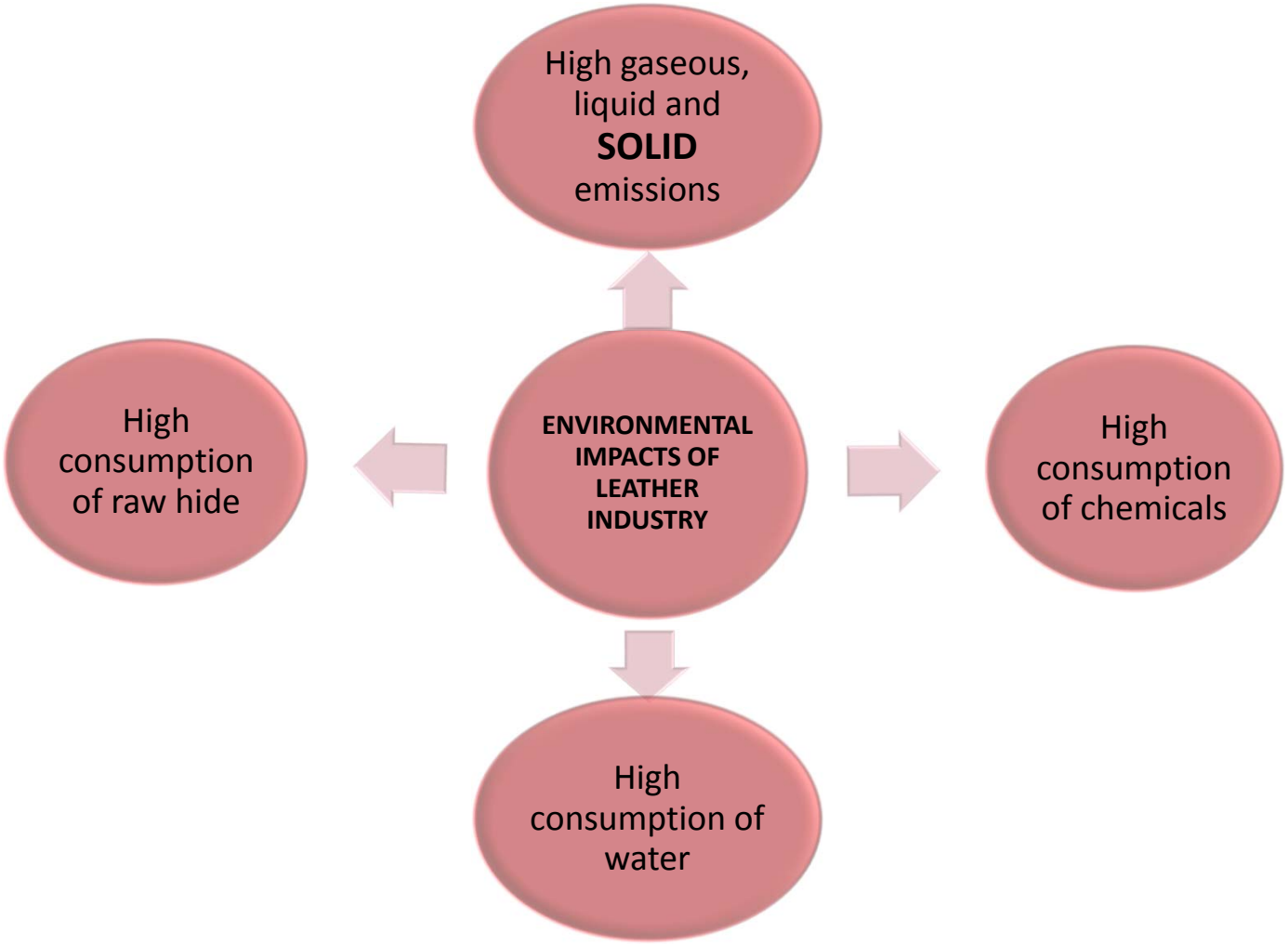
Preparation and Characterisation of a Leather Composite Board from a Mixture of Chrome Tanned Leather Waste and Cyperus Textilis Fibres

Student: Sithabisiwe Gadlula

Introduction

- Tanning processes [1-8,15];
- Environmental impacts of chrome tanned solid waste [2,3,7,16];
- Leather boards [5,6,15,18,19];
- Cyperus textilis [14]
- Natural rubber latex [5,6,21,22]

Background



[1-8,15]

Research question

- How can Chrome tanned leather waste, Cyperus textilis fibres and Natural rubber latex be used to produce a high strength leather composite board?

Proposed research work-plan

Year	2018												2019												2020					
Tasks	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
Proposal writing and submission																														
Submission of progress report																														
Tannery assessment and collection of leather waste																														
Data collection using questionnaires																														
Review of literature																														
Training on use of equipment																														
Collection and preparation of cyperus textilis fibres																														
Preparation of leather waste for experimentation																														
Submission of literature review																														
Submission of progress report																														
Methodology outline																														
Characterisation of raw materials																														
Fabrication of leatherboards																														
Characterisation of leatherboards																														
Methodology write-up																														
Submission of progress report																														
Analysis of results and discussion																														
Final thesis write-up																														
Submission of thesis																														
Submission of final progress report																														

Key:

Completed tasks

Work still to be done

Work in progress

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

Results So Far Attained

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

TOBACCO RESEARCH BOARD

Kutsaga Research Station

Certificate of Attendance

This is to certify that

Sithabisiwe Gadlula

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"

Results : publication of prior work

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Peer Reviewed Journal
Research Article

Development and Characterisation of a Nano-composite Membrane Using Polyethersulphone and Graphene Oxide-Magnetite Nanoparticles for Rejection of Chromium Hexavalent Ions from Tannery Wastewater

