and UVB are directly detrimental tohuman skin, causing harm to both its surface and internal structure when exposed to the Sun for an extended period of time [8].

This occurs because UVC radiation, the third type, is unable to penetrate the Earth's ozone layer and so does not reach the planet's surface. In the malignant form of cancer, a tumour develops due to the aberrant proliferation of skin cells. The uncontrolled proliferation of these cells results in the formation of melanoma tumours, which are often fatal. Melanoma is a malignant skin Tumour that originates frommelanocytes, the cells responsible for producing the skin pigment melanin.Melanoma originates as a pigmented skin lesion and has the potential to metastasize swiftly to other cutaneous regions and internal organs. Typically, melanoma skin cancer is attributed to UVA rays, which have longerwavelengths and can penetrate deeper layers of the skin. Non-melanoma skin cancer, although not life-threatening, gradually develops within the epidermis [9].

The citation [10] is provided. UVB radiation specifically targets the epidermis, which is the outermost layer of the skin, and is the main cause of sunburns. The intensity of the sunshine is at its peak between 10:00 am and 2:00 pm. Negative Effects Of UVB radiation is capable of inducing skin damage, such as the formation of wrinkles, ageing skin problems, and cancer. UVB skin damage can occur through various pathways, including collagendegradation, the generation of free radicals, disruption of DNA repair processes,and suppression of the immune system's ability to fight infections. UVB radiation induces the generation of reactive oxygen species (ROS) [10].

UVB rays, which are responsible for sunburns, fluctuate depending on the time of day and the season. Protection from UVB radiation can be achieved by employing a mix of several methods, including the application of broad spectrum sunscreen compositions. The skin surface can absorb UV radiations (UVR), which can generate hazardous compounds known as free radicals or reactive oxygen species (ROS). These molecules have the potential to induce skin cancer and accelerate the ageing process [11]. UVB rays can also result in protein degradation, lipid peroxidation, and skin diseases. Lipid peroxidation is the oxidative degradation of lipids in cell membranes caused by the transfer of electrons from free radicals, leading to cellular harm. break down unsaturated lipids and produce malondialdehyde (MDA), which is regarded as an indicator of lipid peroxidation. In addition to biochemical changes, UVB radiation can also induce major structural alterations, such as erosion of the epidermis, changes in the thickness of the epidermal surface, fibrinoid and edoema formation, and irregularities in the arrangement of epidermal layers [12].

Disordered collagen fibrils. DNA quickly absorbs UVB light, leading to a frequent alteration in its molecular structure. Therefore, it is crucial to shield the skin from the detrimental impact of UVB radiation.

Sunburn (Erythema)

Sunburn, also known as erythema, is a disorder characterised by redness of the skin. This redness occurs when the superficial blood vessels in the dermisexpand, leading to increased blood flow, as a direct consequence of exposure to UV radiation. UVB radiation is primarily responsible for sunburn due to its significantly higher erythmogenic potential, which is 1,000

times greater than other types of radiation. Individuals with fair skin can get erythema after being exposed to the mid-day Sun for only 15-30 minutes [13]. The face, neck, and trunk are more vulnerable to sunburn compared to thelimbs, with a sensitivity that is two to four times higher.

Tanning:

The process of tanning. Tanning is the process of the skin developing melanin pigmentation, which causes a delayed darkening of the skin. The symptoms typically manifest within one to two days following sun exposure and progressively intensify over the course of many days, persisting for weeks or even months. Tanning occurs due to an augmentation in the quantity of melanocytes (cells responsible for producing pigment), which leads toheightened activity of the enzyme tyrosinase. This results in the production of fresh melanin and a rise in the quantity of melanin granules across the epidermis [14].

Skin experiencing premature ageing:

Prolonged contact with UVB radiation can lead to premature ageing of the skin, characterised by several clinical manifestations that indicate alterations in the structure of the epidermis and dermis. The observed clinical manifestationsencompass dryness, wrinkles, intensified skin furrows, drooping, reduced elasticity, and mottled pigmentation. These manifestations are attributed to degenerative alterations in elastin and collagen. UVB is far more effective than UVA in causing sunburn, nonmelanoma skin cancer, and accelerated ageing of the skin. This difference in efficiency is estimated to be between 1,000 and 10,000 times, as reported by Guarrera et al. [15].

