



“FORMULATION AND EVALUTATION OF HERBAL GEL OF ALOE VERA, AZADIRACHTA INDICA AND LYCOPERSICON ESCULANTUM EXTRACT”

Alfia Sheikh, Aayush Pathak, Charu Bante, Ankita Gedam, Ashvin Sonwane, Apeksha Gharjare,
Poonam Bhange

Assistant Professor Monoharbai Patel Institute of Pharmacy (B.Pharm)
Gondia (MH) – 441 614

Principal Monoharbai Patel Institute of Pharmacy (B.Pharm)
Gondia (MH) – 441 614

ABSTRACT

Method: The aloe vera juice is collected by peeling the outer layer of skin and pericarp of leaf. The azadirachta indica and lycopersicon esculentum extraction was done by using percolation method and by using methanol and ethanol as solvent. Evaluation of antifungal and antibacterial activity of both extract was carried out by agar well diffusion method against bacteria e.coli, and a.niger. Minimum inhibitory concentration (mic) of the resulted gel was determined by using broth dilution method.

Result: The evaluation of antibacterial and antifungal activity of the gel containing aloe vera, azadirachta indica, and lycopersicon esculentum was evaluated by determining of mic using the resulted gel.

Conclusion: We conclude that formation of aloe vera, azadirachta indica and lycopersicon esculentum containing gel is effective in antibacterial and antifungal activity.

Keywords: Aloe vera, azadirachta indica, lycopersicon esculentum, e.coli, a.niger, mic, percolation, antibacterial and antifungal.

Antibacterial and Antifungal activity: -

Antimicrobial activity refers to the process of killing or inhibiting the disease-causing bacteria and

fungus.

For Example: Antibiotics are used against bacteria and Antifungal are used against fungi.

Some herbal drugs which give the antibacterial and antifungal activities: -

Common Name	Scientific Name	Component Present	Therapeutic Action
Thyme	Thymus vulgaris	Thymol	Antibacterial, Antioxidant
Clove	Syzygium aromaticum	Phenylpropanoids E.g., Thymol, Eugenol	Antibacterial, Anti-inflammatory
Fenugreek	Trigonella foenum-graecum	Diosgenin, Alkaloids	Antifungal
Turmeric	Curcuma longa	Curcumin	Antifungal, Antineoplastic

[1]

Introduction: -

Aloe Vera

The Aloe Vera look like a cactus but it isn't. The botanical name of Aloe vera is Aloe Barbadensis miller. It belongs to Ashodelaceae (Liliaceae) family, and is a shrubby or arborescent, perennial, xerophytic, succulent, and pea- green colour plant. Inside the leaf is a jelly like substance. The properties of Aloe vera were well accepted from China to India. Today, Aloe vera is cultivated throughout the world. Terms including, the potted physician and nature's medicine chest, attempted to describe the significant historical uses of Aloe vera. There are over 250 species of aloe grown around the world. However, only two species are grown today commercially, with Aloe Barbadensis Miller and Aloe aboescens being the most popular. The Aloe plant is grown in warm tropical areas and cannot survive freezing temperatures. The Aloe vera plant has been known and used for centuries for its health, beauty, medicinal and skin care properties. The name Aloe vera derives from the Arabic word

-Alloeh meaning -shining bitter substance, while -Ver in Latin means -true. 2000 year ago, the Greek scientists regarded Aloe vera as the universal panacea. The Egyptians called Aloe -the plant of immortality. Today, the Aloe vera plant has been used for various purposes in dermatology. Aloe vera has long been used as a remedy in many cultures. Aloe preparation, including Products based on both the gel and leaf is used, among other reasons, as laxative, in creams for skin in functional foods, and treatment for a wide range of diseases.

