Enhancement of leather waste gelatin resin with Azanza garckeana fruit extract

Student: Notabo Hlabano

Introduction

- Waste production in the leather industry [1-3].
- Waste produced is disposed of together with valuable components (e.g. 11.3% collagen) [1-3].
- Types of waste produced from processing a ton of raw hides (e.g. 35.5% Chrome Tanned Leather Solid Waste CTLS, 39.5% untanned solid waste) [3]**.(only 25% useable hide)**
- Harmful effects of disposing CTLS [2].
- Approximately 2 688 tons of solid waste produced per year, globally, and only 19% of the waste is converted into useful products [3].
- Need for an alternative method to recover and fully utilize the remaining 81% of waste.
- Gelatin resin can be produced from CTLS [4].
- Gelatin resin with some modifications can be used in industrial applications [1-3].

Background

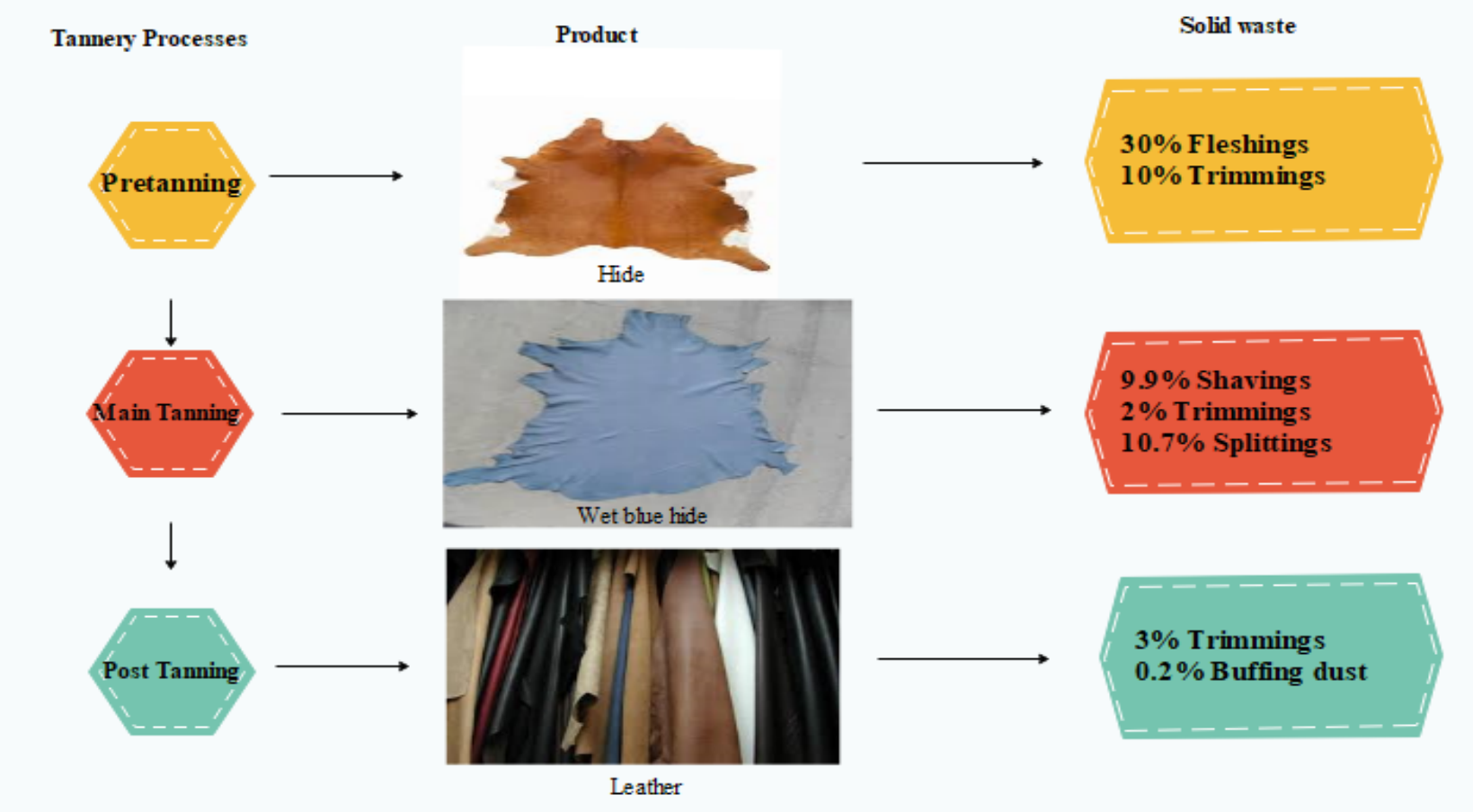
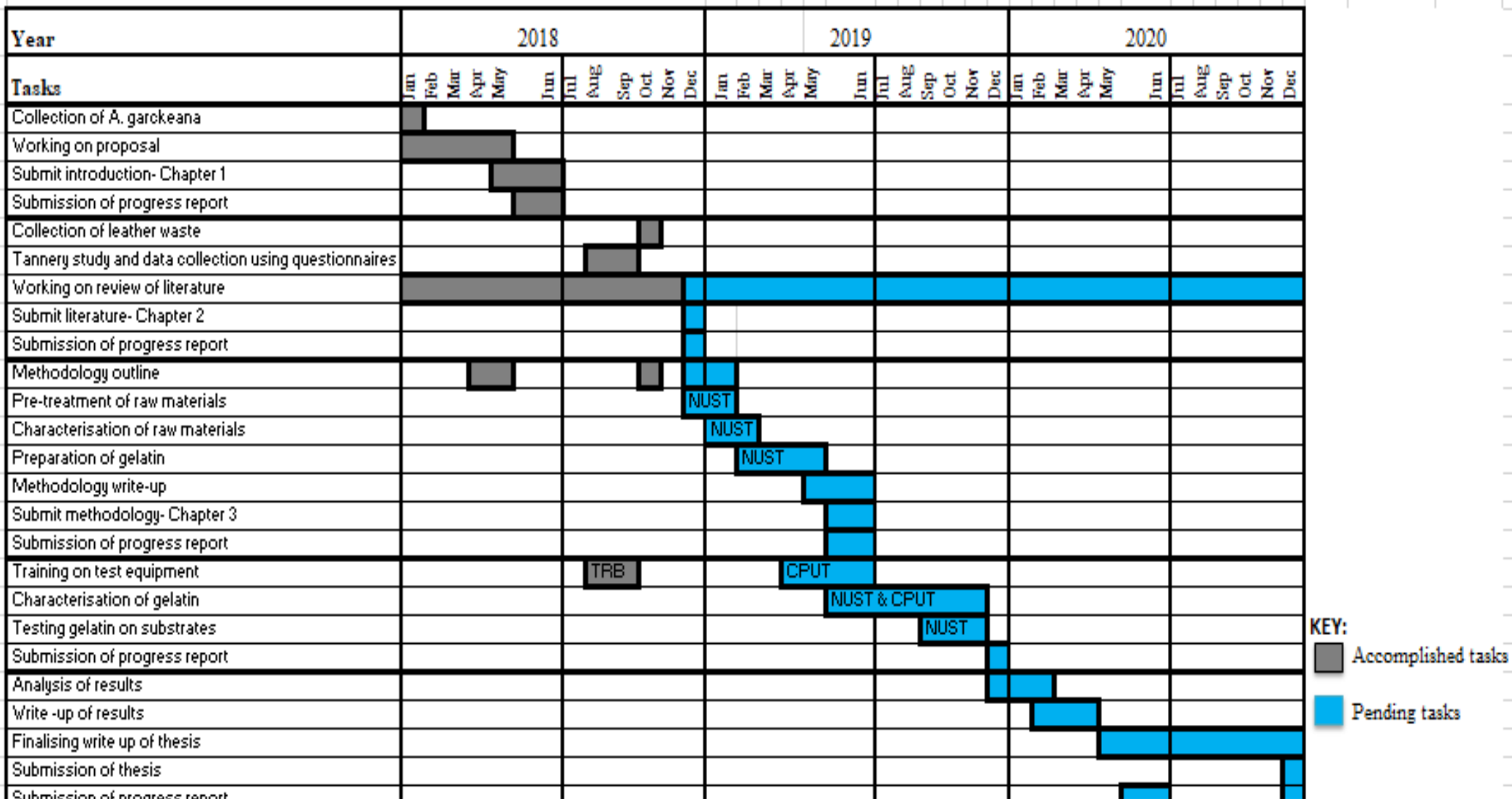


Fig 1: Tannery processes and products produced during the processing of a ton of raw hides [1, 3, 7]

Research question

How can the use of polyphenolic compounds from Azanza garckeana (A. garckeana) enhance the physicochemical properties of dechromed leather waste gelatin?

