Signet brings to your doorstep highly purified and specialized excipients from Ferro Pfanstiehl, NovaMatrix and Friesland Campina.

From the ultra-pure range of alginates, hyaluronates, chitosans, protein hydrolysates to the low-endotoxin sugars and other refined carbohydrates, their products cater to a wide range of applications such as parenteral drug delivery, tissue engineering and cell encapsulation.

At Signet, we partner with companies that epitomize the excellence and consistency our clients have come to expect and enjoy.

**ultrapureability**

- **Ferro Pfanstiehl**
  - Sucrose *(Low endotoxin)*
  - D-Galactose *(Low endotoxin)*
  - Maltose hydrate *(Low endotoxin)*
  - Trehalose dihydrate *(Low endotoxin)*

- **NovaMatrix**
  - Pronova UP / SL *(Ultra Pure Sodium Alginate)*
  - Pronova UP *(Ultra Pure Chitosan)*
  - Sodium Hyaluronate Pharma *(Ultra pure)*

- **FrieslandCampina**
  - Proyield Soy SE50MAF-UF *(Soy protein)*
  - Proyield Soy SE70M-UF *(Soy protein concentrate)*
  - Proyield Pea PCE80B *(Pea protein concentrate)*
  - Proyield Wheat WGE80M-UF *(Wheat gluten protein)*
  - Proyield Cotton CNE50M-UF *(Cotton seed)*

**Partner with ability**

Call: +91 22 61462726 | Fax: +91 22 61462726 | Email: sales@signetchem.com | www.signetchem.com

25 leading excipient companies | Over 400 products | Total solutions since 1986
CONTENTS

REVIEW ARTICLE
- Amorphous Pharmaceutical Solids: A Review
  Dhokchawle B. V., Tauro S. J., and Bhandari A. B. ..................................................5

ORIGINAL RESEARCH ARTICLES
- Forced Degradation Study of Eletriptan by Using Ultra High Performance Liquid Chromatography (UHPLC)
  Sahu S., Singh R.M, Mathur S.C., Sharma D. K., Saini P.K., Duggal D.,
  Tyagi V. and Singh G. N. ..........................................................................................14

- Comparative Assessment of Topical Formulations by Performing Transmembrane Diffusion and Permeation Using Diffusion Cells
  Sawarkar S., Gursalkar T., and Deshpande S. ...........................................................22

- Pharmacognostical, Phytochemical and Anti-Microbial Activity of An Ayurvedic Formulation Nishakatakadi Kashayam
  Radha A., Prabhakaran M., Paul M., Sreevalsan A., Sebastian J.,
  Verghese J., and Jolly C.I. .....................................................................................26

- Design and in Vitro Evaluation of Mucoadhesive Buccal Films of Lercanidipine HCL
  Doddayya H., Patil S.S., Suman M., Kumar P., and Udupi R.H. .............................31

SHORT NOTES
- Evaluation of Mangrove Plants as Putative HIV-Protease Inhibitors
  Rege A. A., and Chowdhary A. S. ..............................................................................41

- Evaluation of Market Samples of ‘Mayur Puccha Bhasma’
  Using ‘Namburi Phased Spot Test’ (NPST)
  Kotrannavar V.S., Sarashetty R.S. and Tambhekar N. ..........................................45
ABSTRACT
The objective of the present study was to develop quality parameters to evaluate and standardize the polyherbal formulation and also to study the eight crude drugs viz. Curcuma longa - rhizome (Manjal), Salacia oblonga - root bark (Ekanayakam), Emblica officinalis - pericarp (Nellika), Strychnos potatorum - seed (Thettanparal), Ixora coccinea - root (Chethi), Vettiveria zizanioides - root (Ramacham), Aerva lanata - root (Cherula) and Symplocos racemosa - bark (Pachotti). The studies included physic-chemical parameters, HPTLC studies, heavy metal analysis and standardization of formulation using chemical markers. Antimicrobial activity of different fractions of kashayam was studied and found to be highest for ethanolic extract of kashayam. The pharmacognostical studies include microscopical, macroscopical examinations, ash values and extractive values, mineral elemental analysis, fluorescence analysis and FTIR analysis.