Skin cancer is a medical condition that affects the skin. Various forms of skin cancer exist, such as nonmelanoma skin cancers, , as well as melanoma [16]. UVB radiation is believed to play asignificant role in the development of various malignancies by causing DNA damage. However, the specific forms of exposure required to produce different types of skin cancer may differ. Cumulative sun exposure is considered significant for nonmelanoma skin malignancies, but the intermittent exposure theory has been proposed for melanoma [17].

2.Materials

Plants for proposed study was collected from the herbal garden District At the time of flower collection, plant was about three and half month old.

Phenolphthalein, Potassium hydroxide (KOH), Hydrochloric acid (HCl) and Glycerol were purchased from Central Drug House, Mumbai. Absolute Ethanol used was from Hayman Limited, England. The water HPLC grade was purchased from Qualigens fine chemicals, Mumbai, India. Methanol and tetrahydrofuran (THF) HPLC grade were procured from Merk India Ltd.Mumbai.

Methods

Aloe Vera gel Obtained were aloe vera leaves . These stems were then washedusing water that was distilled. After thoroughly drying the leaves in an oven with hot air, the outer layer of the leaf was dissected lengthwise using a sterile razor. Subsequently, the colourless parenchymatous material of the aloe vera gel was extracted using a clean knife. Next, the mixture is strained through a muslin cloth to eliminate any fibres and contaminants. Subsequently, thefiltrate, that is a transparent gel derived from aloe vera, was utilised in the

formulation process.

Sample collection:

The herbal plant samples were collected from the local market of Bareilly and bring to lab for further studies.

Phytochemical Analysis

Flavonoid:

It was made with 10% lead acetate and lead nitrate. Then 1 ml liquid extract and1 ml of nitrate of lead were added. The presence of a yellow precipitated indicated the presence of flavonoids.

Saponin:

3 ml of water that had been distilled and 1 ml of the extract were combined. Positive results for saponin are shown by foam.

Tannin:

In one millilitre of extract, a few droplets of nitrate of lead were added. The precipitate was watched for a successful outcome.

Steroids:

2 ml of chloroform as well as 2 ml of H_2SO_4 were added along with 1 ml of theextract. Interface in reddish brown indicates a successful outcome.

Terpenoids:

0.01 ml of extract was added along with 1 ml of formaldehyde. H2SO4 (0.1 ml)was then added. Acetate drops with a few drops display a red colour, which is positive.

Carbohydrates:

0.1 ml of Fehling A was added along with 1 ml of the extract. Then Fehling B was diluted to 0.1 ml and added to the solution. Positive results are shown by ared precipitate [31].

Alkaloids:

Few drops of 1% HCl was added to 2 ml of extract and then 6 ml Mayers reagentwas added to it. Further the solution was incubated at 60°C, for 20 mins. The presence of Creamish precipitate indicate the presence of alkaloid.

Glycosides:

0.1 ml of concentrated HCl was added to 2 ml of extract and then 0.5 ml of NaOH was added over it. Yellow precipitate shows the presence of glycoside.

Phenols:

Few drops of ferric chloride and 2 ml of ferricynide was added to 2 ml extract.The bluish green colour indicates the presence of phenols.

Proteins and Aminoacids:

Add 3 drop of 0.002 percent copper sulphate to the ammoniated alkaline filter(2 ml extract) and look for a red or violet colour.

Formulation and optimization of Lotion:

In another beaker papaya will be mashed .other ingredients are mixed togetherand both the solutions are mixed together with continuous stirring till cream like consistency is obtained. Preservative , perfume are added and then packedin suitable container.

Tab: Formulation of the lotion

Ingredients	Formulation F3H	Formulation F1H	Formulation F2H
Aloe Vera gel	1 ml	1.5 ml	1 ml
Tomato extract	0.4 ml	0.5 ml	0.2 ml
Beeswax	3.2 g	3 g	3.5 g
Papaya extract	1 ml	1.5 ml	1 ml
Borax	0.3 g	0.2 g	0.4 g
Liquid paraffin	12 ml	10 ml	15 ml
Distilled Water	Q. S	Q. S	Q. S
Methylparaben	0.03 g	0.02 g	0.04 g
Rose oil	Q. S	Q. S	Q. S

Cream assessment Physical assessment

During this experiment, the cream was examined for its colour, odour, texture, and status,as indicated in table.