Proposed work plan

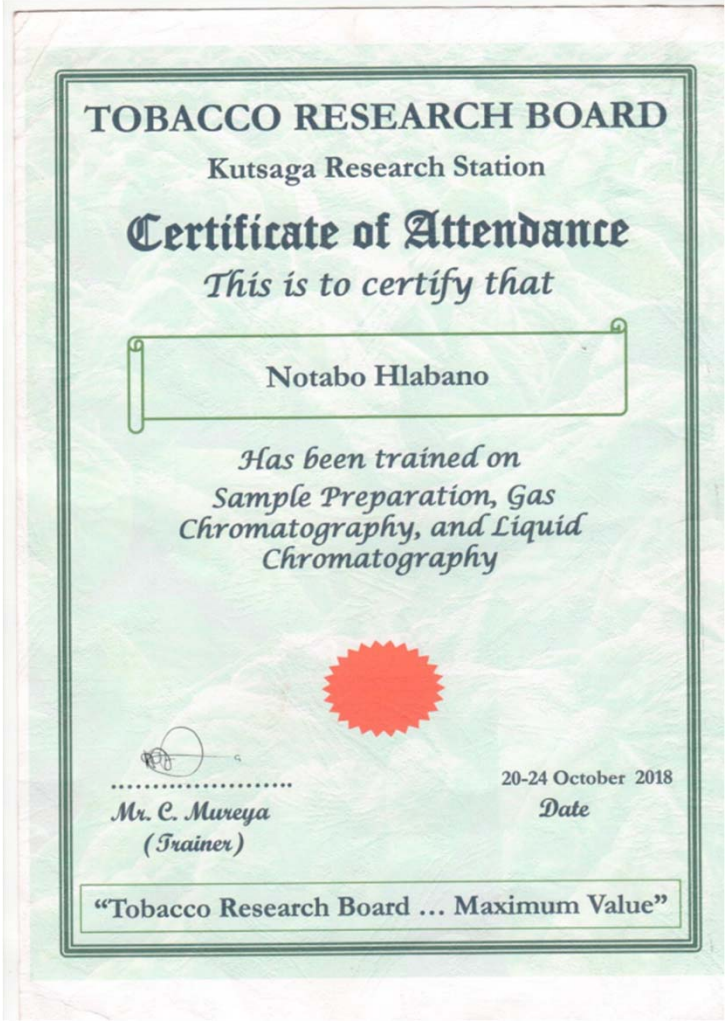


Progress made

- Full registration
  - Process follows initial registration
  - Assessed and then approved by academic board
- Preparation for Experimentation
  - Trained in using the HPLC and GC
  - Collected chrome tanned leather shavings
  - Collected and dried Azanza garckeana

Results so far attained

- Initial assessment of tanneries to ascertain the disposal of chrome tanned leather solid waste - conducted. – **paper underway**
- Received training on use of HPLC and GC



