



Research article

Formulation and evaluation of herbal wet wipes using non-woven fabrics

Subashini P*, Thilak B, Preetika S, Niranjanasree A C

Department of Pharmaceutics, Faculty of Pharmacy, SRIHER (DU), Porur, Chennai, Tamil Nadu, India

Corresponding author: Subashini P, ✉ subashini171999@gmail.com, Orcid Id: <https://orcid.org/0009-0009-8310-3761>

Department of Pharmaceutics, Faculty of Pharmacy, SRIHER (DU), Porur, Chennai, Tamil Nadu, India

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ABSTRACT

Herbal wet wipes are a viable substitute for conventional wipes, tackling worries regarding chemical composition and ecological effects while offering advantages for skin health. This research uses non-woven fabric as the substrate and focuses on the formulation and assessment of herbal wet wipes. Selected plant extracts or essential oils with antibacterial and skin-soothing qualities are incorporated into the recipe. Testing the herbal wet wipes' antimicrobial activity against common skin bacteria and fungus allows for an evaluation of their effectiveness. Testing for skin sensitivity is done to determine safety and suitability for different skin types. To guarantee product integrity under various storage circumstances, stability testing is carried out by incorporating extracts of *Azadirachta indica* (Neem), *Aloe barbadensis*, Tulsi, and Clove Extract. Thus, the final cloth will include qualities like softness, antimicrobial, and anti-allergy for adults and infants. The intended application of the fabric material is to improve skin health through the use of wet wipes.

Keywords: Herbal wet wipes, Non-woven fabrics, Herbal extract, Eco-friendly wipes.

INTRODUCTION

Recent years have seen a notable increase in the use of herbal wet wipes because of their many advantages and the growing customer desire for sustainable and natural product [1]. These wipes effectively cleanse and maintain hygiene while also giving a pleasant and soothing sensation due to the infusion of essential oils and herbal extracts [2].

Herbal wipes are disposable wipes manufactured from natural materials like Neem, Aloe Vera and chamomile. Basically, wipes have been used commercially for a variety of purposes, including personal hygiene and the cleaning of hard surface like floors and kitchen surfaces [3]. Wet wipes are frequently used for baby wipes, face wipes and other purposes since they are soft. In this case, the wet wipes were infused with an herbal extract; these wipes are beneficial for skin cleansing and hygienic because they are often thrown away after one usage. Commercially available Wet wipes have chemicals. *Aloe barbadensis* miller gel, *Azadirachta indica* (Neem) extract [4], Clove extract and essential oil-based formulation were utilized to create herbal wet wipes, with the present objective is to alternate the

chemical ingredients [5]. Herbal wet wipes are a type of facial cleansing wipe that effectively eliminates pollutants, sweat, dirt, and makeup in a single step [1-2]. In addition to helping to preserve the skin's moisture balance which are ecologically friendly, it gently washes and moisturizes the skin [6, 1].

The market for sustainable and organic personal care products is growing in the modern world. People are continually searching for options that are efficient and environmentally friendly as they become more aware of the way the choices they make affect the environment. A increasing market exists for innovative and novel products that prioritise sustainability without compromising quality as a result of this shift in customer behaviour [7].

Benefits of herbal wet wipes

To Prevent and Protect against microbial infections

Retaining good personal hygiene

Herbal wet wipes are safe, low cost, eco-friendly.

MATERIAL AND METHOD

Aloe vera, Neem extract, Vitamin E, glycerin, Tween 20,

Methyl paraben, Basil oil, Ethanol and distilled water.

