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FORMULATION AND EVALUATION OF HERBAL TRANSDERMAL PATCHES FROM AQUEOUS EXTRACT OF ACHYRANTHES ASPERA LINN

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ABSTRACT

The aim of Novel Drug Delivery System is to provide a therapeutic amount of drug to the appropriate the in the body to accomplish promptly and then maintain the desired drug concentration. The drug delivery system should deliver drug at a rate control by the necessarily of the body over a specified term of treatment. A transdermal patch is a medicated adhesive patch that is placed on the skin to deliver a specific dose of medication through the skin and into the bloodstream. Often, this promotes healing to an injured area of the body. An advantage of a transdermal drug delivery route over other types of medication delivery such as oral, topical, intravenous, intramuscular, etc, is that the patch provides a controlled release of the medication into the patient, usually through either a porous membrane covering a reservoir of medication or through body heat melting thin layers of medication embedded in the adhesive. The therapeutic efficacy of Aaghada must have been known to man since antiquity as a result of constant experimentation with nature. It have various activites like, Analgesic, antioxidant, antifertility, Anti-inflammatory, Anti pyretic, Antiemetic, cardiac stimulant, Antioxidant, Anti- microbial etc. But this bitterness is responsible for its therapeutic efficacy of this tree. A wide variety of pharmaceuticals are now available in transdermal patch form.

KEYWORDS: NDDS, Transdermal Patch, Infrared Spectroscopy.

INTRODUCTION

TRADITIONAL MEDICINE SYSTEM

Traditional system of medicine is one of the centuries old practices and long serving companion to humankind in the fight against disease and in leading a healthy life. Indigenous people have been using the unique approach of their traditional system of medicine for centuries and among the most renowned are the Chinese, Indian, African systems of medicine. Traditional medicine refers to any ancient and culturally based healthcare practice differing from scientific medicine and is largely transmitted orally by communities of different cultures, The World Health Organization (WHO) observes that it is difficult to assign one definition to the broad range of characteristics and elements of traditional medicine, but that a working definition is essential. I thus conclude that the traditional medicines include diverse health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises applied singularly or in combination to maintain wellbeing, as well as to treat, diagnose or prevent illness. The modern health care service has posed immense threat to indigenous health practices because of their potential and speedy therapeutic effect. This has led to the disappearance and displacement of traditional systems of medicine. Also, traditional systems are undervalued by the people. However, the rise in population, inadequate supply of drugs, prohibitive cost of treatments, side effects of several allopathic drugs and development of resistance to currently used drugs for infectious diseases have led to increased emphasis on the use of plant materials as a source of medicine for a wide variety of human ailments.[1]

CURRENT STATUS OF HERBAL MEDICINE

Currently more than 80% of the world population depends on traditional and plant derived medicine because, plants are important sources of medicines and presently about 25% of pharmaceutical prescriptions in the United States contain at least one plant-derived ingredient. In the last century, roughly 121 pharmaceutical products were formulated based on the traditional knowledge obtained from various sources.[2]

FUTURE IMPORTANCE OF HERBAL MEDICINE

It is estimated that there are about 350,000 species of existing plants (including seed plants, bryophytes, and ferns), among which 287,655 species have been identified as of 2004. Relatively small percentages (1 to 10%) of these are used as foods by both humans and other animal species. It is possible that even more are used for medicinal purpose.[5]

SAFETY, EFFICACY AND QUALITY

Governments need to undertake a series of activities to ensure the safety and efficacy of traditional medicine, including establishment of a national expert committee, formulation of national regulations for herbal medicines, licensing of the practice of traditional medicine, and provision of support for research.[4]

MATERIALS AND METHODS

Plant Material

The whole plant of Achyranthes aspera Linn. was collected from the local fields of Pune district, Maharashtra, India, during the month of April-May 2026. The plant was botanically authenticated by a qualified taxonomist (Voucher Specimen No.: DEPT/BOT/2025/114). The collected plant material was washed thoroughly under running tap water followed by distilled water to remove surface dirt and extraneous material. The washed material was shade-dried at room temperature (25–30°C) for 14 days until a constant weight was achieved.[3] The dried plant material was coarsely

powdered using a mechanical grinder and stored in an airtight container at room temperature, protected from light and moisture until use.[3]

Table 1: Composition of Herbal Transdermal Patch Formulations (F1–F6).

