"FORMULATION AND DEVELOPMENT OF HERBAL FACE SERUM ON ANTI-AGING CONTAINING CUCUMBER AND TULSI"

Omkar G. Tekale [1], Priya D. Mandave[2] , Vaibhav Chavan[3] , Dr. Amol N. Khedkar[4]

Department of Pharmaceutical Sciences, Saikrupa Institute of Pharmacy, Ghargaon, Shrigonda, Ahmednagar, Maharashtra, India 414728

Corresponding Authers Details: Omkar Ganesh Tekale, Priya Dipak Mandave.

Abstract

Now days, the demand for the skin care product is increasing day by day. Cosmetic science may be read science and its multidisciplinary field since it includes basic knowledge and big selection of data from a variety of various scientific fields, cosmetics are articles intended to be poured, cleaned, sprayed, lead or then applied to the form of any part thereof for cleaning, enhancing ,promoting charm ,modifying the looks without affecting structure and function. Cosmetic serum is concentrated based on o/w emulsion. Wrinkles on the face and ageing of the skin are an undesirable effect of photodamage and ultraviolet radiation,Facial serum has the quick absorption and ability to penetrate deep layers of the skin as well as non-oily finish and deep formula with a very high amount of active ingredients.currently, no effective strategies are available to delay skin ageing process.Based on these properties the purpose of this work was to make serum using polyherbal extract.Tulsi, Cucumber, Aloevera gel and glycerin face serum is highly concentrated cosmetic product.Aloevera gel is commonly used to treat various skin ailments,sunburn,minor cuts,insect bites and also used as a wound healing, anti-inflammatory, antibacterial and anti-fungal effect.Tulsi has antiageing property and cucumber protect against wrinkles and signs of aging.The face serum was evaluated for its physicochemical properties such as colour,odour,ph,viscosity,consistency,homogeneity,skin moisture test,globule size determination and antimicrobial activity.

Keywords *Antioxidant, Cosmetic, Face serum,anti-inflammatory,anti bacterial,anti-fungal.*

Introduction:

Skin Serum is a skincare product you can apply to your skin after cleansing but before moisturizing with the intent of delivering powerful ingredients directly into the skin. Serum is particularly suited to this task because it is made up of smaller molecules that can penetrate deeply into the skin and deliver a very high concentration of active ingredients. This makes them a great tool for targeting specific skincare concerns, like pigmentation,signs of aging.

Skin Skin is the outermost protective covering It is the largest and most protective of the body,but sometimes the skin can become dry for many reasons such as UV rays,dirt,cosmetics left overnight can cause irritation and allergies. It is also known as integument It has a surface area of 1.8m2 and comprises of 16% of the total body weight is the most superficial part of the body. It constitute about 15 to 20% of the total body mass. The skin is an ever changing organ that contains many specialized cells and structures. As we age, changes occur in the structure of the skin that affect its appearance.

The face serum was evaluated for its physiochemical parameters, pH, globule size, consistency. The stability study results showed that there was no change in visual appearance, homogeneity and globule size.

SKIN

The skin is the body's largest and primary protective organ, covering its entire external surface and serving as a first-order physical barrier against the environment. Its functions include temperature regulation and protection against ultraviolet (UV) light, trauma, pathogens, microorganisms, and toxins. The skin also plays a role in immunologic surveillance, sensory perception, control of insensible fluid loss, and homeostasis in general. The skin is also highly adaptive with different thicknesses and specialized functions in different body sites. This article will discuss the anatomy of the skin, including its structure, function, embryology, blood, lymphatic, and nerve supply, surgical, and clinical significance.

Skin Thickness

The thickness of each layer of the skin varies depending on body region and categorized based on the thickness of the epidermal and dermal layers. Hairless skin found in the palms of the hands and soles of the feet is thickest because the epidermis contains an extra layer, the stratum lucidum. The upper back is considered thickest based on the thickness of the dermis, but it is considered “thin skin” histologically because the epidermal thickness lacks the stratum lucidum layer and is thinner than hairless skin.

