

Insilico Analysis and Formulation of Antidandruff Shampoo from *Tridax procumbens* L.

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ABSTRACT

Dandruff is a very common problem nowadays which is caused due to fungus known as *Malassezia globosa* and *Malassezia furfur* and this fungus basically creates some problems related with hair and scalp, like scalp irritation, hair fall and frizzy hairs due to the lack of moisture. Antidandruff shampoo is a type of dosage form which is applied on scalp and gently rinsed out with clean water. It helps to prevent the growth of fungus and retain natural oil of scalp, reduces irritation and hair fall like problems and it also controls freeze. This is the recipe for the preparation of antidandruff shampoo made up of *Tridax procumbens*. Extract of *Tridax procumbens* contains some active ingredients which are responsible to produce antifungal activity (Ex: Apigenin, catechin, daidzein, luteolin, genistein, and quercetin). Soapnut extract has surfactant activity and also responsible to reduce inflammation. The formulation contains methyl paraben, gelatin solution, citric acid and essential oil as excipients. In this procedure docking is also performed to determine the interaction of molecules. A variety of tests were performed like Ph, viscosity, surface tension, foaming ability, and stability etc. The formulation assessed within the specified range when assessed for the parameters.

KEYWORDS: Antidandruff shampoo, Herbal extract, *Malassezia globosa*, Dandruff.

1. INTRODUCTION:

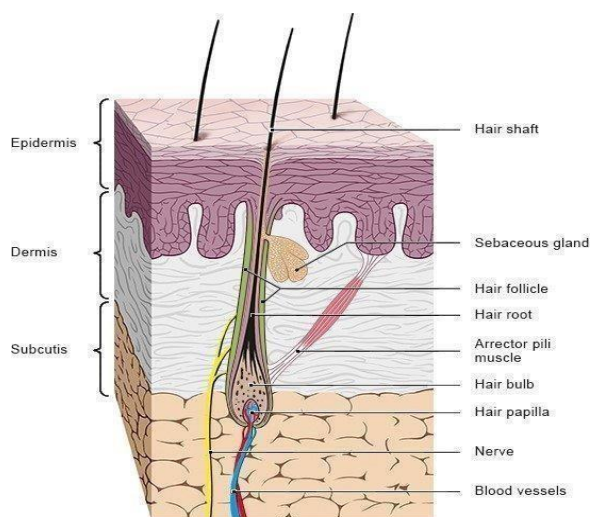


Fig.1: Structure of Hair

Hair is a keratinous filament growing out of the epidermis. It is one of the things that makes humans unique is their hair. It has several functions, such as providing protection from the elements, producing sebum, apocrine exudate, and smells, influencing social and sexual behavior, regulating body temperature, and acting as a source of stem cells.

There are hair roots and hair shafts in every hair. The visible portion of the hair that grows from the skin is called the shaft. The hair root is located in the skin and reaches the skin's deeper layers. The hair follicle, a covering of skin and connective tissue that covers it, is joined to a sebaceous gland. The main element in the growth of new hair is the follicle. The arrector pili, a small muscle that may help hair stand up, is connected to each hair follicle. And at the hair follicle, several nerves die. These nerves are sensitive to even the smallest draft and detect movement in the hair. The hair root broadens to form a rounded hair bulb at the base of the hair. Inside the base of the hair bulb is the hair papilla, which provides blood to the hair root. In the hair bulb, near the papilla, new hair cells are continuously being produced. The hair shaft is composed of cortex, cuticle cells, and the medulla, which contains a wide range of hair styles.

The continuous cycle of development and rest that takes place in the hair follicle is referred to as the "hair cycle." Age, food habits, and the location of the hair all have an impact on when the development and rest cycles occur. These factors are among the many endocrine, vascular, and neural inputs that govern this process.

Dandruff is a disorder which produces over the scalp due to fungus known as 'Malassezia Furfur'. This fungus engulfs sebum which produce over a scalp and releases oleic acid as a byproduct which seems as dry and flaky particles on scalp which results in itchiness and also results in hair loss. Malassezia species, along with stress, exhaustion, extreme weather, oily skin, immunosuppressed status (AIDS), and neurological disorders, play a role in the pathogenesis of dandruff, a common chronic returning inflammatory condition that affects the sebaceous glands.

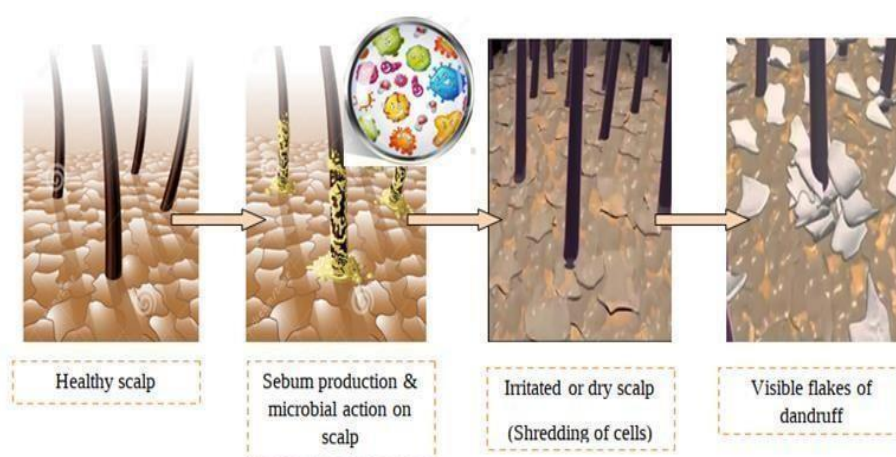


Fig.2: Process of Dandruff

1.1 Causes of Dandruff:

1. Irritated oily skin
2. Dry skin
3. Sensitivity to haircare products
4. Other skin conditions like psoriasis and eczema
5. Hormonal imbalance
6. stress