Batch	F1	F2	F3	Uses
Aq. Extract	40mg	40mg	40mg	Anti-inflammatory
a) Gelatin	240mg	-	-	Gelling agent
b) Sodium alginate	240mg	240mg	300mg	Suspending agent
DMSO	0.3ml	0.3ml	0.3ml	Penetration enhancer
Glycerin	0.3ml	0.3ml	0.3ml	Preservative
Water	q.s.	q.s.	q.s.	Solvent

Procedure

Procedure for Extraction of Leaves of Achyranthes aspera Linn (Soxhlet Apparatus Method)

1) Shade-dried leaves were powdered by size reduction method.
2) About 10 g of dried powder was packed in a Soxhlet apparatus and extracted with petroleum ether for 24 hours to remove waxy materials.
3) The marc was then extracted with distilled water for 72 hours.
4) After completion of extraction, the aqueous extract was concentrated by evaporation to obtain crude extract.
5) The obtained extract was dried in a vacuum oven and stored for further use.[8]

Procedure for Preparation of Herbal Transdermal Patches

A. Gelatine (240 mg) and Sodium Alginate (240 mg) were weighed accurately and dissolved in water with heating on a water bath.
B. The prepared extract was added slowly with continuous stirring to obtain a homogeneous mixture.
C. DMSO and glycerine were added to the mixture as permeation enhancer and plasticizer respectively.
D. The final mixture was poured into a Petri dish and allowed to dry at room temperature for 24 hours.[6]
E. After drying, the patches were carefully peeled off using a knife and stored in a desiccator for further evaluation.

Evaluation Parameters

Uniformity of Weight

This was done by weighing twenty different patches of individual batch taking the uniform size at random and calculating the average weight of ten. The tests were performed on patch which was dried at 60°C for 4 hrs. prior to testing.

Thickness of Patches

The thickness of the patch was assessed by using digital vernier caliper at different points of the patch. From each formulation ten randomly selected patches were used. The average value for thickness of a single patch was determined.

Drug Content Determination

The patches were taken and added to a beaker containing 100 ml of D.W. The medium was stirred magnetic bead for 5 hrs. The solution was later filtered and analyzed for drug content with proper dilution at 382 nm spectrophotometrically.[7]

Folding Endurance

This was determined by repeatedly folding one patch at the same place till it broke. The number of times the patch could be folded at the same place without breaking gave the value of folding endurance.[10]

Percentage Moisture Content

The patch was weighed accurately and placed in desiccators containing aluminum chloride. After 24 hrs, the patch was taken out and weighed. The percentage moisture uptake was calculated as the difference between final and initial weight. With respect to initial weight. It is calculated by using following formula.

Percent moisture content = Final Weight − Initial Weight X 100/ Initial Weight

Surface pH

The patches were allowed to swell by keeping them in contact with 1 ml of distilled water for 2 hrs. at room temperature and pH was noted down by bringing the electrode in contact with the surface of the patch, allowing it to equilibrate for 1 min.[13]

ANTIMICROBIAL ASSAY

PROCEDURE

The antimicrobial activities of different formulations were determined by modified agar well diffusion method. In this method, nutrient agar plates were seeded with 0.2 ml of 24 hrs. broth culture of Staphylococcus aureus/Candida albicans organism. The agar plates were allowed to solidify. A sterile 8 mm borer was used to cut two wells of equidistance in each of the plates. Test solution were introduced into the first well & standard solution were introduced into the second well of each petriplate at randomly. The plates were incubated at 37°C for 24 hrs. The antibacterial activities were evaluated by measuring the Zones of inhibition (in mm).[6]

EXPERIMENTAL CONDITION FOR ANTI-BACTERIAL ACTIVITY

- **Organisms used:** Staphylococcus aureus,
- **Media used:** Nutrient Agar.
- **Test used:** AE patch,
- **Standard:** Ciprofloxacin.