Aloe vera Latex commonly known as aloin having a bitter taste and purgative quality. Because of its bitter taste, it is also known as bitter aloes. Aloin is destructive to healthy tissue and cells. It is obtained from specialized cells known as pericyclic tubules that occur just beneath the epidermis or rind of the same leaves from which the juice is derived. Aloe can be used in raw form or in processed forms; it can be used both externally and internally. Dried Juice is

commercially known as aloe or musavvar.

This is the solidified juice coming spontaneously when the leaf is cut out of the cells in pericycle and adjacent leaf parenchyma. This juice is then dried with or without heat to give a strongly bitter substance having a characteristic disagreeable odor. This is known as aloe in the market.

Three types of aloe are available in market depending upon the source plant viz.

- i. Curacao aloe: a dark brown colored substance sourced from Aloe vera
- ii. Cape aloe: greenish brown colored aloe sourced from Aloe ferox and
- iii. Socotrine aloe: reddish black colored aloe sourced from Aloe peyrii baker.
- iv. The original commercial use of the Aloe plant was in the production of a latex substance called Aloin, a yellow sap used for many years as a laxative ingredient.^[3]



Fig: Aloe Vera

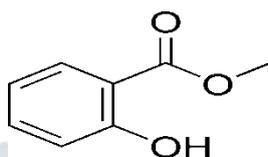
1. Botanical names: Aloe barbadensis miller
2. Family: Liliaceae
3. Synonym: Aloe barbadensis, Aloeindica, Aloe arborescens, Aloe ferox
4. Common names :

Languages	Names
Nepali	Gwarpatha
Sanskrit	Ghritkumari
Hindi	Musabar
Marathi	Korphad
kannada	kathaligida

^[5]

Chemical Constituents**Active Constitutes of Aloe Vera:**

The Aloe vera leaf gel contains about 98% water. The total solid content of Aloe vera gel is 0.66% and soluble solids are 0.56% with some seasonal fluctuation. On dry matter basis, Aloe vera gel consists of polysaccharides (53%), sugars (17%), minerals (16%), proteins (7%), lipids (5%) and phenolic compounds (2%). Aloe vera contains 200 potentially active constituents: vitamins, enzymes, minerals, sugars, lignin, saponins, salicylic acids and amino acids, which are responsible for the multifunctional activity of Aloe 7 - 9.



Salicylic acid

Vitamins:

It contains Vitamins A (beta-carotene), C and E, which are antioxidants. It also contains Vitamin B12, folic acid, and choline. Antioxidant neutralizes free radicals.

Enzymes:

It contains 8 enzymes: amylase, alkaline phosphatase, amylase, brady kinase, carboxy-peptidase, catalase, cellulase, lipase, and peroxidase. Brady kinase helps to reduce excessive inflammation when applied to the skin topically, while others help in the breakdown of sugars and fats.

Minerals:

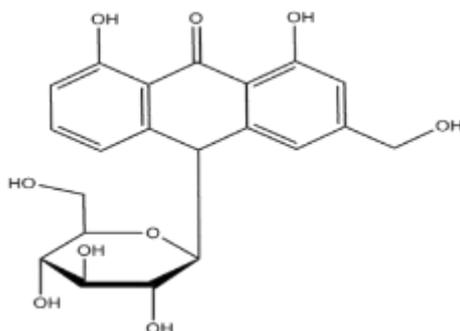
It provides calcium, chromium, copper, selenium, magnesium, manganese, potassium, sodium and zinc. They are essential for the proper functioning of various enzyme systems in different metabolic pathways and few are antioxidants.

Sugars:

It provides monosaccharides (glucose and fructose) and polysaccharides: (glucomannans / polymannose). These are derived from the mucilage layer of the plant and are known as mucopolysaccharides. Recently, a glycoprotein with anti-allergic properties, called alprogen and novel anti-inflammatory compound, C-glucosyl chromone, has been isolated from Aloe vera.