1.1 Structure and Function of Skin

There are mainly 3 majo components of skin: 1.Epidermis 2.Dermis 3.Hypodermis

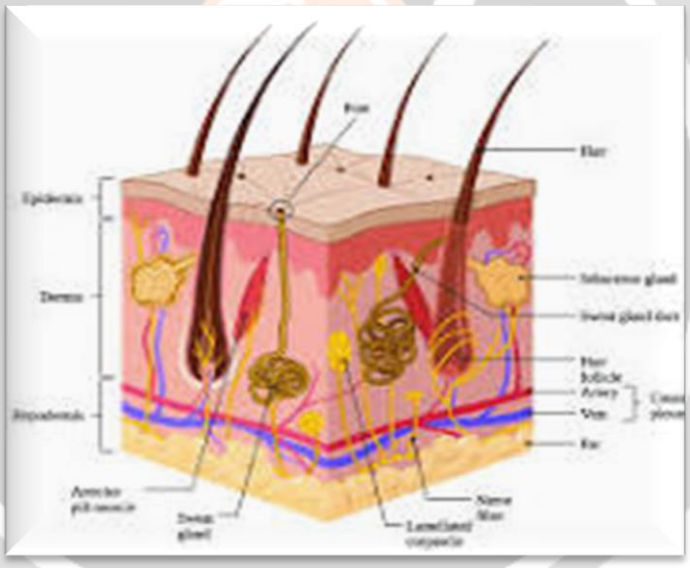


Fig No.1:Structure of skin

Serum is a concentrated product which widely used in Cosmetology. The name comes from itself in professional cosmetology. The cosmetic serum is as concentrated in water or oil as any other cream. Serum, or other concentrated product that contains ten times more organic matter than cream. Therefore, deal with the cosmetic problem quickly and effectively. Rising global cost of living has led to an increase in demand for cosmetic products. The cosmetics industry established in Malaysia is one of the most important economic resources. The value of cosmetics has increased as more and more people want to stay young and attractive. Serum is a skin care product that contains a gel or lightweight lotion or moisturizer and has the ability to penetrate deep to bring the active ingredients to the skin. A good skin serum may give your skin firmness, a smooth texture, make the pores appear smaller and increase moisture levels. Whether it is a moisturizing, anti-aging or anti-wrinkle product or serum for skin, all of these products should contain antioxidants, cellbased ingredients and skin-like ingredients. All skin types need these ingredients to stay as healthy as possible. Gel preparations and Liquids are best for oily skin and a combination, serum and light lotion is best for normal dry skin, more emollients and the best moisturizing creams for dry to very dry skin. Skin texture is all about the skin type but the smart ingredient for healthy skin is the same for everyone, no matter what product, texture or preference you have. The skin is the largest and most protective of the body for 24 hours, but sometimes the skin can become dry for many reasons such as UV rays, dirt, cosmetics left overnight can cause irritation or allergies. Skin serum is a skin care product

that you can apply to your skin after cleansing but before moisturizing with the intention of bringing the ingredients directly to the skin. Serum is particularly well suited for this task because it is made up of a small molecule that can penetrate deep into the skin and bring about a very high concentration of active ingredients. This makes them a tool to identify specific skin care concerns, such as color, signs of aging.

The skin is primarily made up of three layers. The upper layer is the epidermis, the layer below the epidermis is the dermis, and the third and deepest layer is the subcutaneous tissue.

- The epidermis, the outermost layer of skin, provides a waterproof barrier and contributes to skin tone.
- The dermis, found beneath the epidermis, contains connective tissue, hair follicles, blood vessels, lymphatic vessels, and sweat glands.
- The deeper subcutaneous tissue (hypodermis) is made of fat and connective tissue.

Functions of skin

The functions of the skin include:

- **Protection** against microorganisms, dehydration, ultraviolet light, and mechanical damage; the skin is the first physical barrier that the human body has against the external environment.
- **Sensation** of pain, temperature, touch, and deep pressure starts with the skin.
- **Mobility:** The skin allows smooth movement of the body.
- **Endocrine activity:** The skin initiates the biochemical processes involved in Vitamin D production, which is essential for calcium absorption and normal bone metabolism.
- **Exocrine** activity: This occurs by the release of water, urea, and ammonia. Skin secretes products like sebum, sweat, and pheromones and exerts important immunologic functions by secreting bioactive substances such as cytokines.
- **Immunity** development against pathogens.
- **Regulation of Temperature.** Skin participates in thermal regulation by conserving or releasing heat and helps maintain the body's water and homeostatic balance.