Wetting solution formula for wet wipes

Table 1: Formulation table

Ingredients	Quantity %	Uses
Aloe Vera	0.05	Skin conditioning
Neem extract	0.03	Antiseptic, Antibacterial
Tulsi	0.02	Anti-inflammatory
Clove extract	0.01	Antifungal
Vitamin E	0.01	Antioxidant
Glycerin	0.05	Humectant
Tween 20	0.35	Surfactant
Methyl Paraben	0.45	Preservative
Salicylic acid	0.01	Antimicrobial
Ethanol	2	Organic solvent
Water	97.02	Vehicle

METHOD

Collection and processing of Aloe vera extract (*Aloe barbadensis*)^[2]

For experimenting, freshly taken Aloe vera leaves were manually sliced. Fresh water used to thoroughly wash the leaves. Using a knife, the Aloe Vera's outer covering was cut, and the gel inside was removed and put in a beaker. The collected Aloe vera gel is converted to viscous solution by homogenized by blender.

Preparation of Neem extract (*Azadirachta indica*)^[4]

100g of fresh Neem leaves are collected and ground. The Extract was obtained.

Preparation of Clove extract (*Syzygium aromaticum*)^[1]

100g of dried clove buds are boiled, then the residue is ground. The paste has been heated and filtered once more until the essence is fully extracted.

Preparation of Tulsi extract (*Ocimum tenuiflorum*)^[1]

100g of fresh tulsi leaves and stems are collected and ground. The Extract was obtained.

Components of wet wipes

There are two main components of wet wipe are

Wetting solution Absorbent fabric

Natural or synthetic fabric are used to make the absorbent cloth. Table 1 provides information on the different substrate materials and their characteristics.

Preparation of wetting solution and production of wet wipes

The specified quantity of provided ingredients, as listed in the table, were vigorously stirred with a magnetic stirrer until a homogeneous solution was achieved. Wetting solution was sprayed on nonwoven fabric.

Evaluation Parameters

Organoleptic properties of wetting solution

Color

Determined by visual examination of the prepared wetting solution.

Odor

Assessment of the odor by a sensory panel^[8].

pH

pH was determined by using pH meter. By placing the digital pH meter over the wetting solution^[9].

Clarity

By visually evaluating the wetting solution for the presence of particle debris clarity was evaluated^[10].

Properties of finished product

Irritancy test

An irritancy test was carried out by placing the prepared herbal wet wipes to the skin's surface and timing the procedure. Irritancy, redness, dryness and itching were evaluated^[11].

Evaporation test

The prepared herbal wet wipes were made to be tested on the skin. After wiping the skin with wipes, the moisture content formed due to rubbing has been evaporated from the skin and the time was noted. Evaporation rate was below 1 min^[11].

Homogeneity

The polyherbal formulation was set into container and visually inspected, tested for presence and appearance of any particles or aggregates.

Effectiveness

Test on different skin types to assess cleaning ability

Antioxidant assay – DPPH radical scavenging activity

DPPH (1, 1-diphenyl-2-picryl-hydrazyl) is considered a free radical and has a strong absorbance at 517nm due to an odd electron destabilized across the molecule. The antioxidant properties of the plant extract were ascertained by using DPPH radical. In this assay method 1ml of plant extract (Aloe vera & Neem) solution at different concentrations (100, 200, 400, 800, and 1000 µg/ml) was mixed with 0.1 mM DPPH solution, placed in tubes, and incubated for 40 minutes at room temperature. subsequently, the sample's absorbance was determined at 517 nm using a UV-visible spectrophotometer against methanol as a blank, and the control used in this assay was ascorbic acid^[2].

In this assay, IC₅₀ (Inhibitory concentration of sample required to scavenge 50%) of DPPH radicals.

% Inhibition was calculated by the following equation=

$$\frac{[(\text{Control Absorbance} - \text{Sample Absorbance}) / (\text{Control Absorbance})] \times 100}{}$$

Antimicrobial assay

The antimicrobial activity of formulated solutions was done by using the agar well diffusion method. The test strains used are *E. coli*, and *S.aureus*.

