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Development and Evaluation of Herbal Hair-Setting Formulation with Hair Health-Promoting Factors

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Abstract

Marketed synthetic hair setting serum is a common cosmetic product used by consumers for styling and beautification purposes. However, such products may often cause stiffening of the hair and damage on long term exposure and use. In the present study, a gel based hair setting formulation has been developed entirely on plant based natural resources. Further, the formulations were evaluated with various studies and optimized for maximized effect.

Keywords: Hair setting formulation; Gel; Natural resources; Evaluation; Optimization

1. Introduction

Hair setting formulation is an essential hairstyling product which is used to enhance shine, hold, and manageability to the hair. However, numerous commercial hair setting formulations available in the market contain harsh chemicals and synthetic compounds that causes hair damage and dryness on long term use. To avoid these harmful effects, herbal hair-setting formulation is developed from natural ingredients and herbal extracts that contain healthy hair promoting factors. So, the present work is done by formulating herbal gel based hair setting formulation using oats mucilage, aloe vera gel, amla extract and betalain pigment.

Amla: Amla, also known as Indian gooseberry, is a fruit that has been used for centuries in traditional ayurvedic medicine for its numerous health benefits, including its positive effects on hair. Studies have revealed that it contains phenols, flavonoids, and tannins in addition to a variety of other antioxidants. Amla contains 20 times the amount of vitamin C of an Ororaorange, preventing premature graying of the hair. It enhances hair quality and promotes hair growth. Beneficial effects of amla for hair care includes:

a) Amla is rich in vitamin C, which helps in stimulating hair follicles, encouraging hair growth, and preventing hair loss.
b) Regular use of amla can strengthen the hair follicles, reducing breakage and split ends. It also helps maintain the natural pH of the scalp, contributing to healthier hair.
c) Amla has antioxidants and phytonutrients that may help prevent premature graying of hair by fighting free radicals that damage hair pigment cells.
d) Its antibacterial and antifungal properties can help in reducing scalp irritation and dandruff, promoting a healthier scalp environment [1].

Aloe vera: Aloe vera has been known and utilized for its medicinal, cosmetic, and skin-care properties since ancient times. The name Aloe vera is derived from the Arabic word "Alloeh," which means "shining bitter substance," and "vera" means "true" in Latin. Aloe

vera's scientific name is *Aloe barbadensis miller*, and it belongs to *Asphodelaceae (Liliaceae)* family.

Aloe Vera contains an inner gel that consists of 99% water and amino acids, sterols, lipids, and vitamins, and a middle layer i.e. yellow layer latex that contains glycosides and anthraquinones.

It is very effective in fighting dandruff and also having hair conditioning properties. It strengthens and repairs hair strands.

Bradykinase is an enzyme found in Aloe verawhich helps in the reduction of dandruff-related irritation and itching [2].

Oats mucilage: Oats containing omega 6 fatty acids helps to repair hair damage and moisturize hair strands. Oats also make hair more elastic, allowing it to tolerate brushing and pulling much better without breaking.

The exfoliating and cleaning properties of oats help in the treatment of dandruff by sloughing off dry flakes, and omegas and other fats moisturize a dry scalp.

Oat extract is especially beneficial for nourishing hair follicles [3].

Betalain pigment: Betalain pigment is derived from *Beta vulgaris*,a herbaceous flowering biennial plant of the Chenopodiaceae family native to Asia and Europe. It acts as a coloring agent and also has a preservative efficacy [4].

2. MATERIALS

Herbal ingredients like Amla, Aloe Vera, Oats and Beetroot were collected from local market. Hair sample collected from local salon. Purified Water, Velvet cloth, Graph Paper and Cellophane paper were collected and used.

3. METHODS

3.1 Extraction of herbal ingredients

3.1.1 Preparation of Amla Extract: Amla was collected from the local market and grated and oven dried at a temperature of 50℃. Then the dried amla was powdered and it was ultrasonicated for 30 mins with 30 ml of purified water. Then it was filtered and amla extract obtained.

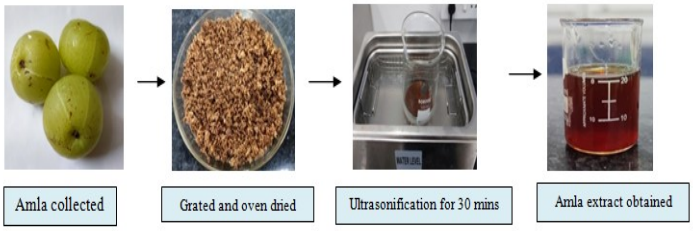

Figure 1. Extraction of amla

3.1.2 3.1.2 Preparation of Aloe Vera gel: Aloe veraleaves were collected and then aloe vera gel was extracted using a simple drain process in which 3-4 aloe leaves were sliced around half an inch from the base to drain off all the yellow sap materials.The mucilage was stirred vigorously in a blender to make it uniform. This solution was filtered and the filtrate was stored.