Anthraquinones:

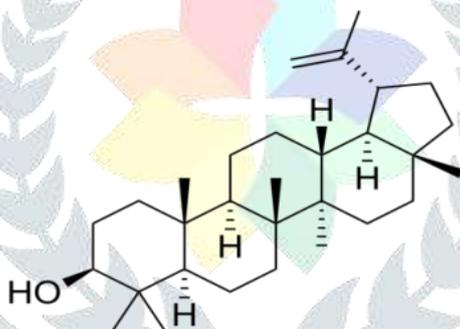
It provides 12 anthraquinones, which are phenolic compounds traditionally known as laxatives. Aloin and emodin act as analgesics, anti-bacterial and anti-viral.



Aloin

Fatty acids:

It provides 4 plant steroids; cholesterol, campesterol, β -sitosterol and lupeol. All these have anti-inflammatory action and lupeol also possesses antiseptic and analgesic properties.



Lupeol

Hormones: Auxins and gibberellins that help in wound healing and have anti-inflammatory action.

Others: It provides 20 of the 22-human required amino acids and 7 of the 8 essential amino acids. It also contains salicylic acid that possesses anti-inflammatory and antibacterial properties. Lignin, an inert substance, when included in topical preparations, enhances penetrative effect of the other ingredients into the skin. Saponins that are the soapy substances form about 3% of the gel and have cleansing and antiseptic properties.^[9]

Uses

The plant Aloe vera is used in Ayurvedic, Homoeopathic and Allopathic streams of medicine, and not only tribal community but also most of the people for food and medicine. The plant leaves contain numerous vitamins, minerals, enzymes, amino acids, natural sugars and other bioactive

compounds with emollient, purgative, antimicrobial, anti-inflammatory, anti-oxidant, aphrodisiac, anti-helminthic, antifungal, antiseptic and cosmetic values for health care. This plant has potential to cure sunburns, burns and minor cuts, and even skin cancer. The external use in cosmetic primarily acts as skin healer and prevents injury of epithelial tissues, cures acne and gives a youthful glow to skin, also acts as extremely powerful laxative.^[10]

Azadirachta Indica

Azadirachta indica (*A. indica*) belongs to the botanic family Meliaceae, commonly known as Neem. It is used in traditional medicine as a source of many therapeutic agents. *A. indica* (leaf, bark and seeds) are known to contain antibacterial and antifungal activities against different pathogenic microorganisms; in addition to antiviral activity against vaccinia, chikungunya, measles, and Coxsackie B viruses

Different parts of Neem (leaf, bark and seeds) have been shown to exhibit wide pharmacological activities such as antioxidant, antimalarial, antimutagenic, anticarcinogenic, anti-inflammatory, antihyperglycemic, antiulcer, and anti-diabetic properties. The biological activities are attributed to the presence of many bioactive compounds in its different parts. Aqueous extract of Neem leaf extract has a good therapeutic potential as an antihyperglycemic agent in insulin dependent and non-insulin-dependent diabetes mellitus.



Fig: *Azadirachta Indica*

Botanical name: - *Azadirachta Indica*

Family: Mahogany

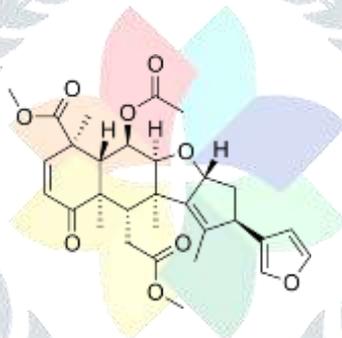
Synonyms: -margosa, arishth, , *Melia Azadirachta*, rosehip, witch-hazel melaleuca,

Common Name:-

LANGUAGES	NAME
English	Paradise tree
Sanskrit	Aristha
Urdu	Neem
Hindi	Nim
Marathi	Kadu-limba