Irritancy

Indicate the specific region (1 cm2) on the upper side of the left hand. Subsequently, the cream was administered to the specified region and the duration was recorded. Afterward, the substance is examined for any signs of irritation, redness, and swelling for a period ofup to 24 hours. The findings are then documented and presented in table.

Ability to be washed

A minimal quantity of cream was administered to the hand and subsequently rinsed offwith water from the faucet.

Acidity level

A quantity of 0.5 grammes of cream was obtained and mixed into 50 millilitres of distilled water. The pH of the mixture was then measured using a digital pH metre (as indicated in results).

Viscosity

The viscosity of the cream was measured using a Brookefield viscometer at an ambient temperature of 25 ℃, with spindle No. 63 rotating at a speed of 2.5 RPM..

Phase separation

Refers to the process by which a mixture of substances separates into distinct phases or regions based on their different properties or compositions. The cream was stored in an airtight container at a temperature ranging from 25 to 100 ℃, while being protected from light. Phase separation was monitored for a duration of 24 hoursduring a period of 30 days. The phase difference was examined and recorded.

Dissemination capability

The spreadability was quantified by measuring the time in seconds it took for two slides to slide off from the cream, which was sandwiched between the slides, under a specific force. The

shorter the period required for the division of the two slides, the higher the spreadability.Two sets of slides made of glass with standard dimensions were obtained. Next, a slide of appropriate dimensions was selected and the cream formulation was applied onto the slide. Subsequently, another slide was positioned atop the formulation. Subsequently, a weight or specific load was applied to the upper slide in order to exert uniform pressure on the cream sandwiched between the two slides, resulting in the formation of a thin layer. Subsequently,the weight was eliminated and any surplus formulation clinging to the slides was scraped away. able to detach easily due to the gravitational strain exerted on it. The duration of the upper slide's slippage was recorded. The information is presented in results. The spread ability is defined as the product of the mass (m) and length (l) divided by time (t). Where, m represents the standard weight that is attached to or put on the upper slide, witha mass of 30 grammes. The length of a glass slide is 5 cm. t represents the duration in seconds.

Oiliness

Here, the cream was topically applied to the skin surface as a thin layer and examined for effectiveness. The smear had an oily or grease-like consistency, as indicated in table 10.

Study on compatibility

A active pharmaceutical ingredients (APIs) was conducted using infrared (IR) spectroscopy. The IR spectra was measured in the solid state. The IR spectrum was measured within the range of 4000.12 to 525.03 in the given location. The sensitivity value was 75. The infraredspectra of the mixture of herbal active pharmaceutical ingredients (APIs) exhibit prominentpeaks at the following wavenumbers: and 3289.05 cm-1. The identical peaks were also detected in the infrared spectra of each unique herbal active pharmaceutical ingredient (API),as shown in Table and figures

1.1. Sample collection:

The herbal plant samples such as *Carica papaya*, *Solanum lycopersicum*, *Aleobarbadensis miller* leaves were collected from the local market of Bareilly and bring to lab for further studies.

Carica papaya ***Solanum lycopersicum***

Aleobarbadensis miller

Fig. : Collected plant samples.

1.1. Sample preparation:

The collected leaves samples were washed with distilled water and then

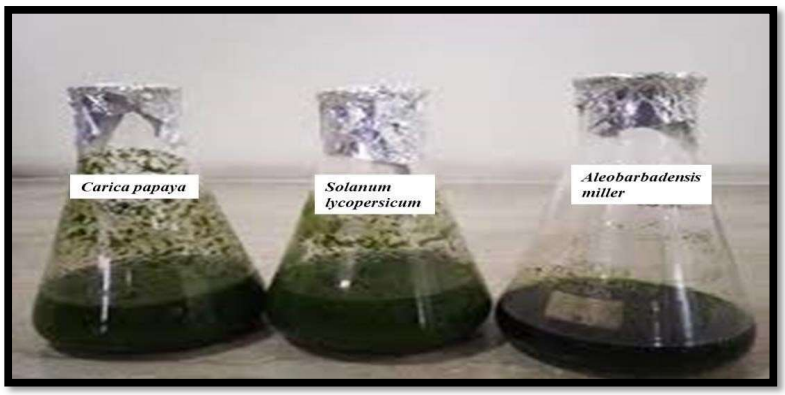
allowed to sun dried for a week. Then the dried leaves were crushed into powder and then stored for further use.