Herbal medicines are the primary medical practice in India. There are about 6000 producers of herbal medicines in India. Approximately 80% of people worldwide make use of herbal medications, according to the WHO. Because they have good activity and very few adverse reactions as compared to synthetic medications, herbal formulations have always attracted a lot of attention. Shampoos are probably applied to the skin like cosmetics. It is a hair care product that we use on a daily basis to clean our hair and scalp. Shampoos are a viscous solution of detergents with appropriate additions, preservatives, and active compounds that are most commonly used as beautifying agents. Typically, it is rubbed into wet hair after being applied, and then the hair is

cleaned by running water over it. Shampoo is used to remove established particles from hair without significantly decreasing sebum production.

There are currently a lot of synthetic shampoos available on the market, both medicated and nonmedicated. However, herbal shampoo received popularity because it comes from a natural source, is safer, improves customer demand, and has no adverse reactions. In basic terms, a shampoo is a detergent solution with appropriate chemicals for additional benefits including lubrication, medicine, and improved hair conditioning, among others. Herbal hair care products are becoming more and more popular. Numerous medicinal plants are frequently used in shampoo composition because of their claimed positive effects on hair. These plant components can be utilized in derivative, improved extract, powdered, or crude form. Making a herbal shampoo with just one natural ingredient that is as safe and mild as a synthetic one while remaining competitive effectively in terms of foaming, detergency, and solid content is really challenging. As a result, we considered creating a pure herbal shampoo employing Indian plant ingredients that are widely and traditionally used for hair washing.

1.2 Description of *Tridax procumbens*:

The plant bears daisy like yellow-centered white or yellow flowers with three-toothed ray florets. The leaves are toothed and generally arrowhead-shaped. Its fruit is a hard achene covered with stiff hairs and having a feathery, plume like white pappus at one end. Calyx is represented by scales or reduced to pappus. The plant is invasive in part because it produces so many of achenes, upto 1500 per plant, and each achene can catch the wind in its pappus and be carried some distance. This weed can be found in field, meadows, croplands, disturbed areas, lawns and road side area as with tropical or sub tropical climates. *procumbens* possess properties like anti-inflammatory, hepatoprotective, wound healing, immunomodulatory, antimicrobial, antiseptic, hypotensive and bradycardia effects.

Synonym: Dagadi pala, tridhara, ek Dandi

Kingdom: plantae

Family: Astereace

Genes: tridax

Species: procumbens

Biological name: *Tridax procumbens*



Fig 3: *Tridax procumbens* L.

1.3 Benefits of Herbal Shampoo:

1. More Shine
2. Less Hair Loss

3. Long Lasting Colour
4. Stronger and More Fortified Hairs
5. All Natural, No Chemicals
6. Don't Irritate Skin or Scalp
7. Keep Healthy Natural Oils

2.LITERATIURE REVIEW:

Table No. 1: Table showing Information related Journals and Authors

Name of Author	Journal of Publication	Date of Publication	Remark
Shubham lahane, Anjali mali, Dr Gajanan sonap	Journal of emerging technologies and innovative researchers (JETIR)	March 2013	In this journal, study of antimicrobial, antibacterial and hair growth activity of T. procumbens for hair disorders against microbial strains is described.
Rajaram's. Sawant	International journal of science, Environment and technology	2 June 2013	In this journal phytochemical analysis of leaves of T. procumbens is described.
Merve peniz kase, oguz bayraletar	World journal of research and review (WJRR)	May 2016	This journal covers study of extraction of saponins from soapnut and their antimicrobial properties.
Mr. Prajwal R. Bhujbal, Mr. Vishal P. kopnar,	International journal for multidisplanary research	Nov-Dec 2023	This journal provides the study of herbal shampoo formulation and its evaluation.
Kashinath Hiremath, Sneha. B. patil, Kalpana S. patil	International journal of ayurvedic medicine	Jan 2022	This journal provides pharmacogenetic and in vitro antioxidant and antimicrobial potentials of tridax procumbence.
Miss tirtha wagh, Mr Vishal Choudhri, Mr Kunal wani	International journal of creative and innovative research in all studies (IJCIRAS)	May 2020	This journal provides the study of antimicrobial and hair regrowth activity of Tridax procumbens.

3.Need of project:

1. Herbal remedies are used for the treatment of various health conditions.
2. Herbal shampoos for hair growth are formulated to strengthen the hair follicles by delivering essential oils and nourishment all through the roots and follicles.
3. The study demonstrated that shampoos containing a proven antifungal compound were the most effective in controlling the causative yeast.
4. Natural herbs present in the shampoos remove excess oil from your scalp and help to maintain the perfect oil balance.

4.Aim and Objectives:

4.1 Aim:

To formulate and evaluation of a herbal based shampoo using combination of Tridax procumbens extract, soapnut extract, fenugreek seeds extract having antifungal activity without damaging the hair.

4.2 Objectives:

The purpose of this study is to develop antifungal herbal shampoo and evaluate their efficacy for antifungal activity and used as herbal formulation.

The main objectives are:

1. Development of antifungal herbal shampoo
2. Provide the cleaning of scalp skin hair.
3. Evaluation of the herbal shampoo.
4. To treat dandruff and nourishes the hair.