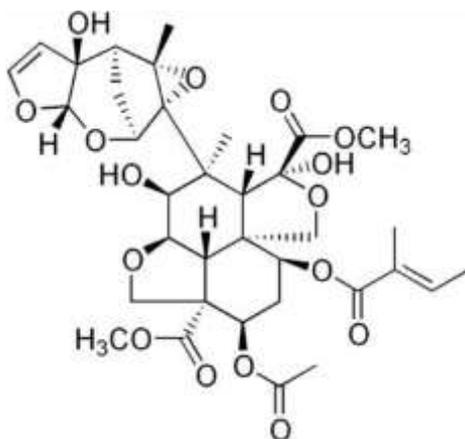
Chemical Constituents: -

Constituents: Leaf extracts: Active constituents of neem leaf extract include isomeldenin, nimbin, nimbinene, 6-desacetylnimbinene, nimbandiol, immobile, nimocinol, quercetin, and beta-sitosterol. Two additional tetracyclic triterpenoids zafaral [24,25,26,27-tetranorapotirucalla-(apoeupha)-6alpha-methoxy-7alpha-acetoxy-1,14-dien-3,16-dione-21-al] and maleinanhidrider [24,25,26,27-tetranorapotirucalla-(apoeupha)-6alpha-hydroxy,11alpha-methoxy-7alpha,12alpha-diacetoxy,1,14,20(22)-trien-3-one] have been isolated from the methanolic extract of neem leaves.



Nimbin

Seed: Active constituents have not been determined with certainty. The neem seed extracts vary in each batch in terms of stability and activity. Two new tetranortriterpenoids, azadirachtin H and azadirachtin indica, have been isolated from neem seeds.



Azadirachtin

Tree: Azadirachtin is a tetranortriterpenoid from the neem tree. Neem bark and leaves contain tannin and oil.^[16]

Uses: -

Neem is considered a boon for mankind by nature. Use of Neem has been recommended by Ayurveda for a wide range of diseases. Such usage is attributed to its purification effect on blood. Scientific research on Neem demonstrates it to be a Panacea. It is suggested to be an antibacterial, anthelmintic, antiviral, anticancer and more importantly immunomodulatory agent.^[17]

Lycopersicon Esculentum: -

Solanum Lycopersicon, popularly known as tomato, originated in South America and now is used and cultivated in various parts of the world. This product is cultivated in warm climate regions, but can also be planted inside a greenhouse during winter. Tomatoes are full of vitamins and antioxidants essential to a healthy body. Since the tomato doesn't need a lot of tending, it's an easy plant to grow. Tomatoes can be consumed in several ways from salads up to sauces and easily harvested, making it the second most consumed vegetable of the American diet and has China being the main country that produces tomatoes in 31% of the total produce in the world.



[19]

Fig: *Lycopersicon esculentum*

- Binomial name: - *Solanum lycopersicum*
- Family: - Solanaceae
- Synonyms: - *Solanum lycopersicum* L., *Lycopersicon lycopersicum*
- Common name:-

Language	Name
English	Tomato
Tamil	Takkali
Hindi	Tamatar
Kashmiri	Ruvangum

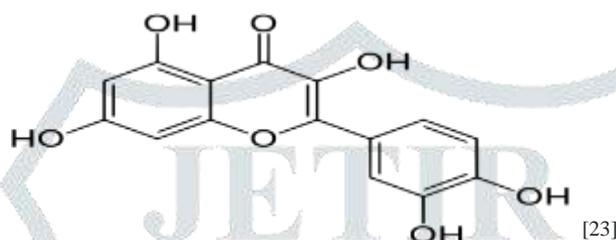
[20]

Geographical sources: -

Tomato originated from the Andean region of South America, in the area now covered by parts of Bolivia, Chile, Ecuador, Colombia and Peru. The related species of cultivated tomato are native and widely distributed in this region.^[21]