The plates were prepared with 20ml of muller Hinton agar broth used for bacteria and savoured dextrose broth for fungi and then plates with all strains maintained in each culture medium plate. Petri plates were prepared with 20 mL of sterile MHA. On a solidified MHA medium, 200µL of a culture solution containing 108CFU/mL of bacteria was swabbed and dried for ten minutes. In the study, a concentration of 2.5 mg per disc was employed in the investigation. After impregnating the discs, the agar plate was seeded and incubated for 24 hours at 37°C. Microbial growth was determined by measuring the diameter of the zone of inhibition. For each bacterial strain, controls were maintained in which pure solvents were used. The experiment was repeated thrice. By measuring the inhibitory zone

diameter in millimeters (mm) surrounding the wells, the antibacterial activity was assessed. A positive control of 10 µg was employed. By measuring the inhibitory zone diameter in millimeters (mm) surrounding the wells, the antibacterial activity was assessed. A positive control of 10 µg was employed. Erythromycin was used as positive control and Water as negative control [2].

Tested microbes:

Gram-positive: Erythromycin

Gram-negative: Amoxicillin

Stability test

Stability study was carried out for the formulation by providing different temperatures. i.e., at room temperature 37°C and hot air oven at 40°C. Celsius. Sample was checked on different time interval, analysed for visual appearance and weight variation.

RESULTS & DISCUSSION

Table 2: Characterisation of wetting solution and wet wipes

Parameter	Observation
Color	Pale yellow
Odor	Pleasant
pH	5.3
Clarity	Opaque
Dry Tissue	
Dimension	19*15 cm
Weight of Dry Tissue	1.330 g
Colour	White
Thickness	0.2mm
Volume occupied by dry tissue	4.5 ml
Properties of finished product	
Irritancy test	No irritation sign was observed
Evaporation test	Less than 1 min
Homogeneity	Was found to be homogeneous (visual inspection)

Figure 1: Irritancy test – No irritation



Table 3: Antioxidant assay

Concentration (µg/ml)	% SCV of control	% SCV of Aloe	% SCV of Neem
12.5	12.28	21.59	23.21
25	17.103	32.21	30.92
50	26.28	46.62	42.22
100	52.17	59.21	53.42
200	73.02	68.72	71.23
400	77.85	76.73	80.98

Figure 2: Graphical representation of the antioxidant activity of plant extract by DPPH method

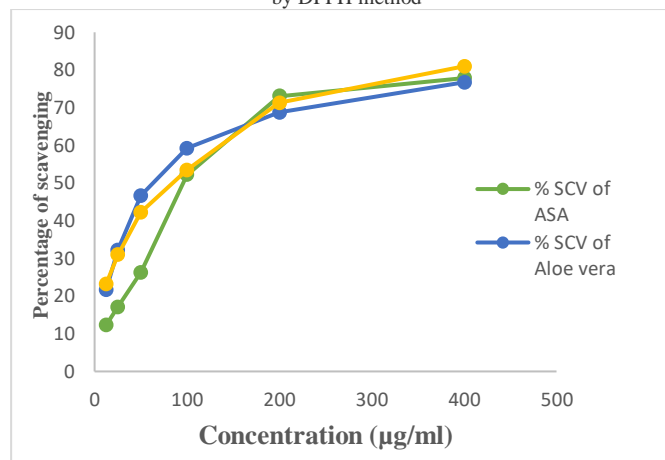
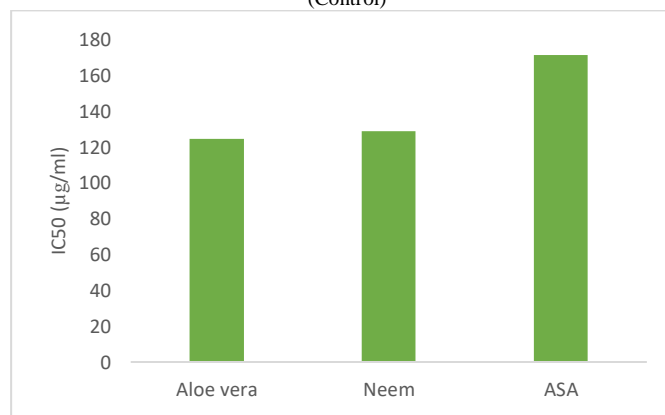


Figure 3: IC₅₀ of Aloe vera, Neem extract (Sample), and Ascorbic acid (Control)



Antioxidant assay for aloe vera, Neem was measured with DPPH -free radical scavenging assay method using DPPH (2, 2-diphenyl-1-picrylhydrazyl).