Material and Methods: Materials:

Sr. No.	Name of instruments
1.	Water Bath
2.	pH meter
3.	Weighing balance

Chemicals:

Sr.No.	Name of chemicals
1.	Gelatine
2.	Methyl paraben
3.	Rosemary oil
4.	Citric acid

1 Softwares:

Sr.No.	Name of software
1.	Pyrex
2.	Discovery studio
3.	PubChem

5. EXPERIMENTAL EVALUATION:**5.1 Selection of Plant:**

The plant of *Tridax procumbens* grows up to 20-75 cm long. The leaves of *Tridax procumbens* are opposite pinnate oblong to ovate, and 1-2 inches (2.5-5cm) and they are green in colour.

5.2 Identification of Phytochemicals:

By phytochemical analysis of the leaves of *Tridax procumbens* shows apigenin, catechin, daidzein, Genistein, luteolin, quercetin. Identification of phytochemicals is very important step.

5.3 Selection of Target:

The various numbers of research papers were studied for antifungal mechanism.

1. Lanosterol: it is a chemical which is responsible for synthesis of cell wall of bacteria.
2. Lanosterol serves as precursor of sterols such as cholesterol in mammals and ergosterol in yeast and fungi.
3. With the help of an enzyme lanosterol 14 alpha demethylase lanosterol gets converts into ergosterol.

4. So, by inhibiting 14 alpha demethylase enzyme synthesis of cell wall of bacteria can avoided.

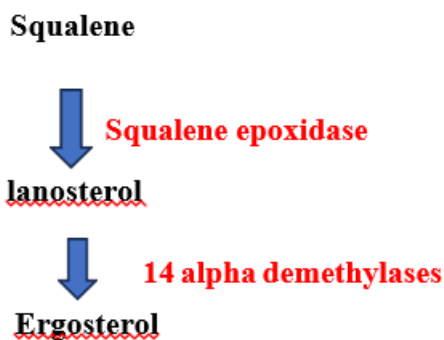


Fig 4: Mechanism of lanosterol 14 alpha demethylase

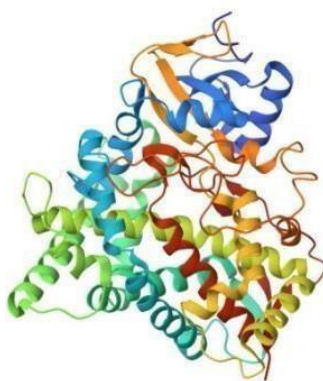


Fig 4: Protein Structure PDB ID- 4UYM

5.4 Docking Study:

Docking study helps in understand interaction between receptor (protein) and ligands, thus we performed a series of docking stimulations on the active site of the proteins to analyse docking score in terms of fitness score.



Extraction:

1) **Collection:** - The *Tridax procumbens* leaves are collected from local area of Anandi Pharmacy College, Kalambe. Another ingredient required for extraction and formulation of cream is purchased from unique laboratory.



Fig 5: Collected leaves of Tridax procumbens

2) Drying:

The leaves of tridax procumbence are collected and dried under shade.

3) Methods:

In present study we have concluded to different methods for extraction of Tridax procumbens. Which can give maximum yield with minimum requirements.

1.Maceration of Tridax procumbens:

In this process, the whole or coarsely powdered crude drug is placed in a stoppered container with solvent and allow to stand at room temperature for a period of at least 3 days with frequent agitation until the soluble matter has dissolved. The mixture is then strained, the Marc (the damp solid material) is pressed and the combined liquids are clarified by filtration or decantation after standing.



Fig 6: Maceration of Tridax procumbens

2.Decoction of Soapnut:

Crushing 100 - parts of dried soapberry peel by weight into powder with the granularity of 20- 80 meshes, adding 100-1000 parts of water, and uniformly stirring at the temperature of 40– 80-degree c. after cooling filter the extract and stored in a bottle for 3 days.

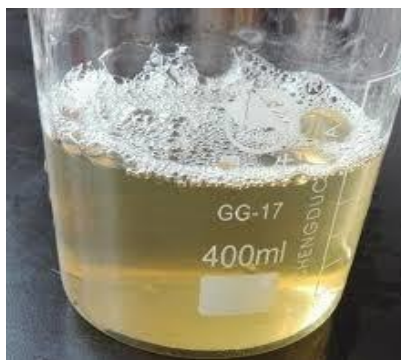


Fig 7: Decoction of Soapnut

7.PHYTOCHEMICAL SCREENING:

Table No. 2: Table showing Identification Test for Phytochemicals.

Alkaloids	a. Mayers test b. Dragendorff test c. Wagers test
Flavonoids	a. Shinoda test b. Alkaline reagent test c. Fecl3 test
Tannins	a. Lead acetate test b. Fecl3 test
Glycoside	a. Bontrager’s test b. Keller killani test

8.FORMULATION OF SHAMPOO:

8.1 Preparation of Aqueous phase:

Water is heated at 65-70°C in water bath. Add accurately weighed Glycerine, and water maintains temperature at 65-70°C.

8.2 Devolvement of Shampoo Formulation:

In prepared aqueous solution of gelatine add all required ingredients and mix it well till homogenous solution is prepared. Then cooled it too room temperature to form viscous solution of shampoo.