Keywords: High Performance Thin Layer Chromatography (HPTLC), Inductively Coupled Plasma Mass Spectroscopy (ICPMS).

INTRODUCTION
Ayurveda utilises many dosage forms in the treatment of diseases. Nishakathakadi kashayam is a decoction popularly used for curing diabetes mellitus. It is prepared by boiling coarse powders of Curcuma longa - rhizome (Manjal), Salacia oblonga - root bark (Ekanayakam), Emblica officinalis - pericarp (Nellika), Strychnos potatorum - seed (Thettanparal), Ixora coccinea - root (Chethi), Vettiveria zizanioides - root (Ramacham), Aerva lanata - root (Cherula) and Symplocos racemosa - bark (Pachotti). Care Keralam undertook an extensive study on this Kashayam, focusing on pharmacognosy (Fig. 5-8), phytochemical screening (Table I), antimicrobial activity (Fig. 1), HPTLC analysis (Fig. 2) and estimation of heavy metals and other minerals (Table II). The FTIR profiling of kashayam powder was done and it was found to contain amines, carboxylic acids esters and phenols (Fig. 4).

MATERIALS AND METHODS
EXPERIMENTAL
Plant collection
All the eight raw materials were collected and authenticated by the botanist from the raw drug division of Kerala Ayurveda Ltd, Athani. These raw materials were further authenticated by established pharmacognostical evaluations vis-a-vis free hand sectioning and powder analysis. The raw materials were air dried, pulverized, homogenized to fine powder and stored in airtight bottles.

Kashayam Preparation
Coarse powders of eight raw materials at the rate of 100 g were mixed thoroughly and boiled with 1600mL distilled water. This was further reduced to 400mL under low heat. The decoction thus obtained was strained through a clean cloth, allowed to cool and kept in airtight bottle in refrigerator.
Phytochemical Screening of Kashayam

25 mL of this kashayam was evaporated to dryness using a water-bath. Methanolic extract of this sample filtrate was dissolved in dilute hydrochloric acid and filtered. The above filtrate was subjected to derivatized developed plates was performed using vanillin sulphuric acid reagent, ferric chloride reagent and Libermann Burchard reagent to re-confirm the presence of bitters, tannins and sterols respectively.1,3.

Table I: Phytochemical screening of eight raw materials

<table>
<thead>
<tr>
<th>SI No</th>
<th>Raw Material</th>
<th>Tannins</th>
<th>Alkaloids</th>
<th>Sterols</th>
<th>Phenols</th>
<th>Saponnins</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Curcuma longa</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>2</td>
<td>Aerva lanata</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>3</td>
<td>Ixora coccinea</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>4</td>
<td>Phyllanthus emblica</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>5</td>
<td>Salacia reticulata</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Strychnos potatorum</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>7</td>
<td>Symplocos racemosa</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>+</td>
</tr>
<tr>
<td>8</td>
<td>Vetiveria zizanioides</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table II: Heavy metal analysis of formulation and its ingredients

<table>
<thead>
<tr>
<th>SI No</th>
<th>Raw Material</th>
<th>Mercury (ppm)</th>
<th>Arsenic (ppm)</th>
<th>Cadmium (ppm)</th>
<th>Lead (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Curcuma longa</td>
<td>BDL</td>
<td>0.070</td>
<td>0.273</td>
<td>0.49</td>
</tr>
<tr>
<td>2</td>
<td>Aerva lanata</td>
<td>ND</td>
<td>0.075</td>
<td>0.058</td>
<td>2.55</td>
</tr>
<tr>
<td>3</td>
<td>Ixora coccinea</td>
<td>BDL</td>
<td>ND</td>
<td>ND</td>
<td>0.75</td>
</tr>
<tr>
<td>4</td>
<td>Phyllanthus emblica</td>
<td>0.103</td>
<td>BDL</td>
<td>0.36</td>
<td>1.32</td>
</tr>
<tr>
<td>5</td>
<td>Salacia reticulata</td>
<td>BDL</td>
<td>ND</td>
<td>ND</td>
<td>1.64</td>
</tr>
<tr>
<td>6</td>
<td>Strychnos potatorum</td>
<td>0.069</td>
<td>BDL</td>
<td>BDL</td>
<td>1.53</td>
</tr>
<tr>
<td>7</td>
<td>Symplocos racemosa</td>
<td>BDL</td>
<td>ND</td>
<td>ND</td>
<td>0.41</td>
</tr>
<tr>
<td>8</td>
<td>Vetiveria zizanioides</td>
<td>1.27</td>
<td>BDL</td>
<td>0.082</td>
<td>2.17</td>
</tr>
</tbody>
</table>