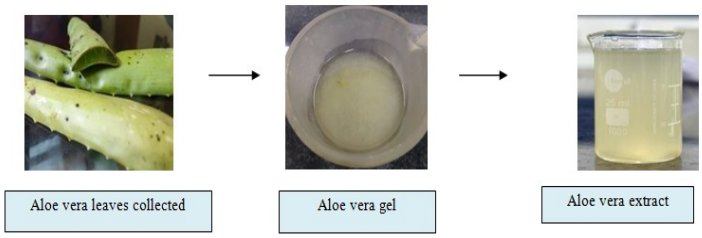

Figure 2. Preparation of aloe vera gel

3.1.3 Preparation of Oats Mucilage: Oats were collected and then boiled in water with continuous stirring. Then the mixture was filtered and oats mucilage was collected.

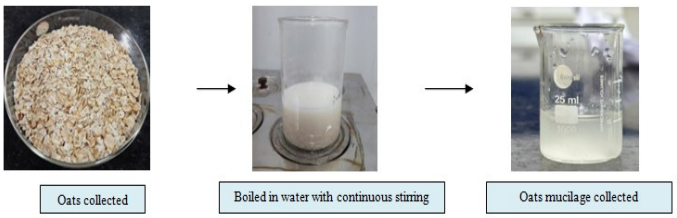

Figure 3. Preparation of oats mucilage

3.1.4 Preparation of Betalain Conc. Extract: Beetroot was collected from the market and grated and then ultrasonicated for 30mins. Then it was filted and concentrated betalain pigment obtained.

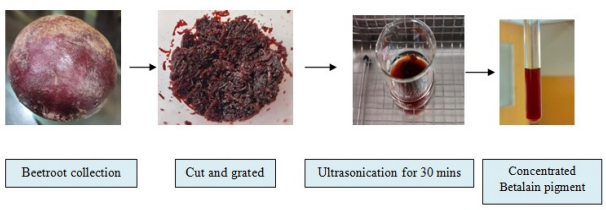

Figure 4. Preparation of betalain concentrated extract

3.2 Preparation of Formulation:

Four formulations were prepared using amla extract, aloe vera extract, oats mucilage and betalain pigment. The concentrations of the various ingredients are given in the following table. Aloe vera extract was added to a beaker in a magnetic stirrer. Oats mucilage was added to the formulation.Next, Amla extract was added to it and Betalain concentrated extract was finally added and Herbal hair-setting formulation was prepared. Prepared formulations were centrifuged to remove any suspended matter.

Table 1. Composition of hair setting formulations

NAME OF THE INGREDIENTS	FORMULATION 1	FORMULATION 2	FORMULATION 3
Amla Extract (ml)	30	5	30
Aloe Vera Extract (ml)	30	30	5
Oats Mucilage (ml)	10	10	10
Betalain extract (ml)	1	1	1

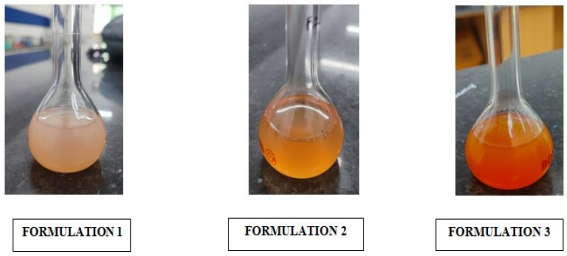

Fig. 5 Hair setting formulations

3.3 Evaluation of formulations

(a) Physical appearance: The physical appearance of the hair-setting formulations was evaluated based on their colour, odour and texture [5]

(b) pH determination: The pH value of each formulation was measured at room temperature and recorded [6].

(c) Viscosity: Brookfield Viscometerwas used to determine the viscosity of the hair setting formulations. Suitable amount of formulation was takenin a 100 ml beaker and then the viscosity was measured at various rpm, i.e., 30,50,60 [7].