8.3 Formulation Table:

Table no.3: Table showing Ingredients of Formulation

Sr.No	Ingredients	Quantity		
		Batch A	Batch B	Final Batch
1.	Tridax extract	1ml	2ml	2.5 ml
2.	Reetha extract (soapnut)	1ml	2ml	2.5ml
3.	Methyl paraben	1ml of 0.005% solution	1ml of 0.005% solution	1ml of 0.005% solution
4.	Gelatine solution	q.s.	q.s.	q.s.
5.	Citric acid	q.s.	q.s.	q.s.
6.	Essential oil	1-2 drops	1-2 drops	3-4 drops



Fig. No.8: Batches of formulation of Herbal Shampoo

8.4 Procedure for Anti-fungal Activity Analysis:

- Media and reagent preparation:

Antibiotic Assay Medium No. 19 (pH is 6.1 ± 0.2)

Table No. 4: showing Ingredients required for Antifungal Activity Analysis

Ingredients	Quantity
Peptone	9.4 g
Yeast extract	4.7 g
Beef extract	2.4 g
Sodium chloride	10.0 g
Dextrose	10.0 g
agar	23.5 g
Water	1000 mL
Ph after sterilization	6.1 ± 0.1 .

- Preparation of the Sample Solution:

Use directly 100 μ l and 200 μ l to inoculate.

- Preparation of Test Organism and Suspension: Test organisms:

Malassezia furfur slant ATCC 140521

- Stock Culture: Malassezia Furfur Slant ATCC 140521

Streak a loopful of Malassezia furfur slant ATCC 140521 two slants of pre incubated Sabouraud dextrose agar. Incubate the slants at 30-35°C for 24 hours in an incubator

• Plate Preparation for Analysis:

1. After the suspension is prepared, use each 2 ml of culture suspension of *Malassezia furfur* is to inoculate separately in 200 ml of sterile molten and cooled medium at 40°C - 45°C Antibiotic Assay Medium No. 19. 15-20 ml of Sterilized agar medium is poured into a sterile Petri plate with the help of sterile measuring cylinder give a depth of 3 to 4 mm.
2. Allow to cool at room temperature by placing the dishes or plates on a level surface.
3. Keep plates in refrigerator for 15 to 20 minutes for hardening.
4. Ensure that the layers of medium are uniform in thickness.
5. Make 4-5 agar cups on each plate using 8-10 mm SS borer.
6. Label the plates for sample, standard and negative control samples and analysis details.

9. Evaluation tests for herbal shampoo:**• Physical Appearance:**

The shampoo can be checked for physical appearance, colour, odour, texture, homogeneity and phase separation, etc

• pH Evaluation:

The pH can be calculated using pH meter. First calibrate the pH meter using neutral and acidic buffers. Take 1 ml of accurately weighed quality of the shampoo and dissolve it in 100 ml of distilled water and store it for two hours. Then measure the pH of suspension at 27°C and calculate average.

• Washability:

In this basically the formulation is applied and washability of that formulation with water is checked.

• Viscosity:

The viscosity of shampoo was determined by using Brookfield viscometer. 10 ml of shampoo is taken in beaker and spindle is dipped in it for 5 mins and reading is taken.

• Foaming Ability and Foam Stability:

Cylinder shake method was used for determining foaming ability. covered the cylinder with hand and shaken for 10 times. The total volumes of the foam contents after 1- minute shaking were recorded. The foam volume was calculated

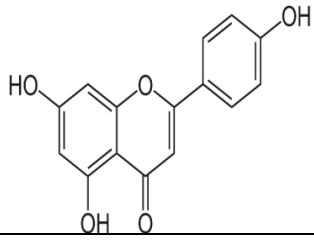
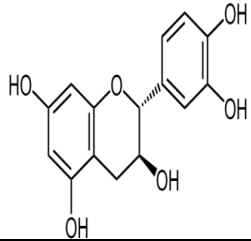
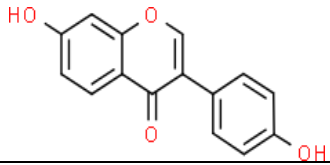
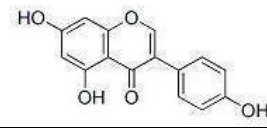
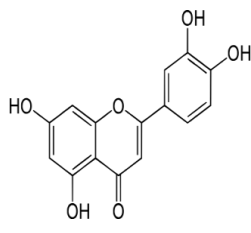
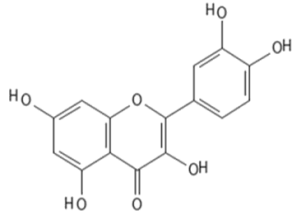
• Stability Study:

Stability and acceptability of organoleptic properties (odour and colour) of formulations during the storage period indicated that they are physically and chemically stable.

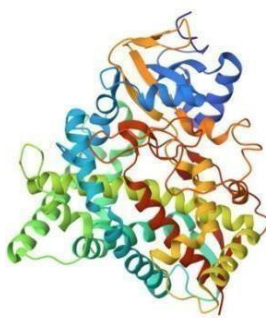
• Surface Tension:

Measurement It has been mentioned that a proper shampoo should be able to decrease the surface tension of pure water to about 40 dynes/cm². Surface tension reduction is one of the mechanisms implicated in detergency. The reduction in surface tension of water from 72.8 dynes/cm to 34.70 dynes/cm by the herbal shampoos is an indication of their good detergent action.