1.1 Advantages

- Improves skin texture.
- Minimizes the skin pores.
- Hydrates and nourishes the skin.
- Improves skin elasticity.

1.2 Disadvantages

- The liquid or gel-like texture of a serum can be a poor match for people with chronic skin conditions like
- eczema or rosacea, which weaken the skin barrier.
- For these people, serums may penetrate too quickly, causing irritation.

Clinical Significance of Skin

There are numerous clinically significant aspects of the skin, including the dermatomes of the skin, skin segments divided based on the afferent nerves they are supplied by which are numbered according to the level of spinal vertebral from which they arise. There are seven cervical, twelve thoracic, five lumbar, and five sacral. Certain diseases like shingles, caused by varicella-zoster infection, have pain sensation and eruptive rashes that involve a dermatomal distribution. Dermatomes are useful in the diagnosis of vertebral spinal injury levels. Aside from the dermatomes, the cells of the epidermis are susceptible to neoplastic changes resulting in various cancer types. Some autoimmune and immunological diseases target the desmosomes and hemidesmosomes founds in the epidermis. Certain infections can also disrupt the integrity of the epidermis along with drug reactions that present variably as well.

Face Serum

Serum is a concentrated product that is widely used in cosmetology. The cosmetic serum is as concentrated in water or oil as any other cream serum or other concentrated product that contains ten times more organic matter than cream4. Serum is a skin care product containing a gel or lightweight lotion or moisturizing consistency and have the ability to penetrate deeper to deliver active ingredient into the skin. A good skin serum can give your skin a stronger, smoother texture, make pores appear smaller and increase moisture levels5.

Serum providing intensive nutrition to the deeper skin layer and non-fat finish product which suitable for skin.Cosmetic serum was classified based on its rate of absorption and the ability to penetrate into the deeper layer of the skin.

Types of Face serum

There are five types of serum are as following given below.

- The oil serum
- The Gel serum The
- The Water based serum
- The Emulsion serum
- The pressed balm serum

1. The oil serum

The oil serum is the simplest to make of all the face serums. It often starts with a base of just premium, fastabsorbing carrier oils, also referred to as "dry" oils. In addition to having moisturising and barrier-repairing characteristics, the premium oils used in the serum also include polyphenols, essential fatty acids, and other substances that may be broken down by the skin.

Figure no. 2: **The Oil serum**

2. The gel serum

Gel serums provide the skin a "tightening" sensation, giving your consumer the impression that their skin is momentarily lifted or tightened in particular regions of the face. The gel serum provides you the chance to include some fantastic water-based (hydrophilic) plant extracts because this formulation is water-based.

Figure no.3The Gel Serum

3. The Water based serum

Water-based serums are comparable to gel serums, although they may contain none or very little gums and thickeners. To administer high-performance hydrophilic plant extracts that are trapped against the skin beneath a cream or lotion, you would utilise a water-based face serum. Layering an anti-ageing face mist under an emulsion and then under an oil is the ideal technique to promote higher penetration of water-based compounds into the skin, delivering their high performance elements slightly deeper into the layers of the skin. The oils will form an occlusive barrier that will promote higher component penetration.

Figure no. 4:Water based serum

4. The emulsion serum

An emulsion-based face serum is a moisturiser that strengthens the skin's barrier function while also delivering high performance components to the skin. Two "immiscible" phases-phases like oil and waterthat don't want to mix-are combined in an emulsion. An emulsifier is used to bind water and oil together and retain them in a stable state. The best chance of delivering high performance actives deeply into the tissues of the skin is through an emulsion. Given the skin's barrier function, it is highly difficult for any cosmetic component to penetrate the dermis, yet an oil and water mixture is best suited to accomplish this remarkable feat. The skin's barrier function will be strengthened by the emulsion's moisturising characteristics.

Figure no.5:Emulsion serum

5. The pressed balm serum

A balm serum has a conventional balm basis of butters, waxes, and oils but also includes active substances that are oil-soluble (lipophilic) and may help the skin.The butters and waxes form an occlusive barrier on the skin that hydrates and nourishes it while allowing the pressed serum's active components to do their job. In a balm serum, dozens of intriguing unique butters and waxes can be combined with thousands of exquisite plant oils.