Fig.: Powdered sample

1.1. Extraction of phytocompound:

1 gm samples were taken and dissolved in 10 ml distilled water and incubated at 70°C for 1hour. Further the samples were incubated for 48 hours at room temperature. The extracts were filter using the Whatman filter paper. The filtrates were collected in a bowl and stored for further phytochemical analysis.

Fig: Extraction of phytocompounds from samples



Phytochemical Analysis:

It was composed of a mixture containing 10% lead acetate as well as lead nitrate. Subsequently, 1 millilitre of liquid extraction and 1 millilitre of lead nitrate were introduced.The existence of a yellow precipitation signifies the existence of flavonoids. A total of 3

millilitres of purified water and 1 millilitre of the extraction were mixed together. Foam indicates positive findings for saponin. A few drops of lead nitrate were added to one millilitreof extract. The formation of the precipitate was observed in anticipation of a favourable result.

Tab: Phytochemical analysis of extracts

S. No.	Tests	Samples aqueous extract		
		Carica papaya	***Solanum lycopersicum***	***Aleobarbadensis miller***
1	**Flavonoid**	+	+	+
2	**Saponin**	+	+	-
3	**Tannin**	+	+	+
4	**Steroids**	-	-	-
5	**Terpenoids**	-	+	+
6	**Carbohydrates**	+	+	+
7	**Alkaloids**	-	+	-
8	**Glycosides**	+	+	
9	**Phenols**	-	-	+
10	**Protein and amino acids**	+	-	+

Fig: Phytochemical test

1.1.

1.1. Formulations:

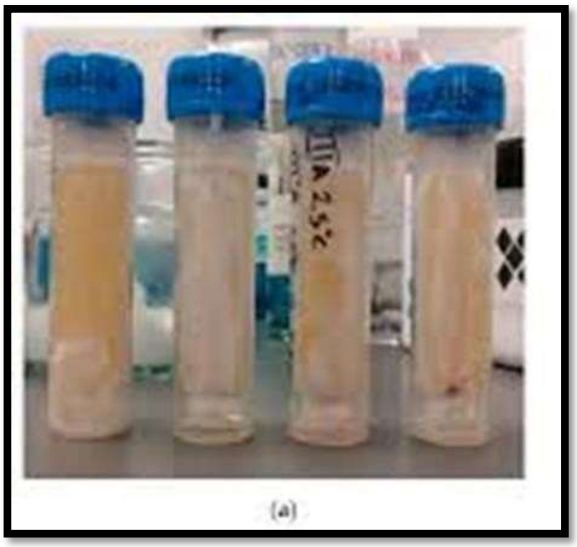


Fig: Formulated lotions

The evaluation findings for all three formulations are provided below: Physical assessment:

The colour, odour, texture, and status of the three formulations were assessed in this test.

Irritancy:

It refers to the quality or state of being irritating or causing annoyance. Indicate the specific region (1 cm2) on the upper side of the left hand. Subsequently, thecream was administered to the specified region and the duration was recorded. Afterward, the sample is examined for any signs of irritation, redness, and swelling within a 24-hour period and the findings are documented. The results indicate that all three formulations, namely F1H, F2H, and F3H, did not exhibit any signs of irritancy, erythema, or edoema.

Ability to be washed:

A washability test was conducted by placing a tiny quantity of cream onto the hand and subsequently rinsing it off with tap water. All three formulas were readily cleanable. Based on findings, the pH levels of all three formulations (F1H, F2H, and F3H) were determined to be close to the pH of the skin. Therefore, these formulations can be safely applied to the skin.

Viscosity:

It refers to the measure of a fluid's resistance to flow. The viscosity of the cream was measured using a Brookefield a viscometer at an ambient temperature of 25 ℃, using spinning No. 63 at a rotational speed of 2.5 RPM. Based on the results, each of the formulas exhibited sufficient viscosity.