10. Result and discussion:
10.1 Identification of Phytochemicals:
Table No.5: Phytochemicals

Name	IUPAC name	Structure
Apigenin	5,7-dihydroxy-2-(4-hydroxyphenyl)chromen-4-one	
Catechin	2R,3S)-2-(3,4-dihydroxyphenyl)-3,4-dihydro-2H-chromene-3,5,7-triol	
Daidzein	7-Hydroxy-3-(4-hydroxyphenyl)-4H-1-benzopyran-4-one	
Genistein	4',5,7-Trihydroxyisoflavone	
Luteolin	2-(3,4-dihydroxyphenyl)-5,7-dihydroxy-4H-chromen-4-one	
Quercetin	2-(3,4-dihydroxyphenyl)-3,5,7-trihydroxychromen-4-one	

10.2 Selection of Target:



Protein structure PDB ID- 4UYM

• Characterization:

Table No. 6: Characterization of Protein PDB ID 4UYM

Protein	Resolution	Amino acids
Crystal structure of sterol 14 alpha demethylase (CYP51B) from a pathogenic filamentous fungus aspergillus fumigatus in complex with voriconazole	2.55 Å	ALA A:307, VAL A: 135, GLY A:308, PRO A:455, CYS A:463, SER A:312.

10.3 Molecular Docking:

After successful docking analysis we found that phytoconstituent present in *Tridax procumbens* gave successful result against fungal infection. Hence from this the methanolic extract constituents of *Tridax procumbens* can be used to reduce fungal infection. We found successful drug interaction as follows:

Table No.7: Showing Interaction of Phytochemicals against PDB

Chapter	Molecule	Conventional H-Bond	Amide pistaked	Pi sigma	Pi alkyl	Pi- pi shaped	Pi donor H-Bond	Binding affinity
1.	Apigenin	PRO A:372 SER A:312	GLY A: 308	ALA A:307	ALA A:469 PRO A:455	-	-	-7.2
2.	Catechin	HIS A:310	-	-	ALA A:194 LYS A:506	-	LYS A:191	-7.2
3.	Daidzein	-	-	VAL A:135	LEU A:143	PHE A:130	-	-7.6
4.	Genistein			VAL A:135	LYS A:147 ALA A:303 ALA A:307	PHE A:130		-7.6
5.	Luteolin	PRO A:455	-	-	ALA A:307 ALA A:469 PRO A:372 CYS A:463	-	-	-8.0
6.	Quercetin	PRO A:455 GLY A:308 SER A:312	ALA A:307		CYS A:463	-	-	-8.1