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Abstract

Polyethersulphone (PES) polymer blended with Graphene Oxide (GO) and magnetite (nano-composite was synthesized using an immersion precipitation process for the filtration of chromium hexavalent ions from leather processing waste water. PES is a synthetic polymer with good chemical resistance, wide pH range (2-13) as well as good mechanical and thermal properties. However, it is hydrophobic and prone to fouling hence its limitations in aqueous separation processes. In order to improve hydrophilicity, porosity, permeability and strength properties of the polymeric membrane, GO was synthesized from coal via a modified Hummers Method and then blended with anhydrous ferrous chloride to form Graphene oxide/ magnetite () hybrid nano-particles. To assess the performance of the membrane pure water flux, Equilibrium Water Content (EWC) and tensile strength test was measured. Structural analysis involved porosity measurement. The filtration efficiency of the membranes was found by testing the waste water for chromium ion concentration before and after filtration. It was established that both the physical properties and chromium ion rejection improved with increase in polymer concentration and addition of hybrid nano-particles.

Keywords: Polyethersulphone, Graphene-magnetite nanoparticles, Nano-composite membrane

Introduction

Increasing demand for and shortage of clean water as a result of rapid urbanization, population growth, misuse, and climate disruption have become unprecedented urgent global issues. The increased concern about global environment pollution problems has resulted in the continuous expansion in finding new approaches to dealing with heavy metal ions (1–5). Different from the organic components, heavy metallic ions are toxic, not degradable and have an infinite lifetime, thus they may be accumulated in living tissues, causing various diseases and environmental problems. Among these various kinds of metals, chromium is considered to be one of the most toxic (2–7).

Chromium is a heavy metal, naturally found in rocks and

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Remaining Work

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Tasks	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	April	May	Jun
Review of literature																				
Collection and preparation of cyperus textilis fibres																				
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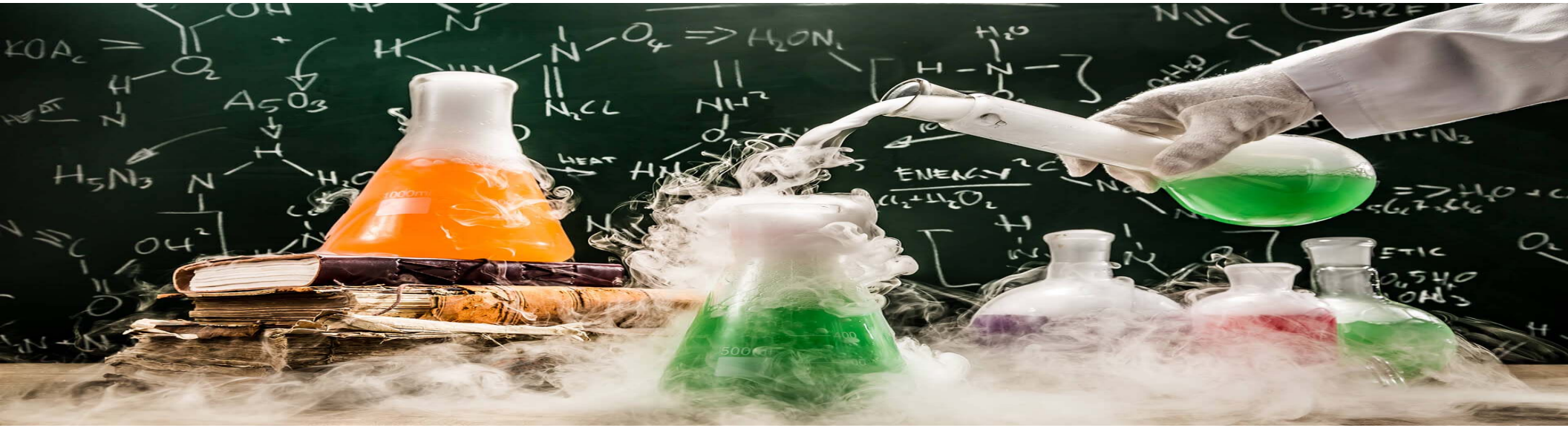
Submission of final progress report																				

Remaining Work

- Resources
  - Financial Resources
    - Purchase of laboratory-size grinder, pH meter and other needed equipment to use for experimentation - NUST
    - Funding from COMESA/ALLPI
  - Infrastructural Resources
    - Experimentation at Cape Peninsula University of Technology in South Africa
      - Thermogravimetric Analysis
      - Scanning Electron Microscopy

METHODOLOGY



Collection and preparation of raw materials

- Collection of Chrome tanned leather waste (CTLW) - DONE
- Collection of Cyperus textilis (CT) - DONE
- Chemical treatment of raw materials [13]
  - Alkaline treatment for both CT and CTLW. This pre-treatment enhances the binding efficiency of the leather waste and the matrix and the resultant high interfacial binding reduces chromium leaching

Characterisation of raw materials

- Characterisation of chrome tanned leather shavings
- Characterisation of Cyperus textilis fibres [12]

Fabrication of leather boards [6].

Characterisation of leather composite

- Mechanical properties, biodegradability, water absorption, thermal properties, morphology

Characterisation of Leather-Composite Boards

TECHNIQUE	PROPERTY
UV-Vis Spectrophotometry	*To determine total chromium content*
Mechanical Tests	To determine tensile strength, elongation and tearing strength
Thermogravimetric Analysis (TGA)	To analyse thermal stability of composite boards
Scanning Electron Microscope (SEM)	*To examine surface morphology and fibre-matrix adhesion in composite board samples*
Bio-degradability Test (Sabouraud Dextrose Agar medium)	To assess the biodegradability of composite boards
Water Absorption Tests	

Expected outcomes

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