Phase segregation:

The cream was stored in a sealed container at a temperature ranging from 25 to 100 °C, while being protected from light. Phase separation was monitored for a duration of 24 hours during a period of 30 days. Phase separation was monitored for any alterations. All three compositions showed no evidence of separation of the phases, according to the results.

Dissemination:

The spreading capacity of the three formulations, F1H, F2H, and F3H, was evaluated. Among these, F2H demonstrated superior spreadability as indicated by the shorter time required for the two slides to separate. This aligns with the evaluation test's description, which states that a shorter separation time indicates better spreadability. Therefore, F2Hexhibited better spreadability compared to the other formulations.

Oiliness:

Here, the cream was topically applied to the skin surface as a thin layer and examined for its oily or greasy consistency. Based on the findings, it can be concluded that every one of the formulations exhibited a non-greasy characteristic.

Study of compatibility:

Based on the figure, it can be concluded that the herbal components, namely Aloe Vera gel, Papaya, and Tomato, are friendly with each other. The active compounds in these ingredients exhibited distinct peaks in the infrared (IR) graphs. Furthermore, all three herbal ingredients displayed similar peaks in their respective IR graphs.

Tab: In this test color, odor, texture and state of the three formulations was checked

Parameters	**Formulation F3H**	**Formulation F1H**	**Formulation F2H**
State	Semisolid	Semisolid	Semisolid
Odor	Pleasant	Pleasant	Pleasant
Color	Faint green	Faint green	Faint green
Texture	Smooth	Smooth	Smooth

Tab: Irritancy study observations

S. No.	**Formulation**	**Irritant effect**	**Erythema**	**Edema**
1.	F1H	No	No	No
2.	F2H	No	No	No
3.	F3H	No	No	No

Tab : Washability observation

S. No.	Formulation	Washability
1.	F1H	Easy Washable
2.	F2H	Easy Washable
3.	F3H	Easy Washable

Table: pH observation table

PH	Formulation
6.4	F2H
6.8	F3H
6.9	F1H

Table : Viscosity observation table

Formulation	Viscosity (Cps)
F1H	21140
F2H	11250
F3H	18780

Table: Phase separation observation table

Formulation	Phase separation
F1H	No pahse
F2H	
F3H	

Table : Spreadability observation table

Formulation	Time(sec)	Spread ability (g×cm/sec)
F1H	9	32.8
F3H	14	18.14
F2H	8	31.0