TOBACCO RESEARCH BOARD

Kutsaga Research Station

Certificate of Attendance

This is to certify that

Notabo Hlabano

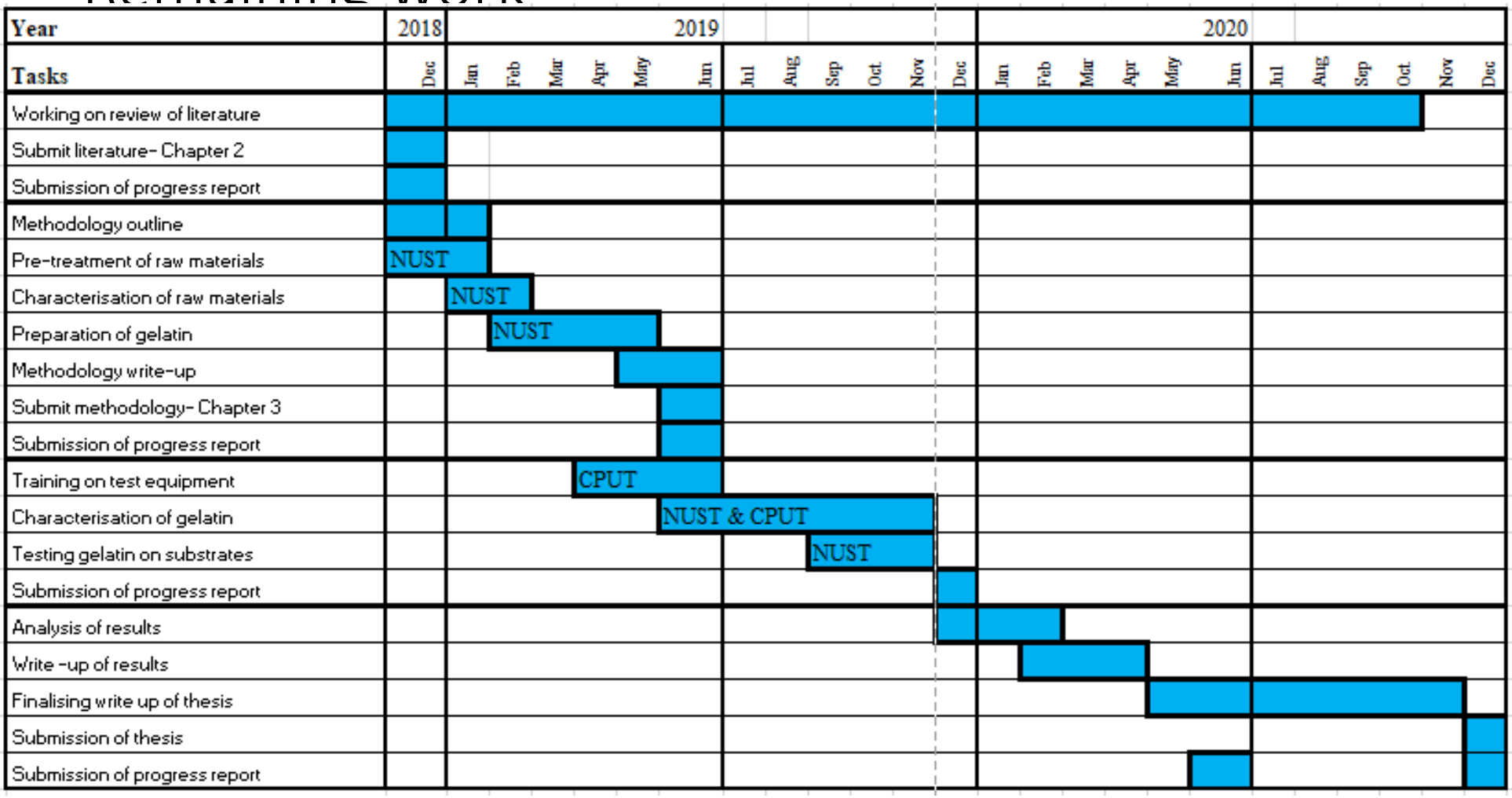
Has been trained on
Sample Preparation, Gas Chromatography, and Liquid Chromatography

.....
Mr. C. Mureya
(Trainer)

20-24 October 2018
Date

"Tobacco Research Board … Maximum Value"

Remaining work



Remaining work

- Resources
  - Financial Resources
    - Purchase of laboratory-size grinder, portable gelatin reactor, whatman or mechanical bag filter, fine sieve (1mm pore size) and a portable pH meter - NUST
    - Funding from COMESA/ALLPI
  - Infrastructural Resources
    - Experimentation at Cape Peninsula University of Technology in South Africa
      - Differential Scanning Calorimetry (DSC)
      - Scanning Electron Microscopy (SEM)
      - Texture Analyser
      - Rheometer

Methodology

01

Preparation of raw materials

- Collection, grinding and pretreatment of Chrome Tanned Leather Solid waste (CTLS)
- Alkaline hydrolysis of CTLS to eliminate Chromium ions and inorganic salts
- Collection, drying and grinding of Azanza garckeana fruit
- Extraction of polyphenolic compounds from Azanza garckeana using soxhlet solvent extraction method

02

Characterisation of raw materials

- Determination of residual chromium, pH, ash content and collagen yield in CTLS
- Determination of polyphenols present in Azanza garckeana

03

Synthesis of a polyphenol cross-linked gelatin resin

[4, 6-8,18-21]

Characterisation

Table 3: Characterisation of gelatin resin

Technique	Property and Method
Atomic Absorption Spectroscopy (AAS)	*To determine the chromium content (ASTM E363-16)*
UV-Visible spectroscopy (UV-Vis)	To assess the nature and quantity of amino acid in gelatin (Sarbon et al., 2015)
High Performance Liquid Chromatography (HPLC)	To determine polyphenolic compounds found in A. garckeana fruit extract (Michael et al., 2015)
Differential Scanning Calorimetry (DSC)	To investigate thermal stability and degradation of gelatin resin (ASTM E2550-17)
Scanning Electron Microscope (SEM)	*To study surface morphology, size and shape of cross-linked gelatin polymer (ASTM F2603-06)*
Texture Analyser	To test the gel strength of gelatin resin (ASTM D903-98)
Rheometer	To measure viscoelasticity (ASTM D4212-99)

Characterisation (continued)

- **Crude gelatin yield**

The yield will be calculated as the percentage of leather material converted to gelatin and will be calculated according to equation 1:

$$Yield\ (\%) = 100\ (1 - \frac{Wres}{Wshav}) \qquad (1)$$

Where;

W_{res} is the residual weight of gelatin after filtration and/or centrifugation,

and W_{shav} is the initial weight of shavings.