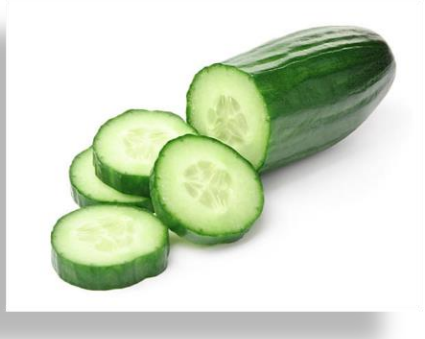
Figure 6: Pressed balm serum

Experimental work:

Material and Methods:

Materials:

List of ingredients and materials used in dissertation work



1)Tulsi Extract 2)Cucumber Extract 3)Aloevera Extract 4)Honey 5)Lavender Oil

6)Rose Water 7)Lemon 8) Sodium lauryl sulfate (SLS) 9) Carbopol 10)Water

List of Equipment :

1)Digital Weighing Balance 2)Beaker 3)Glass rod 4)Funnel

5)Morter and Pestle 6)Petri Plate 7)Magnetic stirrer 8)Hot air oven 9)Incubator 10)Digital Ph meter 11) Maceration 12)Brooke field Viscometer 13)Microscope 14)Refrigerator 15)Ph Paper

1. Active = Tulsi leaves Extract

Biological Name : Ocimum tenuiflorum

Synonym : Gauri, bahumanjari, pavani,

Family : Lamiaceae

Use : It helps to fight acne, provides clear skin, reduces sebum production, eliminates acne marks and blemishes, and strengthens skin barreir.

2. Active= cucumber extract

Biological Name: Cucumis sativus

Family: cucurbitaceae

Use : it helps to protect against UV rays and environment pollution while fighting free radicals that leads to wrinkles and sings if aging.

3. Active = Aloe vera gel

- **Kingdom:**Plantae
  - **Order :**Asparagales
  - **Family:**Asphodelaceae
  - **Subfamily:**Asphodeloideae
  - **Genus:**Aloe

- **Sprcies:**Aloe vera
- **Botanical name:**Aloe barbadensis miller

- **Use:** It can make your skin radienat and

Youthful

4.Honey

Biological Name:Madhu

Family: Apidae

Uses: It is used as preservative.

It is used for face whitening and glowing skin.

5.Rose Water

Rose water is said to be a natural skin toner due to this amazing pH- balancing properties.

It is cleansing your skin and removing any impurities that could cause unwanted spots.

6.Lemon Juice

The citric found in lemon juice brightness your skin, making it look more youthful and radiant.

Their antibacterial qualities help combat pesky pimples, giving you clearer, smoother skin.

7.Lavenderv Oil

It shous anti ageing property.

Lavender oil works to kill bacteria, and this prevent and heals acne breakouts.

Painful inflammation can be treated with lavender oil.

Methods :

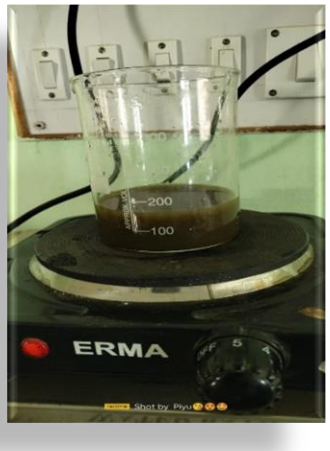
1)Tulsi Leaves extraction : Extracted by using Maceration method for 6 hours .

2)Cucumber Peel Extraction: Cucumber Peel is Extracted by using Maceration method for 6 hours.

Preparation of cucumber extract: Extracts were prepared by the macearation method.
Macearation Process:-
Fresh mature cucumbers were purchased from the local market.
The cucumbers were washed thoroughly under running tap water and were manually blend using a sterilized blender. The peels were then shade dried at room temperature for 5 days. The shade dried cucumber peels were powdered in a laboratory blender and was kept in airtight bottles until further use. The powdered cucumber peel was soaked in methanol and chloroform for 72 h by maceration technique. The supernatant was filtered through Whatman No.1 filter paper and concentrated using rotary evaporator and dry residue was preserved at 5°C in airtight bottles until further use.

Preparation of Tulsi extract:

By Macearation Process



50 gm of fresh tulsi (Indian basil) leaves

Deep in water for 3-4 hrs.

Heating for 2 hours on heating metal.