Mayer’s test, Dragendorf’s test to check the presence of alkaloids. Presence of tannins and sterols was checked using ferric chloride reagent and Liebermann-Burchard reagent and these classes of compounds were quantified as per standard methods cited in IP2010, 2.6.4.

HPTLC Analysis of Class of Compounds in Kashayam

HPTLC of Methanolic extract of kashayam powder was carried out to substantiate the presence of all eight raw materials. Derivatized of developed plates was performed using vanillin sulphuric acid reagent, ferric chloride reagent and Libermann Burchard reagent to re-confirm the presence of bitters, tannins and sterols respectively.1,3.

Table III: Heavy metal analysis in Kashayam

<table>
<thead>
<tr>
<th>SI No</th>
<th>Metals analysed</th>
<th>Results (ppm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Arsenic</td>
<td>BDL</td>
</tr>
<tr>
<td>2</td>
<td>Sodium</td>
<td>1679.54</td>
</tr>
<tr>
<td>3</td>
<td>Potassium</td>
<td>9422.07</td>
</tr>
<tr>
<td>4</td>
<td>Cadmium</td>
<td>BDL</td>
</tr>
<tr>
<td>5</td>
<td>Mercury</td>
<td>BDL</td>
</tr>
<tr>
<td>6</td>
<td>Lead</td>
<td>BDL</td>
</tr>
</tbody>
</table>
Table IV: The antimicrobial activity of Kashayam

<table>
<thead>
<tr>
<th>Extracts</th>
<th>Microorganisms</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Escherichia coli</td>
</tr>
<tr>
<td>Methanol</td>
<td>14 mm</td>
</tr>
<tr>
<td>Ethanol</td>
<td>18 mm</td>
</tr>
<tr>
<td>Water extract</td>
<td>-</td>
</tr>
<tr>
<td>Gentamycin</td>
<td>21 mm</td>
</tr>
</tbody>
</table>

Fig. 1: Plates showing the antimicrobial activity of Kashayam

Fig. 2: Developed plates of kashayam and its raw materials at 254nm and 366nm Track details: Track 1-Kashayam 2-Sympliocus racemosus 3-Salacia oblonga 4-Emblica officinalis 5-Ixora coccinea 6-Kashayam 7-Strychnos potatorum 8-Vetiveria zizanioides 9-Curcuma longa 10-Aerva Lanata

Fig. 3: Batch comparison of three batches of kashayam

HPTLC Comparison of Three Batches of Kashayam

Three batches of kashayam were prepared and compared the HPTLC to check any difference in the chemistry and manufacturing process.1,3 (Fig. 3).

FTIR Profiling of Kashayam Powder

Finely powdered methanolic extract of kashayam powder was subjected to FTIR analysis to reconfirm the presence of phenols, sterols and tannins in kashayam (Fig. 4).

Heavy Metal Analysis of Kashayam using ICPMS

25 mL of kashayam was evaporated to dryness and 1g of the sample kashayam powder was digested in microwave digestive system (MDS) for thirty minutes. This sample was analysed for the presence of heavy metals, inorganic minerals and elements like...
Fig. 4: FTIR profile of Kashayam

Peak Details

- 3400-3200-Phenols
- 2927.492-Alkanes
- 1626.457-Arenes
- 1402.823-Carboxylic acid (C-O-H bending)
- 1224.620-Carboxylic acid (med-str O-C)
- 1037.414-Amines med (C-N)
- 1076.857- Amines med (C-N)
- 767.7-S-OR esters

Fig. 5: Trichomes and Phloem fibers of Kashayam powder

Fig. 6: Oleoresin cells of Kashayam Powder

Chromium, calcium, potassium, sodium and vanadium were also analysed using ICPMS.