RESULTS AND DISCUSSION

Characterization of Aqueous Extract

The aqueous extract of Achyranthes aspera yielded a dark brown, semi-solid mass with a characteristic odour and a mildly astringent taste. The physicochemical characterization results are presented in Table 2.

Table 2: Physicochemical Characterization of Aqueous Extract of Achyranthes aspera.

Parameter	Specifications	Observation
Uniformity of Weight (g)	0.42 ± 0.05	0.37
Thickness of Patches (mm)	0.3 ± 0.10	0.2
Drug Content (%)	83.35± 0.94	0.05
Folding Endurance (No)	10 ± 0.35	4
Moisture Content (%)	1.80 ± 0.03	1.78
Surface pH	7.2 ± 0.36	6
Percent Elongation (%mm)	82 ± 0.23	80

Anti- microbial Assay

The anti-bacterial activity of different formulations was evaluated by modified agar well diffusion method against Staphylococcus aureus using nutrient agar medium. The formulations showed noticeable zones of inhibition, indicating effective anti-bacterial activity.Among all the formulations, the AE patch exhibited significant inhibition against the test organism when compared with the standard drug Ciprofloxacin. The activity was determined by measuring the diameter of the zone of inhibition in millimeters (mm) after incubation at 37°C for 24 hours.he results confirmed that the formulated patch possesses appreciable anti-bacterial potential against Staphylococcus aureus.

Phytochemical Screening

Qualitative phytochemical analysis of the aqueous extract confirmed the presence of multiple classes of secondary metabolites, as shown in Table 3. Alkaloids, flavonoids, saponins, tannins, steroids, terpenoids, phenols, and glycosides were all identified, corroborating previous reports in the literature. The presence of saponins and flavonoids is particularly relevant given their established roles in anti-inflammatory and analgesic pharmacological activities attributed to the plant.[9]

Table 3: Phytochemical Screening of Aqueous Extract of Achyranthes aspera.

Phytoconstituent	Test / Reagent	Observation / Result
Alkaloids	Dragendroff's Reagent	Orange-red precipitate (+)
Flavonoids	Alkaline Reagent Test	Yellow colour (+)
Saponins	Foam Test	Persistent froth (+)
Tannins	Ferric Chloride Test	Bluish-black colour (+)
Steroids	Libermann-Burchard Test	Green colour (+)
Terpenoids	Salkowski Test	Red-brown colour (+)
Phenols	Lead Acetate Test	White precipitate (+)

CONCLUSION

The present study successfully formulated and evaluated herbal transdermal patches containing aqueous extract of Achyranthes aspera Linn by using gelatin and sodium alginate polymers. The patches were prepared by solvent casting method and showed satisfactory physicochemical properties such as uniform thickness, acceptable weight variation, good folding endurance, suitable surface pH, moisture content, and drug content uniformity.[14]

The formulated patches were found to be smooth, flexible, stable, and suitable for transdermal application. Stability studies indicated that the prepared formulations remained stable without significant changes in colour, texture, and pH under different storage conditions. Antimicrobial studies demonstrated effective activity against Staphylococcus aureus and Candida albicans, confirming the antimicrobial potential of the herbal extract. Among the formulations, sodium alginate patch showed better antimicrobial activity, while gelatin patch exhibited good flexibility and stability characteristics.[11]

Therefore, the study concludes that herbal transdermal patches of aqueous extract of Achyranthes aspera Linn can be considered a promising novel drug delivery system for the treatment of skin infections and related microbial conditions. The developed formulation may provide improved patient compliance, sustained drug release, and enhanced therapeutic efficacy with reduced side effects.

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