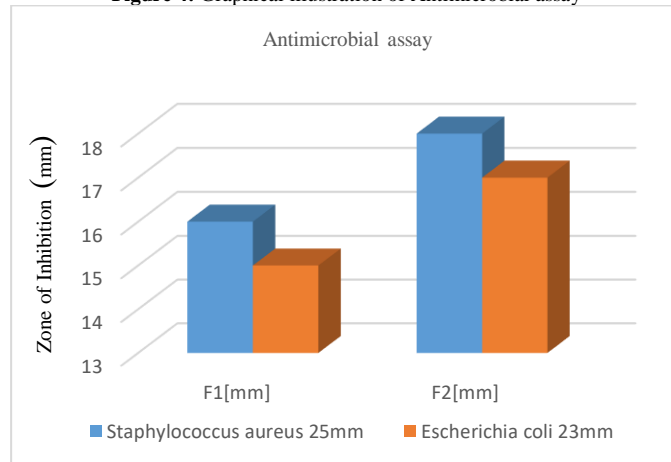
In this assay method, the maximum level of inhibition (% of Scavenging) of Aloe vera, Neem was determined. This can be seen in Figure 2 and IC₅₀ value was also determined in Figure 3.

Antimicrobial assay

Table 4: Zone of inhibition

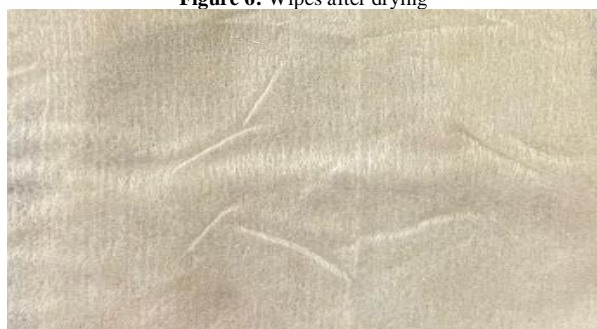
Bacteria Name	Antibiotics (mm)	F1[mm]	F2[mm]
Staphylococcus aureus	25mm	16	18
Escherichia coli	23mm	15	17

Figure 4: Graphical illustration of Antimicrobial assay



Stability studies**Table 5:** Stability studies

Wet wipes	Initial weight (g)	Weight variation (g)	
		Over a month (g)	
1.	5.960	At room temperature	At hot air oven
		4.646	2.562

Figure 5: wipes before drying**Figure 6:** Wipes after drying**CONCLUSION**

The formulation and evaluation of herbal wet wipes with non-woven fabrics present a promising research area, merging herbal extracts' benefits with the practicality of disposable hygiene products. This innovative approach could revolutionize personal care by offering a natural and convenient alternative to traditional wipes. By incorporating soothing and antibacterial herbal extracts, these wipes enhance skin health while maintaining on-the-go usability. To fully capitalize on their potential, challenges like ensuring herbal extract efficacy, optimizing odor and texture, and addressing skin sensitivities must be addressed. Understanding consumer preferences will also be pivotal for market success. Effective communication about the natural ingredients and skin benefits will be crucial, alongside marketing campaigns highlighting eco-friendliness to appeal to environmentally-conscious consumers. In conclusion, herbal wet wipes using non-woven fabrics have the potential to meet consumer demand for natural

hygiene solutions, making a significant impact in the personal care industry.

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