(d) Spreadibility: 0.5 g of the formulations were weighed and then placed on graph papercovered with transparent cellophane paper. Then, the formulation was covered with another cellophane cover. The formulations start spreading. The diameter for the spreading was measured from several sides. Then a load of 150 g was placed on the top cellophane sheet, and kept for a period of 1 min. The diameter was again measured as above. The longest diameter was noted in each case [8].

(e) Wetting Time Test: The wetting time test was conducted using disc method. One inch discs were cut from a thick velvet sheet weighing approximately 0.38 g and placed on the surface of the formulations kept in 100 ml beakers. The time taken for the velvet discs to begin sinking

was recorded as the wetting time of each formulation [7].

(f) Evaluation for moisturization and anti frizz effect: Hair sample was collected from hair salon and then separated into 2 g mass. One 2 g mass was used as a control, while another 2 g mass was sprayed with each formulation.2 g of hair mass was taken in a petri dish, and 3ml of solution was sprayed onto the hair mass, which was then allowed to dry at room temperature. Distilled water was used to spray onto the control hair mass. Finally, the smoothness and softness of the hair mass were assessed using blind touch test procedures with three randomly selected volunteers. The volunteers were blindfolded and instructed to touch and feel the hair mass to rate it as per its smoothness, softness, and frizz control. The volunteers were asked to rate it as very poor (score 1), poor (score 2), satisfactory (score 3), good(score 4), and excellent (score 5).Also, the hair mass was inspected visually for its shine and silkiness [7].

4. RESULTS AND DISCUSSION:

a. Physical Appearance

Table 2. Physical appearance of the formulations

PARAMETER	FORMULATION 1	FORMULATION 2	FORMULATION 3
COLOUR	Peach	Light orange	Reddish brown
ODOUR	No strong odour	No strong odour	No strong odour
TEXTURE	Smooth	Smooth	Smooth

The formulations were observed for physical appearance. Colour of the formulations was different due to the amount of amla extract added. No strong odour was found in the formulations. The texture was found to be smooth.

b. pH determination

Table 3. pH of the formulations

PARAMETER	FORMULATION 1	FORMULATION 2	FORMULATION 3
pH	**4**	**5-6**	**3-4**

The pH of the formulations ranged between 3-6 which was in the acidic range and relates to pH range of the human skin.

c. Viscosity:

Table 4. Viscosities of the formulations

	30rpm	50rpm	60rpm
FORMULATION 1	14.6 mpa.s	10.6 mpa.s	9.85 mpa.s
FORMULATION 2	14.8 mpa.s	9.77 mpa.s	10.9 mpa.s
FORMULATION 3	13.9 mpa.s	9.20 mpa.s	1.13pa.s

The viscosities of the formulations decreased with increasing rpm.F2 had the highest viscosity

d. Spreadability :

Table 5. Spreadability of the formulations

	FORMULATION 1	FORMULATION 2	FORMULATION 3
Initial diameter (cm)	**4**	**6**	**12**
Diameter after putting the weight of 150g (cm)	**6.6**	**7.5**	**16**

Formulation 3 was found to have the highest spreadability.

e. Wetting Time Test:

Table 6. Wetting time of the formulations

	WETTING TIME (sec)
FORMULATION 1	**11.42**
FORMULATION 2	**11.34**
FORMULATION 3	**16**

f. Evaluation of moisturization and frizz control

Table 7. Volunteer study

Volunteer number	FORMULATION 1		FORMULATION 2		FORMULATION 3		CONTROL	
	M	F	M	F	M	F	M	F
Volunteer 1	3	4	4	3	4	3	1	1
Volunteer 2	2	3	2	3	3	3	1	1
Volunteer 3	2	4	3	4	4	3	1	1
Composite Score	2.3/5	3.6/5	3/5	3.3/5	3.6/5	3/5	1/5	1/5

Three volunteers rated the moisturization and frizz control efficiency of the formulations based on which a total composite score was determined. All the formulations proved to be better than the control (which was purified water). Among the formulations, F3 was rated for the best moisturization property and F1 for the best frizz control property.

Based on Spreadability test, wetting test and moisturization evaluation, F3 formulation was considered to be the best. F3 had the highest amount of amla extract which should have been responsible for good spreading, wetting and moisturization. The amount of oats mucilage was similar in all the formulations

5. CONCLUSION

Hair setting formulations were developed using oats mucilage, amla extract and aloe vera gel. Three initial formulations were developed and evaluated with respect to moisturization, spreadibility, viscosity, pH and wetting time. F3 formulation was determined to be the best when the various evaluation parameters were compared.

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