Lycopene



Quercetine

Uses: -

The pulped fruit is an extremely beneficial skin-wash for people with oily skin. Sliced fruits are a quick and easy first aid treatment for burns, scald and sunburn. A decoction of the root is ingested in the treatment of toothache. The skin of tomato fruits is a good source of lycopene, a substance that has been shown to protect people from heart attacks. It seems to be more effective when it is cooked and so can be obtained from food products such as tomato ketchup and tinned tomatoes. Lycopene has also been shown to have a very beneficial effect upon the prostate and is being used increasingly to treat enlarged prostate and the difficulties in urination that accompany this disorder. A homeopathic remedy is made from the plant. It is used in the treatment of rheumatism and severe headaches.^[24]

Material and Method:-**Plant Material Collection:-**

Aloe Vera, Neem (*Azadirachta indica*), Tomato seed (*Lycopersicon esculentum*) plants were collected from market of Gondia, Maharashtra, India. [Table.1]

Authentication of Plant Material:-

The authentication of the herbal drug Neem (*azadirachta indica*), Tomato seed (*Lycopersicon esculentum*) is done from D.B Science College, Gondia.

Excipient Profile:-**Carbopol 934⁴⁹:-****Hydroxypropylmethyl****cellulose⁴⁹:-****Procedure:**

An excess of gel sample 2.5 g was placed between two glass slides and a 1000g weight was placed on slides for 5 minutes to compress the sample to a uniform thickness. Weight (60g) was added to the pan. The time (seconds) required to separate the two slides was taken as a measure of spread ability

It was calculated using the formula,

$$S = m.l / t$$

Where,

S - Spread ability in g.cm / secm -

Weight tied to upper slide l -

Length of glass slide

t - Time in seconds Length of glass slide was 11.3 cm and weight tied to upper slidewas (60g) throughout the experiment.^[34]

1. Determination of Antibacterial and Antifungal activity:**Test Microorganism:**

Bacteria: E. coli, Fungi: A. niger

Antifungal and antibacterial activity

The agar well diffusion method described by Zaria, (1955) was adopted for the antimicrobial sensitivity test. For antibacterial studies, the microbial strains Escherichia coli and for anti fungal studies the microbial strains Aspergillus niger was collected from Manoharbai Patel Institute of Pharmacy, Gondia

Preparation of Inoculums:

Bacterial suspensions were prepared from overnight cultures by the direct colony method. Colonies were taken directly from the plate and suspended broth. These pre-culture broth were 31 allowed to stand overnight in a rotary shaker at 37°C, after which these cultures were maintained on broth in freeze for further use.

Preparation of growth media:-

Nutrient agar was used for preparation of medium for growth of above said organisms. Nutrient agar was taken (2.3 gm with 100 ml of distilled water) for preparation of growth media. Prepared nutrient agar was autoclaved at 121°C 9 and 15 lb. pressure and then nutrient agar was poured in petri plates under the laminar flow with suitable sterile conditions. After solidification, plates were kept in incubator at 24 hours for checking of contamination in media, followed by using the plates for further testing the antibiotic susceptibility of the isolated strains.

Determination of zone of inhibition:-

Antifungal and Antibacterial activity was checked by agar well diffusion method. In this method a previously liquefied medium was inoculated with 0.2 ml of Fungal and Bacterial suspension having a uniform turbidity at temperature of 40°C.

20 ml of culture medium was poured into the sterile petri dish having an internal diameter of 8.5 cm.

Care was taken for the uniform thickness of the layer of medium in different plates. After complete solidification of liquefied inoculated medium, the wells were made aseptically with cork borer having 6mm diameter.

In each of these plate gel solutions was placed carefully. Plates were kept for pre diffusion for 30 mins.

After it normalized to room temperature; the plates were incubated at 37°C for 24 hours in case of bacteria and at 27°C for 48 hours in case of fungi.