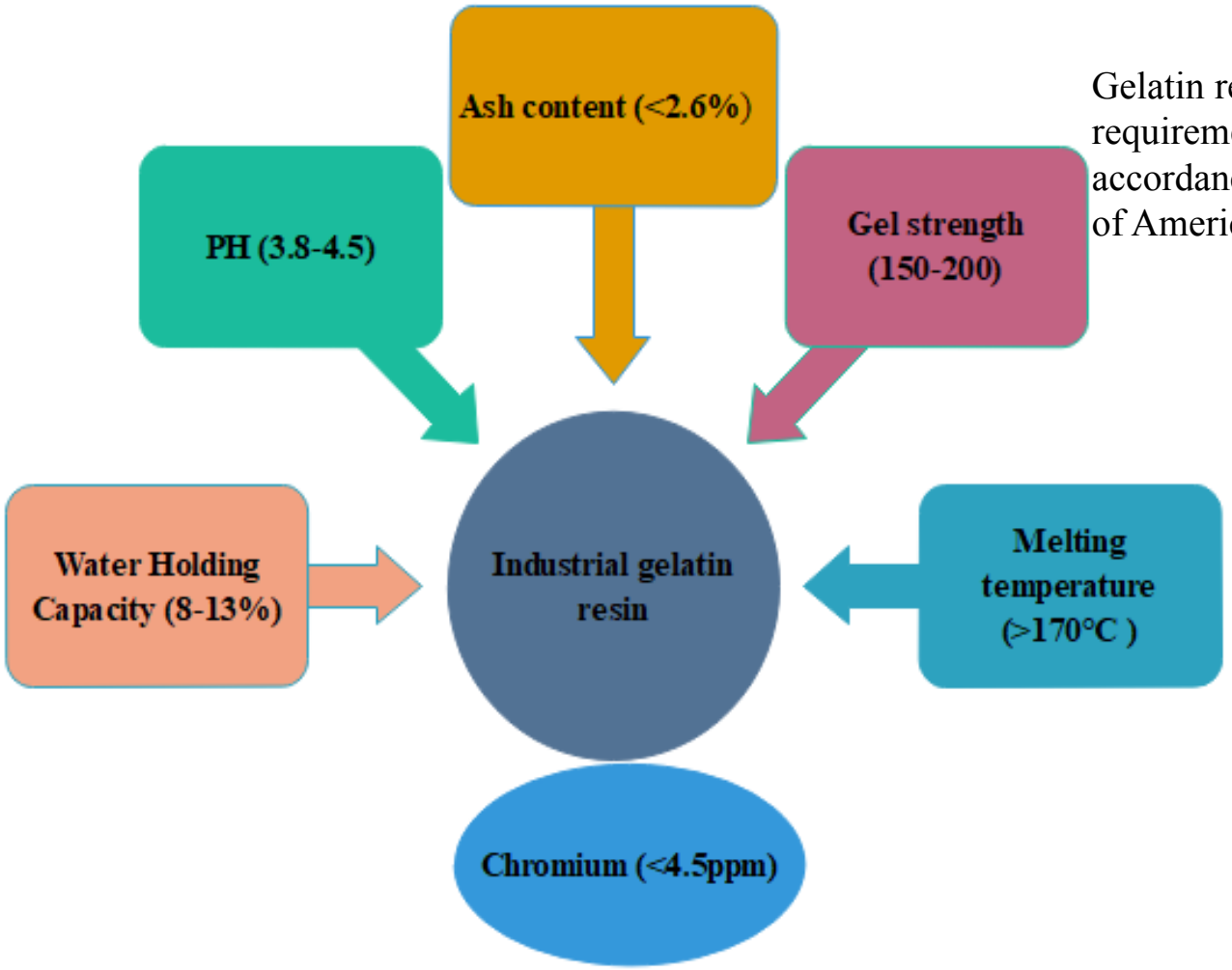
- **PH**

To be measured using a pH meter

- **Water Holding Capacity (WHC)**

To measure water absorption, ASTM D5229 standard will be used.

Expected outcomes



Gelatin resin that meets the minimum property requirements of industrial gelatin resin (in accordance to Gelatin Manufacturers Institute of America standards).

Fig 8: Minimum property requirements of commercial gelatin resin [5]

OTHER Papers awaiting publication

1. Needs Assessment in Value Addition of Hides and Skins in Matabeleland – ZJST
2. Membrane Technology in Tannery Wastewater management – A REVIEW – Water SA
3. Quantification of Solid Leather Waste and Recycling Strategies adopted by the Zimbabwe Leather Industry - ZJST

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The end

Thank You!!!!!!!!!!