Collect the extract.

Cool and filter

Formulation Table:-

Table No:1

Ingrediants	**F1 (in20 ml)**	**F2 (in15ml)**	**F3 (in10 ml)**	**F4 (in25 ml)**	**F5 (in30 ml)**
Tulsi extract	25 %	33.33 %	40 %	24 %	26.66 %
Cucumber peel extrct	25 %	20 %	20 %	24 %	23 33 %
Aloe vera gel	10 %	10 %	10 %	14 %	13 %
Honey	10 %	10 %	10 %	10 %	3.2 %
Lavender gel	14 %	13.34 %	10 %	12 %	3.2 %
Rose water	q.s	q.s	q.s	q.s	q.s
Lemon	q.s	q.s	q.s	q.s	q.s
SLS	0.5 %	0.66 %	1%	0.025 %	0.03 %

Carbopol	q.s	q.s	q.s	q.s	q.s

Table No:2

Sr No	Ingredients	Use
1	Tulsi extract	Antioxidant
2	Cucumber peel extract	Protect against UV rays
3	AloeVera gel	Moisturizing
4	Honey	Preservative
5	Lavender oil	Anti-inflammatory,skin clearing propraties
6	Rose water	Antiageing
7	Lemon	Anti-acne
8	SLS	Emulsifying agent
9	Carbopol	Geling agent

Evaluation :-

1. **Antimicrobial Test**

1) Cup plate method

Procedure :

1.Divide the NA plate into four equal portions.
2.Then with the help of a sterile borer make four cavities one in each portion.
3.Then fill three cavities with antibiotic solution and in one fill the standard solution.
4.Incubate the plates at 370C for 48 hours.

2)Test for Antioxidant Activity of Extracts:-

Reducing Power method:

Requirement : UV Spectrophotometer , Incubator .

Procedure:-The reducing power was assayed by taking different concentration of extract (1ml) from each other were mixed in different test tubes with 2.5 ml of phosphate buffer (pH-7) and 2.5 ml of 1% potassium ferric cyanide. The mixture was then incubated at 50®C for 20 minutes. Then 2.5 ml of trichloroacetic acid (10%) solution was added to the mixture, which was mixed for 15 minutes. Finally 1.25 ml of distilled water was mixed with 0.50 ml of Feclȝ solution (0.1 w/v). The absorbance was measured at 700nm.

3) In Vitro Studies :

[A] Determination of Ph Apparatus

pH meter, preferably equipped with glass electrode.

Procedure : Take 5gm of sample in a beaker and add 45 ml of distilled water in it. Mix it properly until the whole gel is dissolved in water, then note the pH of the sample mixture by using pH meter.

[B] Determination of Viscosity :-

Apparatus : Brook Field Viscometer.

Procedure : The viscosity of serum was determined by using spindle no. 4 using brook field viscometer then all the operating conditions was set up. Then five readings were taken at different rpm and average of there will be the final reading. Viscosity was measured at 6 rpm in cps.

[C] Determination of Spreadablity Time :

Procedure : 2 Gm of serum sample was placed on a surface. A slide was attached to a pan to which 20 gm weigth was added. The time (seconds) required to seprate the upper slide from surface was taken as a measure of spreadability.

[D] Microbial Examination of the Product : Cosmetics do not need to be sterile, but they must be adequately preserved. When consumers use cosmetics they repeatedly challenge the cosmetics with micro organism in salivaon dirty hands, in tap water. Microbial growth may occur in cosmetics and toiletry product like cream, lotion and gel and many more intended to be use as skin care preparation. Hence it is very important that the cosmetics product must be free from microbial contamination,so that it will ensure safety to product to the client. The cosmetic product must be safe and adequately preserved.
Procedure : Sterilize the work area with disinfectant. Wash and dry thoroughly all the apparatus required. Prepare the dilution of the product take 1gm/ml of product and add to first test tube with pipette and shake it thoroughly then take 1ml from it in second test tube and prepare further dilution in same way.

Stability study of serum: The sample of serum was kept at 50C, room temperature 40C. The changes in physical appearance, colour, feel etc were studied.