**Powder Analysis of Kashayam**

Powder microscopy of kashayam filtrate was done to establish the presence of phloem fibres, oleoresin cells, oil cells, trichomes and to ensure absence of starch. The kashayam powder was also subjected to aflatoxin analysis. Microbial load in kashayam powder was performed. Total viable plate count, yeast and mould count, specific organisms including *E.coli*, *Salmonella* sp., *Pseudomonas aeruginosa* and *Staphylococcus aureus* according to was also carried out (Fig. 1, 5-8).
Antimicrobial Activity of Kashayam

Five microbial cultures were analysed. The bacteria include *Escherichia coli* (MTCC 433), *Salmonella typhimurium* (MTCC 3231), *Listeria monocytogenes* (MTCC 657), *Staphylococcus aureus* (MTCC 9886) and fungal species of *Microsporum gypseum* (MTCC 2819), which were taken from IMTECH culture collection (MTCC), Chandigarh. Concentrated methanolic, ethanolic and aqueous extract of the powdered kashayam in four different concentrations (50µL, 100µL, 150µL, 200µL) were employed for the study. Well-diffusion assay method\(^1,7\) (CCRAS 2010) was used to check the antimicrobial activity (Fig. 1).

**RESULTS AND CONCLUSION**

The alkaloids, tannins, sterols and bitters were found to be present in Nishakathakadi kashayam and furthermore the percentage of alkaloids, tannins, and bitters were estimated to be 0.32%, 0.65%, and 0.24% respectively\(^4,6,8,9\). HPTLC analysis revealed the presence of all eight raw materials in kashayam, which was confirmed by the Rf values of individual raw materials (Fig. 2). Arsenic, cadmium, mercury and lead were found to be under acceptable limits during heavy metal analysis (Table II, III). It was found to be highest for ethanolic extract of Kashayam powder whilst methanolic extract exhibited some antimicrobial activity and aqueous extract showed no antimicrobial activity (Fig.1, Table IV). Three batches of kashayam was compared using HPTLC to check any variations in the chemistry during kashayam preparation. The HPTLC finger print of three batches was exactly the same by comparing the Rf values (Fig. 3). FTIR profile confirmed the presence of sterols, Phenols and tannins in Kashayam (Fig. 4).

**ACKNOWLEDGEMENT**

Authors are thankful for the immense support and whole hearted encouragement given by Mr Karimpuzha Raman, Managing Director, CARe Keralam Ltd. The authors also acknowledge tremendous scientific inputs provided by Dr Suresh Kumar, R&D Head and Dr. K.C Chacko they provided the much needed directionality for the research.

**REFERENCES**

1. Laboratory guide for the analysis of Ayurveda and Siddha Formulations; 2010: Central Council for Research in Ayurveda and Siddha.
The Agilent 1290 Infinity ELSD delivers sensitive, universal detection with uniform response independent of compound structure. The unique cooled evaporator enables detection of semi-volatile compounds; gas flow programming improves uniformity of response.

**Boost Performance**  Laser light source delivers optimal signal-to-noise and high sensitivity

**Save Time**  Analyze compound libraries without the need for extensive sample preparation

**Reduce Costs**  One single detector solution for UHPLC, LC/MS, GPC/SEC, and SFC

INFINITELY BETTER TECHNOLOGIES

True universal detection is one of a wave of innovative Agilent technologies for ensuring your Agilent 1200 Infinity Series LC stays at the forefront of separation potential.