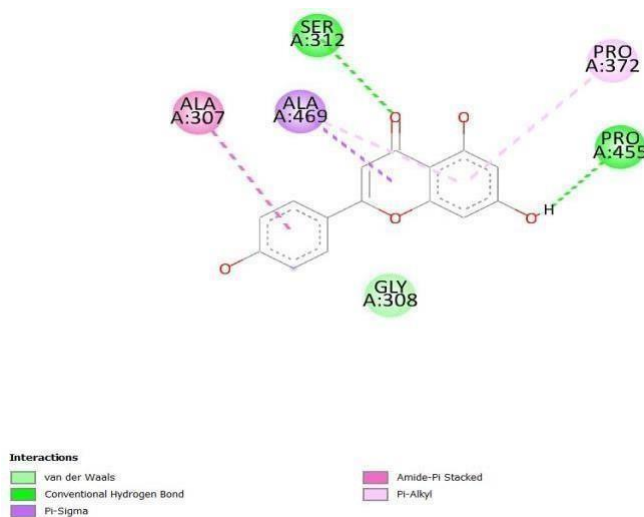


Fig 9: 2D Interaction of apigenin with PBD ID 4UYM

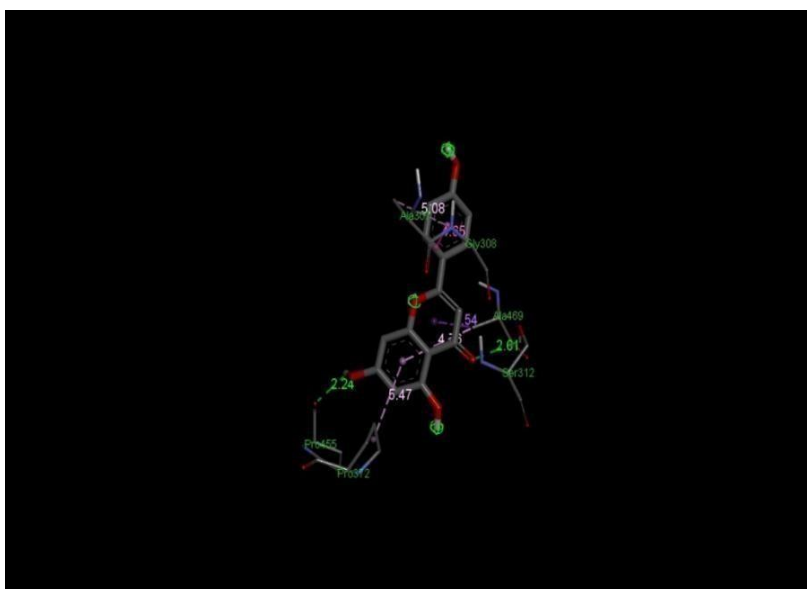


Fig 10: 3D Interaction of apigenin with 4UYM

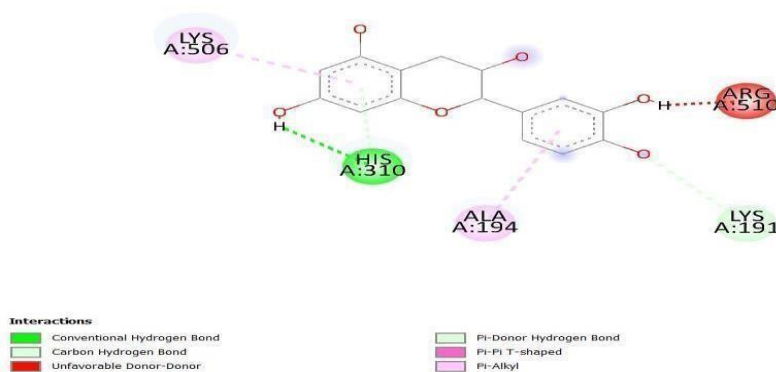


Fig 11: 2D Interaction of catechin with PBD ID 4UYM

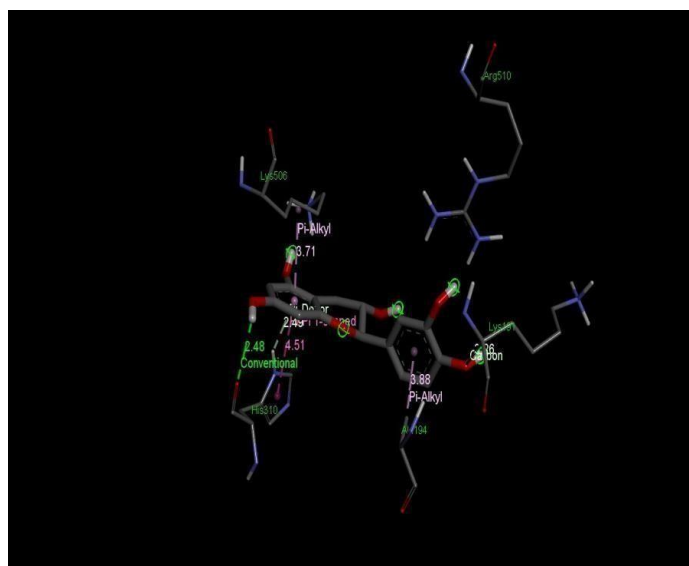


Fig 12: 3D Interaction of catechin with 4UYM

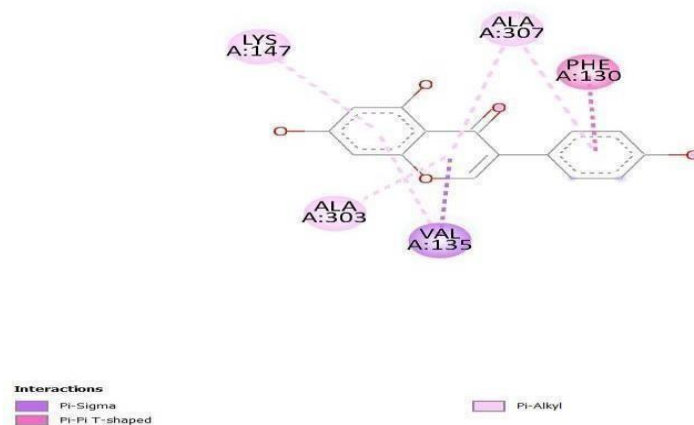


Fig 13: 2D Interaction of Genistein with PBD ID 4UYM

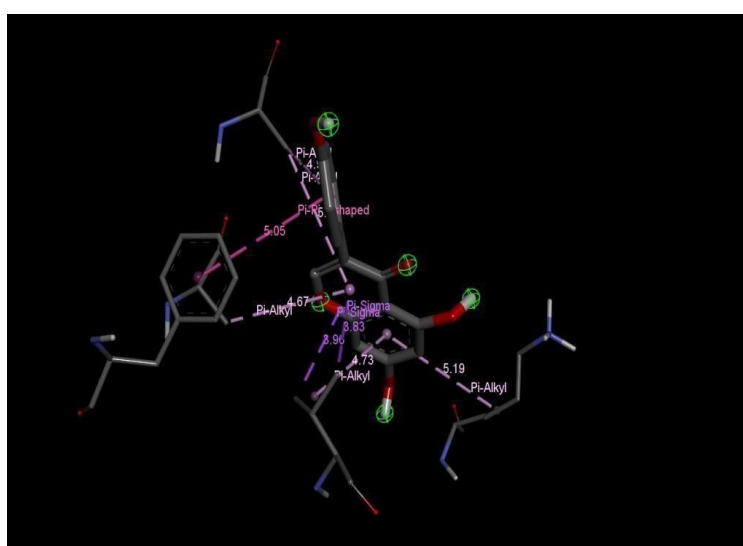


Fig 14: 3D Interaction of Genistein with 4UYM

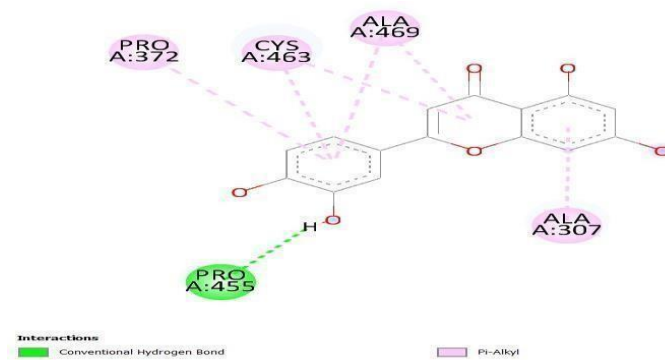


Fig 15: 2D Interaction of Luteolin with PBD ID 4UYM

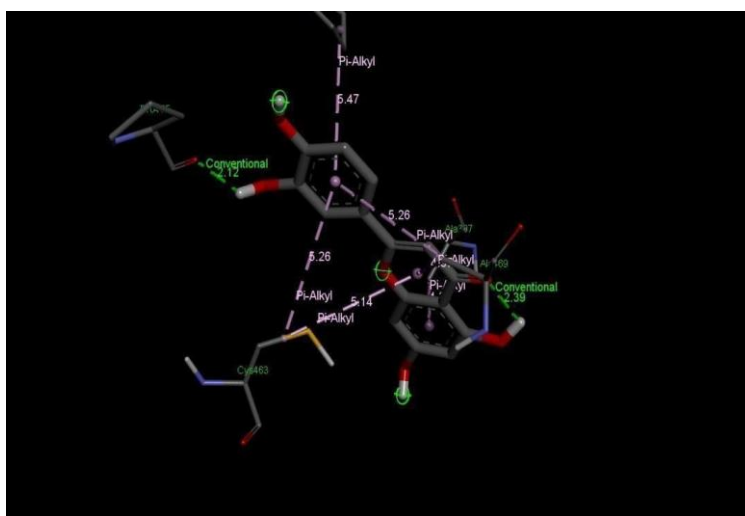


Fig 16: 3D Interaction of Luteolin with 4UYM

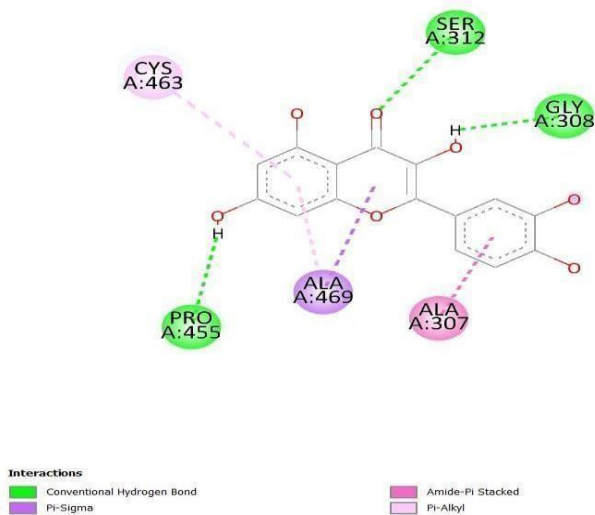


Fig 17: 2D Interaction of Quercetin with PBD ID 4UYM

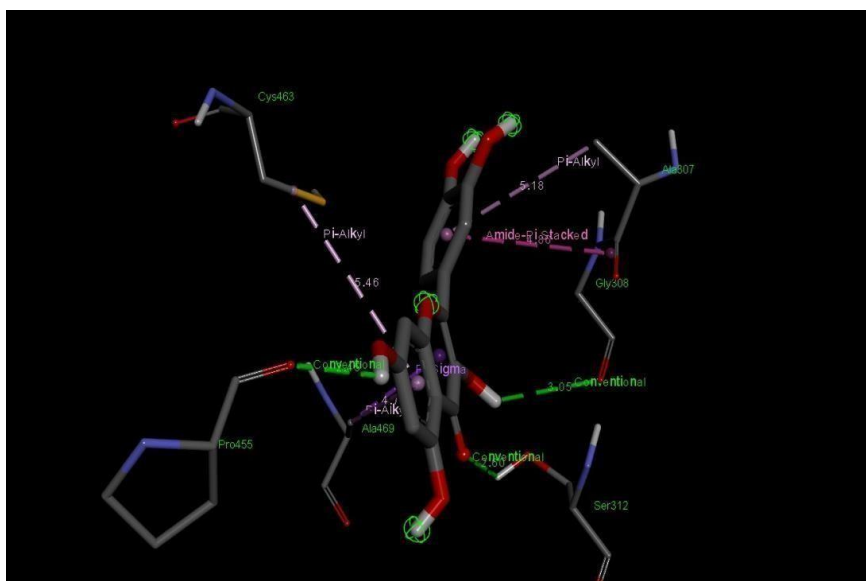


Fig 18: 3D Interaction of Quercetin with 4UYM

10.4 Phytochemical screening:

Table No.8: Showing result of Identification Tests

Sr. No.	Phytochemicals	Tests	Tridax procumbens
1.	Alkaloids	Mayers test Dragendorff test Wagers test	+ + +
2.	Flavonoids	Shinoda test Alkaline reagent test Fecl3 test	+ + +
3.	Tannins	Lead acetate test Fecl3 test	+ +
4.	Glycoside	Bontrager's test Keller killani test	+ +

10.5 Physical Evaluation:

Table No. 9: Table showing Characteristics of Shampoo

Sr. no	Test	Result
1.	Colour	Caramel Brown
2.	Odour	Pleasant
3.	pH	5.63