Accelerated Stability Studies :

[A] Cyclical Temperature Tests : These tests are not carried out at fixed temperature and humidity. In this test, temperature was changed cyclically every day e.g. low-high-low-high to stimulate the changes in temperature

7.4 In vivo studies

[A] Patch test
Patch test was performed on sensitive part of skin, e.g. blend of elbow, popliteal space of skin behind ears. The cosmetic was tested by applying to an area of 1 sq.cm of the skin. Central patches were also applied. The site of the patch was inspected after 24 hours. There was no reactions and then test was repeated once more on the same side. Since there was no reaction as the person was considered as not hyper sensitive and product pass the test.

[D] Photographic evaluation:
Photographic evaluation is carried to see the effect of the product visually. To study whether the finished product were really effective formulated de pigment products have been subjectively studied. Four individual human volunteers of different age groups (30-50) were required to aasist in this research. The newly formulated de pigment products was requested to apply for 45 days.Photographs of their lower arm were taken before applying the products and then after 15 days, 30 days, 45 days of application of the antiageing products. The comparison can be easily made between two state side. Before applying the products and after applying the products. The difference between the skin before and after applying the formulated de pigment products were able to distinctly visualize easily.

[E] Globule size determination :
Microscopic sizing involves comparing the projected area of a particle with the areas of reference circles, or graticules, of known sizes, and it is essential for meaningful results that the mean projected areas of the particles are representative of the particle size.

Result and Discussion :
30ml of Face Serum was Prepared, Evaluated and Submitted.

Physical Evaluation:

Table No:3

Sr No	F1	F2	F3	F4	F5
Colour	Greenish	White Yellowish	Yellowish White	Yellowish	Yellowish
Odour	Characteristics	Characteristics	Characteristics	Characteristics	Characteristics

Texture	Smooth Homogeneous	Smooth Homogeneous	Homogeneous	Homogeneous	Homogeneous
Homogeneity	Good	Good	Good	Good	Very Good

PH Value:

Table No:4

Sr No	**F1**	**F2**	**F3**	**F4**	**F5**
PH	6.3	5.9	6.1	5.8	6.4

Viscosity:

Table No:5

Sr No	**F1**	**F2**	**F3**	**F4**	**F5**
Viscosity	**11856**	**10869**	**12869**	**14896**	**10860**

Cyclic Temperature Test:

Table No:7

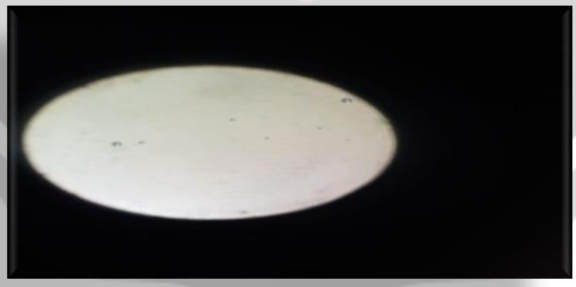
Sr .No	Parameter	F1	F2	F3	F4	F5
1	Freeze temperature	Stable	Stable	Stable	stable	Stable
2	Room temperature	Unstable	Stable	Stable	stable	Stable
3	High temperature	unstable	Stable	Unstable	stable	Unstable

Patch Test:

Table No:8

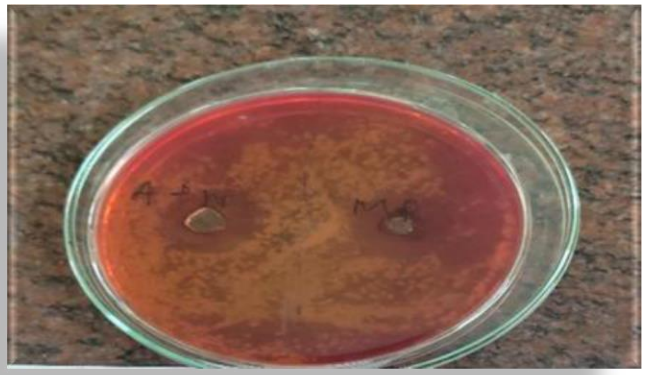
Sr.No	Parameter	F1	F2	F3	F4	F5
1	Immediately after removal of product	NR	NR	NR	NR	NR
2	After 24 hrs	NR	NR	NR	NR	NR
3	After 48 hrs	NR	NR	NR	NR	NR

Globule size Determination:-



Spreadiality :-

Antimicrobial Activity:-



Conclusion:

The aim of the study was to formulate and evaluate extract of different herbals into serum for moisturizing,fairness,glowing and antiaging activity on skin.In the present scenario people need to cure various skin related problems without any side effects.cosmeceuticals are skin care products that is used for both cosmetics and drugs In this serum kiwi,cucumber was used.Kiwi is used for anti-aging effect and cucumber is used for reduce wrinkles and give protection against UV rays and environmental pollution.The fresh aloevera gel is used to trat acne,pimples an d other skin problems like burn to heat,sunexposure and in treatment of radiation.The face serum is used to increase skin texture,skin elasticity and Hydrates and nourishes skin elasticity and reduce skin.