Watch video [www.agilent.com/chem/infinity-elsd](http://www.agilent.com/chem/infinity-elsd)
LISTEN TO YOUR HEART

Pycnogenol® helps maintain healthy circulation by increasing vasodilation of blood vessels, consequently improving blood flow and cardiovascular function.*

LOOK, FEEL AND LIVE BETTER

DKSH India Pvt.Ltd.
Mobile +91 96 1915 8814,
Phone +91 22 6157 7000
pharmaceuticals.in@dksh.com, www.dksh.in

WWW.PYCNOGENOL.COM
Central India’s Largest Pharma Expo is Back

An International Exhibition on Pharma, Lab & Packaging Equipments

:: EXHIBITORS PROFILE ::

- Processing Plant & Machinery
- Lab Equipment, Instruments, Lab Wares
- Packing Materials & Machinery
- Bulk Drugs, Intermediates, Formulators
- Water Treatment, East Management
- Biotechnology & CROs.
- R&D, Quality Control etc.
- Healthcare Products
- Clinical Research & Development
- Environment & Pollution Control
- Ayurveda, Herbal & Nutraceutical
- Cosmetic & Personal Care

www.PharmaTechExpo.com

VISITOR PROFILE

- CEOs, Engineers, & Technocrats
- Pharmacists & Scientists
- R&D Professionals
- Academicians, Teachers & Students
- Equipment Suppliers & Distributors
- Policy Makers & Decision Makers
- Foreign Commercial Corporations
- Regulatory Officers
- Purchase Officers of Pharmaceutical Companies
- Trade Delegates of Various Countries

Jointly Organised By:

PharmaTechnologyIndex.com Pvt. Ltd.
E-mail: events@pharmatechnologyindex.com
Indian Drug Manufacturers’ Association
E-mail: ppr@idmaindia.com

Contact Person: Aarjav Shah - Mob: 098796 16665 / 091736 60040
Website: www.PharmaTechExpo.com

Contact Person: Prachi Rane - Mob: 098676 34383
Website: www.idma-assn.org
**Application**

**Fermentation broths:**
- Antibiotics, amino acids, enzyme, organic acids,
- Vitamin, pharmaceutical intermediates, etc.

**Extraction & purification of nature herbal:**
- Puerarin, Soybean peptide, nature color, tea polyphenols, etc.

**Food & Beverage:**
- Fruit juice, vegetable juice, tea drinking, wine, dairy.
- Sugar and sugar alcohols, vinegar, soy, etc.

**Ceramic membrane has many unique advantages:**
- Acid/alkaline/oxidation chemicals resistance.
- Solvent stability.
- High thermal stability and steam disinfected.
- Wearability and excellent strength.
- Narrow pore size distribution.
- Easy to be cleaned and regenerated.

http://www.jiuwu.com  
Contact person: Ms. Claire Ding  
Email: claire@jiuwu.com, dingjian@jiuwu.com  
Tel:+86–25–58849045/58103595  
Fax:+86–25–58749295
Customer Compliments are bigger awards than any other awards ..... go green

- Chamber designed for significant low power consumption over competitors
- Highly accurate PLC-based controlling systems with large data storage capacity
- Intelligent backup systems with auto, scheduled and manual change-overs
- PC communication on ethernet
- 21 CFR PART 11 ready software
- SMS/emails with detailed description of alerts
- Best suitable for all regulatory requirements

Manufacturers of: Walk-In Chambers, Humidity (Stability) Chambers, Photostability Chambers, Cooling Chambers, Incubators, Deep Freezers, Pharma Refrigerators, Ovens, Data Logger

Newtronic Lifecare Equipment Pvt. Ltd.
108-ABCD, Kandivli Co-op. Ind. Estate Ltd. Charkop, Kandivli(West), Mumbai - 400067, India.
Tel: +91-22-2867 9326 | Fax: +91-22-2867 6059 | website: www.newtronic.in | E-mail: sales@newtronic.in
ONE BRAND TOTAL SOLUTION

- READY-TO-USE FILM COATING SYSTEMS
- NEUTRAL SPHERES
- FILM COATING FOR NUTRACEUTICALS
- PHARMA ACRYLIC POLYMERS
- R&D COATER
- CONTROL RELEASE PRODUCTS
- COOLING COMPOUNDS

Tel: +91-22-42688700 | Fax: +91-22-42688713 | E-mail: info@idealcures.co.in | Website: www.idealcures.co.in