4.	Consistency	Excellent
5.	Viscosity	1.17
6.	Surface tension	32.06
7.	Foaming ability	168

10.6 Stability Test: -

Table No. 10: Table showing Stability testing

Temperature	Evaluation Parameter	Observation (Days)			
		After 24 hrs	7 Days	14 Days	28 Days
25°C	Visual appearance	Caramel Brown	Caramel Brown	Caramel Brown	Caramel Brown
	Phase Separation	No	No	No	No
	Homogeneity	Good	Good	Good	Good
	pH	6.2	6.2	6.2	6.2
	3°C	Visual appearance	Caramel brown	Caramel brown	Caramel brown
3°C	Phase Separation	No	No	No	No
	Homogeneity	Good	Good	Good	Good
	pH	6.2	6.2	6.2	6.2

10.7 Anti- fungal activity results: Analysis:

1. The volume of solution added to each cylinder or cavity must be uniform and sufficient almost to fill the holes when these are used.
2. Add 100 µl 1mg/ml Solution A to agar cup labelled as STD.
3. Add 100 µl 1mg/ml = Solution B to agar cup labelled for each compound ID labelled on plate.
4. Add 100 µl dimethyl Sulphide (DMSO) to agar cup labelled as N (Negative).
5. Leave the dishes or plates standing for 15-20 min. at 2-8°C or as appropriate, as a period of pre- incubation diffusion to minimize the effects of variation in time between the applications of the different solutions.
6. Incubate them for about 24-48 hours at the temperature 30-35°C for bacteria and 20- 25°C for yeast and mould.
7. After completion of incubation accurately measure the diameters or areas of the circular inhibition zones and record the results.