References:

1.Smriti ojha,Surabhi Sinha,Swadhapriya Das Chaudhuri,Hina Chadha,Babita Aggrawal,Seema Mahor Jain,Ajeet and Meenu;Formulation and Evaluation of face serum containing Bee Venom and Aloevera Gel;World Journal of Pharmaceutical Research 2019 Volume 8,Issue 2,1100-1105

2.Miss.Purva S Rajdev,Prof.Gaikwad.S.D,Miss.Aakanksha A Somvanshi,Miss Shubhangi S Gunjal.Formulation and Evaluation of Face Serum. International Journal of Advanced Research in Science,Communication and Technology (IJARSCT) .Volume 2, Issue 5, June 2022.

3,Shan Sasidharan,Pyarry Joseph,Junise Formulation and Evaluation of faireness serum using polyherbal extracts;International Journal of Pharmacy 2014:4(3):105-112

4.S.Budiasih,I.Masyitah,K,Jiyauddin,M.Kaleemullah,A.D.Samer,A.Mohd Fadli and Eddy :Formulation and Characterization of cosmetic serum contain Argan Oil as Moisturizing Agent:

5.Neha joshi,Rohit Ade,Gokul Gangurde,Bhagyashree.S.Suryawanshi;International journalof pharmaceutical Research and Applications:Formulation of Herbal Face Serum containing Aloe Vera and CitricA cid;Volume 7 Issue 6 No-Dec 2022 pp-815-820

6.Akshay D Thakare;International Journal of Innovative Science and Research and Technology Formulation and Development of De Pigment Serum Incorporating Frits Extract;Volume 2,Issue 12,December 2017;ISSN No:2456-2165

7.Vaishnavi.P.Koulge,Prathmesh V Kokate,Vaishanavi v Kuditrekar,Prajwal S Kumbhar,Apoorva R Kundal.Sonali K Diwate;International Journal Of Pharmacy and Pharmaceutical Research.Development and Authentication of Skin Care Pharmaceutical Serum Using Herbal Extractss;August 2022 volume 25(1):317-334 ISSUE:1

8.Yaar M, Gilchrest B. Cellular and molecular mechanisms of cutaneous aging. *J Dermatol Surg Oncol.* 1990;16:915–22.

9.El-Domyati M, Attia S, Saleh F, et al. Intrinsic aging vs photoaging: a comparative histopathological, immunohisto-chemical, and ultrastructural study of skin. *Exp Dermatol.* 2002;11(5):398–405.

10.American Society for Aesthetic Plastic Surgery (ASAPS) *Cosmetic Surgery National Data Bank: 2003 Statistics.* New York, NY: ASAPS; [Accessed on October 10, 2010]. http://www.surgery.org/download/2003-stats.pdf.

11.Nagashima H, Hanada K, Hashimoto I. Correlation of skin phototype with facial wrinkle formation. *Photodermatol Photoimmunol Photomed.* 1999;15(1):2–6.

12.Mumtaz BT M. Sultan Suhai Buddeen. Optimization, Stability and Characterization of Face Serum Formulation. 2018.

13.Drallos and thaman, "Cosmetic formulation of skin care products" volume 30, 167-180.

14.http://www.skin biology.com Leveque and Agache "Ageing skin, properties and functional changes"

15.M. Sanchez, E. Gonzalez-Burgos, I. Iglesias And M. P. Gomez-Serranillos, "Review, Pharmacological Update Properties of Aloe Vera and its major Active Constituents", Molecules 2020, 25, 1324; doi:10.3390/molecules25061324178

16. Dr. Satyprakash singh , Dr.Vijay Nigam Cosmetic Science Thakur publication lucknow .2021 first Edition , 32-36