After incubation period was over, the zone of inhibition was measured with help of Hi- antibiotic zone scale.(Table.9)^[35]



Fig. Plate inhibition zone showing antifungal activity

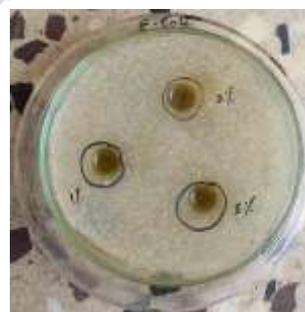


Fig. Plate inhibition zone showing the antibacterial activity

Result and Discussion:-

The gel formulated showed good activity against both fungi and bacteria. The gel having Carbopol showed good viscosity but lacked consistency. All formulations were turbid. All the formulations had characteristic odour. Spread ability was observed best in *Aloe vera* with HPMC

3%. The pH required was also in limits in case of HPMC 2-3%. pH of Carbopol was more on acidic side. Based on the physical evaluations, formulation with HPMC 2-3% exhibited good physical properties and was found to be best choice for preparing gels.

Table.1: Plant material collection

Parameter	Aloe vera	Azadiracta Indica	Lycopersicon Esculentum
Color	Depends on variety dark brown, Brownish Black or black	Greenish brown color Powder	Red uneven with light inclusion
Taste	Intensely bitter and nauseating	Acrid, Bitter	A bit sour with a smack of overripe tomatoes
Odor	Characteristic	Typical	Typical
Size	Masses of various sizes	20-40 centimeters	1-10 centimeter
Shape	N/A	Oblong	Oval

Table.2: Excipient Profile.

Parameters	Carbopol	HPMC
Colour	White powder	White or creamy granular powder.
Odour	Characteristic odour	odourless
pH.	2.5-3.0	4.2 - 9.2
Viscosity	29400 to 39400 cps. At 25°C	2600-5600 cp at 20°C
Solubility	Water, Ethanol(96%), Glycerol.	Polar organic solvent, Water and Ethanol(96%)

Table.3: Clarity and Color of different gels.

Formulation	Concentration		
	1%	2%	3%
Aloe vera	Green/ Turbid	–	–
HPMC	Green/Turbid	Green/Turbid	Green/Turbid
Carbopol	Green/ turbid	Green/Turbid	Green/Turbid

Table.4: Odor of different gels.

Formulation	Concentration		
	1%	2%	3%
Aloe vera	Characteristic	–	–
HPMC	Characteristic	Light	Very light
Carbopol	Characteristic	Characteristic	Light

Table.5: Viscosity (poise) of different gels.

Formulation	Concentration		
	1%	2%	3%
Aloe vera	2.841	–	–
HPMC	13.564	17.128	20.434
Carbopol	3.342	7.210	8.776

Table.6: pH of different gels.

Formulation	Concentration		
	1%	2%	3%
Aloe vera	5.8-6.7	–	–
HPMC	5.5-6.2	5.8-6.5	6.1-6.8
Carbopol	3-3.5	3-4	3-4

Table.7: Spreadability of different gels.

Formulation	Concentration		
	1%	2%	3%
Aloe vera	Fair	–	–
HPMC	Fair	Good	Best
Carbopol	Fair	Good	Good

Table 8: Chemical tests for formulated gel

Sr.no	Chemical tests	Observation	Result
1	For tannins	Brownish-green coloration seen	passed
2	For phlobatannins	No change	failed
3	For saponins	Froth formation seen	passed
4	For terpenoids	Yellow color appeared	passed

Table 9: Antibacterial and Antifungal activity of different extract and gel

Sr. no	Ointments	Zone of inhibition(mm)	
		E.coli	A.niger
1	Aloe vera extract	10	19
2	Neem extract	08	14
3	Tomato seed extract	12	16
4	Gel (3% HPMC gel)	12	12

Conclusion

From the above study we concluded that herbal gel is prepared for topical administration. Aloe vera is used with polymers in gels to provide synergistic effect as well as moisturising effect on skin. Herbal formulation have growing demand in the world market. It is very good attempt has made to established the Herbal gel containing Aloe vera, Azadirachta indica and Lycopersicon esculentum seed extract. The study of antifungal and antibacterial activity show best formulation at 3% concentration. The extract taken in the present study can be replaced with other extract having more activity.