Table No.11: showing Antifungal activity results

Sr. No.	Sample	Concentration	Zone of inhibition (mm) <i>M. furfur</i>
1.	Control		-
2.	Standard marketed herbal shampoo	100 µl	15
3.	Sample- herbal shampoo	100 µl 200 µl	Nil 10

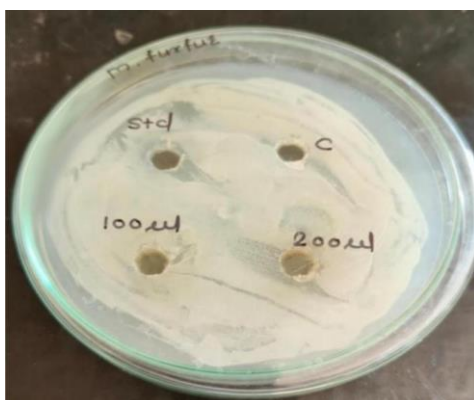


Fig. No.19: Malassezia furfur slant ATCC 140521



11. Conclusion:

The herbal shampoo preparation was formulated based upon traditional knowledge and emphasis was to formulate a stable and functionally effective. The formulated shampoo was not only safer than the chemical conditioning agents, but also greatly reduce the dandruff from scalp as well as strengthen the hair growth. The pH of the shampoos was adjusted to 5.63, to retain the acidic mantle of scalp. It was found to be harmless, more effective and economical. During the study it has been found that sample – herbal shampoo showed good inhibiting the growth of micro-organisms against *M. furfur* as compared to marketed preparation.

REFERENCES

1. Shankul Kumar, Anuradha Prasad, S.V. Iyer and Santosh Vaidya. International Journal of Pharmaceutical & Biological Archives 2012, 3(4):747-751.
2. Himanshu C. Chaudhari, Kiran P. Patil. Research & Reviews in Pharmacy and Pharmaceutical Sciences, vol 11, January 2022.
3. Varsharani V. Ingole, Pravin C. Mhaske, Sushma R. Katade, Phytomedicine Plus 2(2022).
4. Shubham Lahane, Anjali Mali, Dr. Gajanan Sanap. Journal of Emerging Technologies and Innovative Research (JETIR), March 2023, Volume 10.
5. Rajaram S. Sawant and Ashvin G. Godghate, International Journal of Science, Environment and Technology, Vol. 2, No 3, 2013, 388 –394.
6. Catherine C. Ikewuchi, Jude C. Ikewuchi, Mercy O. Ifeanacho. Food and Nutrition Sciences, 2015, 6, 992-1004.
7. Merve Deniz Köse, Oguz Bayraktar. World Journal of Research and Review (WJRR), Volume-2, Issue-5, May 2016 Pages 89-93.
8. Suyog Sunil Bhagwat. International Journal of Creative Research Thoughts (IJCRT), Volume 8, Issue 9 September 2020, ISSN: 2320-2882.
9. Utane R., Deo S. and Itankar P. INTERNATIONAL JOURNAL OF RESEARCHES IN SOCIAL SCIENCES AND INFORMATION STUDIES, Vol. V, March 2017: 254-258
10. Mr. Prajwal R. Bhujbal, Mr. Vishal P. Kopnar, Miss. Kalyanee V. Gavande, Dr. Amol N. Khedkar, Mr. Pratik R. Khandagale. International Journal for Multidisciplinary Research (IJFMR), Volume 5, Issue 6, November-December 2023.
11. VIJAYALAKSHMI A, SANGEETHA S, RANJITH N. Asian journal of pharmaceutical and clinical research, Vol 11, 2018.
12. Brandão LB, Santos LL, Martins RL, Rodrigues AB, Rabelo ED, et al. Larvicidal Evaluation against *Aedes aegypti* and Antioxidant and Cytotoxic Potential of the Essential Oil of *Tridax procumbens* L. Leaves. Sci. World J. 2021 Jan 1; 2021.
13. Pandey S, Seth A, Tiwari R, Singh S, Behl HM, et al. Development and evaluation of antimicrobial herbal cosmetic preparation. Afr. J. Pharm.
14. Dognon G, Ito M. Medicinal uses, thin-layer chromatography and high-performance liquid chromatography profiles of plant species from Abomey-Calavi and Danto Kpa Market in the Republic of Benin. J. Nat. Med. 2020 Jan;74 (1)
15. Samantha Beck, Heather Mathison, Toma Todorov, Esli-Armando & Olga R. Kopp, Journal of Plant Studies; Vol. 7, No. 1; 2018
16. OG Akintunde, AA Oloye, AS Adetomiwa, WO Subuloye & CO Olaiya; Sokoto Journal of Veterinary Sciences, Volume 15 December, 2017.

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Conflict of Interest Statement:

The authors have no conflicts of interest to declare.

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