Table : Greasiness observation table

S. No.	Formulation	Greasiness
1.	F1H	Non-greasy
2.	F2H	
3.	F3H	

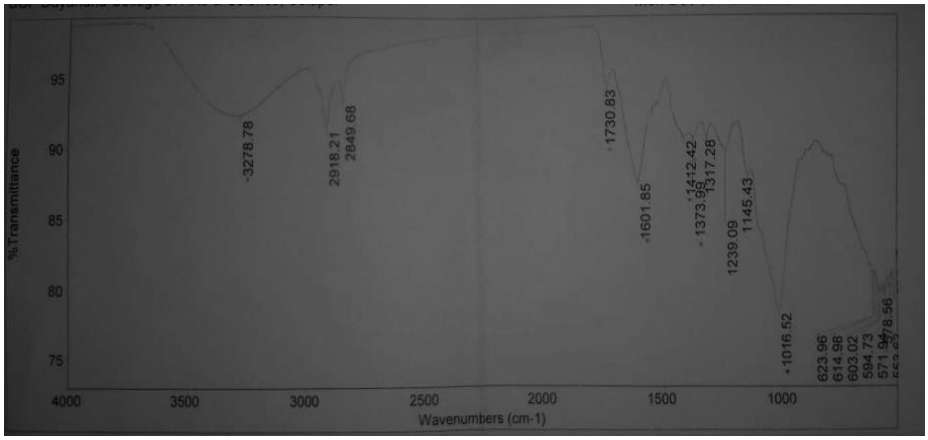


Fig. IR graph of tomato

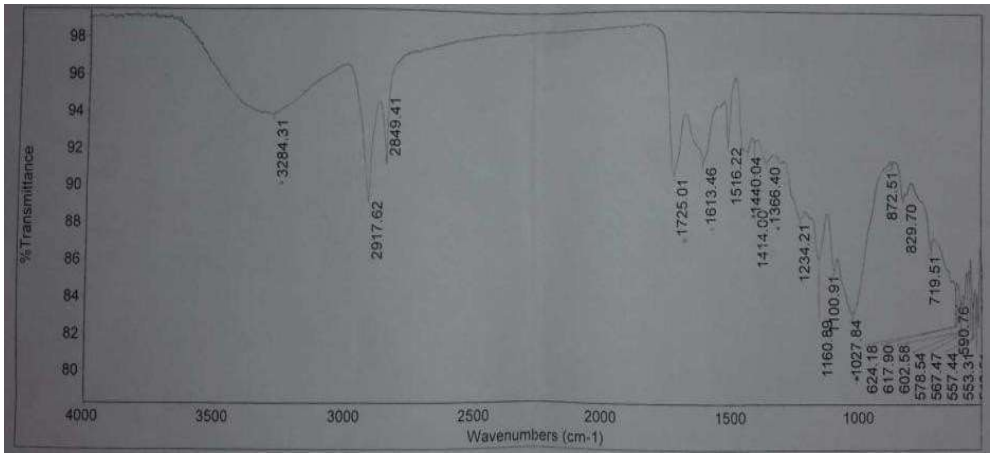


Fig: IR graph of papaya

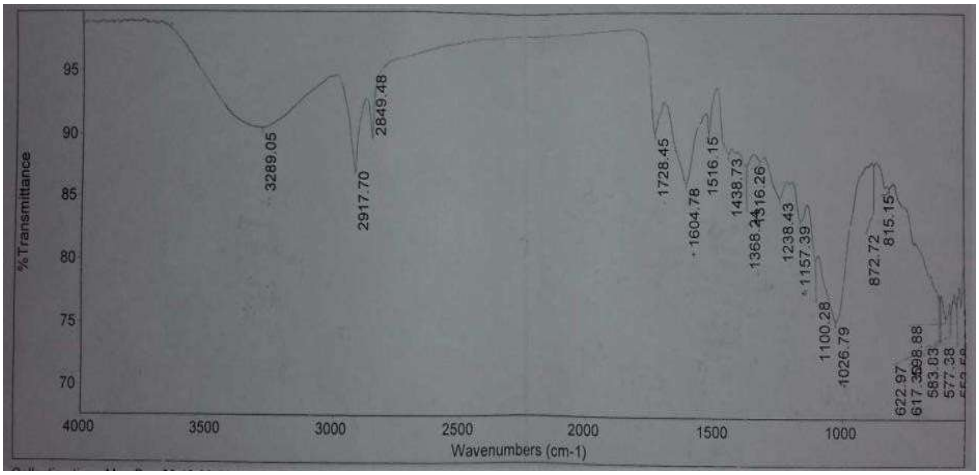


Fig: IR graph of Tomato+Papaya+Aloe Vera lotion mixture

Tab: Interaction studies through IR spectroscopy of tomato

Material	Peaks (Cm^{-1})	Characteristic functional group
	1730.83	C=O stretching vibration
	1412.42	C-O-H Bending vibration
Tomato	1373.99	Sulfate stretching vibration
	1601.85	C=O stretching vibration
	1016.52	C-O stretching vibration
	3278.78	N-H Bending vibration

Tab: Interaction studies through IR spectroscopy of papaya

Material	Peaks (cm^{-1})	Characteristic functional group
	1725.01	C=O Stretching vibration
	1440.04	C-O-H bending vibration
Papaya	1366.40	Sulfate stretching vibration
	1027.84	C-O stretching vibration
	1613.46	C=O Stretching vibration
	3284.31	N-H Bending vibration

Table : Interaction studies through IR spectroscopy

Materials	Peaks	Characteristic function group
	1026.79	C-O stretching vibration
Tomato+Papaya+ Aloe Vera gel	1368.24	Sulfate stretching vibration
mixture	1438.73	C-O-H Bending vibration
	1604.78	C=O stretching vibration
	1728.45	C=O stretching vibration
	3289.05	N-H Bending vibration

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