References

1. Wińska, K., Mączka, W., Łyczko, J., Grabarczyk, M., Czubaszek, A. And Szumny, A., 2019. Essential oils as antimicrobial agents—Myth or real alternative?. *Molecules*, 24(11), p.2130
2. S. And Bharadvaja, N., 2019. Market analysis of medicinal plants in India. *Current pharmaceutical biotechnology*, 20(14), pp.1172-1180.
3. En.wikipedia.org
4. https://garden.lovetoknow.com/wiki/growing/Aloe_Vera_Plants.
5. <https://www.newworldencyclopedia.org/entry/Aloe>.
6. Mehta, I., 2017. History of Aloe vera-(a magical plant). *IOSR J Humanit Soc Sci*, 22,pp.21.
7. 8.Shah, B.N., 2009. Textbook of pharmacognosy and phytochemistry. Elsevier India.
9. Ujwala, T.K., Tomy, S., Celine, S. And Chander, J.S.J.U., INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH.
10. <https://www.webmd.com/diet/supplement-guide-aloe-vera>.
11. En.wikipedia.org
12. <https://www.asianage.com/amp/life/health/100319/wonder-benefits-of-neem-leaves.html>.
13. <https://www.vedantu.com/biology/scientific-name-of-neem>.
14. 15. Hashmat, I., Azad, H. And Ahmed, A., 2012. Neem (*Azadirachta indica* A. Juss)-A nature's drugstore: an overview. *Int Res J Biol Sci*, 1(6), pp.76-79.
16. Alzohairy, M.A., 2016. Therapeutics role of *Azadirachta indica* (Neem) and their active constituents in diseases prevention and treatment. *Evidence-Based Complementary and Alternative Medicine*, 2016.
17. <https://www.dabur.com/amp/in/en-us/about/science-of-ayurveda/herbal-medicinal-plants/benefits-and-uses-of-neem>
18. En.wikipedia.org
19. 20. <https://www.nutraingredients-usa.com/Article/2021/03/02/Tomato-powder-beats-isolated-lycopene-in-study-but-expert-questions-scope-of-conclusions>.
21. 22. <https://www.britannica.com/plant/tomato>.
23. Alsuhaibani, A.M.A., 2018. Chemical composition and ameliorative effect of tomato on isoproterenol-induced myocardial infarction in rats. *Asian J. Clin. Nutr*, 10(1), pp.1-7.
24. <https://www.emedicinehealth.com/tomato/vitamins-supplements.htm#:~:text=Tomato%20is%20used%20for%20preventing,%20catarac>

ts%2C%20and%20asthma.

25. En.wikipedia.org
26. Ujwala, T.K., Tomy, S., Celine, S. And Chander, J.S.J.U., INTERNATIONAL JOURNAL OF PHARMACEUTICAL SCIENCES AND RESEARCH.
27. <https://www.webmd.com/diet/supplement-guide-aloe-vera>.
28. 29. En.wikipedia.org
30. <https://www.lubrizol.com/Health/Pharmaceuticals/Excipients/Carbopol-Polymer> Products/Carbopol-934-NF-Polymer
Majumder, T., Biswas, G.R. and Majee, S.B., 2016. Hydroxy propyl methyl cellulose: different aspects in drug delivery. J. Pharm. Pharmacol, 4(8), pp.381-5.
31. <https://www.medicinalplants-pharmacognosy.com/pharmacognosy-s-topics/extraction>
Methods/percolation/
<https://moisturecontrol.weebly.com/drying-methods.html>
<https://www.summaryplanet.com/engineering/Grinding-process.html>
32. 33,34,35 Pandey, A., Jagtap, J.V., Polshettiwar, S.A. and Kuchekar, B.S., 2011. Formulation and Evaluation of Antibacterial and Antifungal Activity of Herbal Gel Containing Aloe vera, Azadirachta Indica and Lycopersicon esculentum Seed Extract. Res. J. Pharm. Technol, 4, pp.552-554.

