



# FEDERAL UNIVERSITY OF BAHIA, BRAZIL POLYTECHNIC SCHOOL

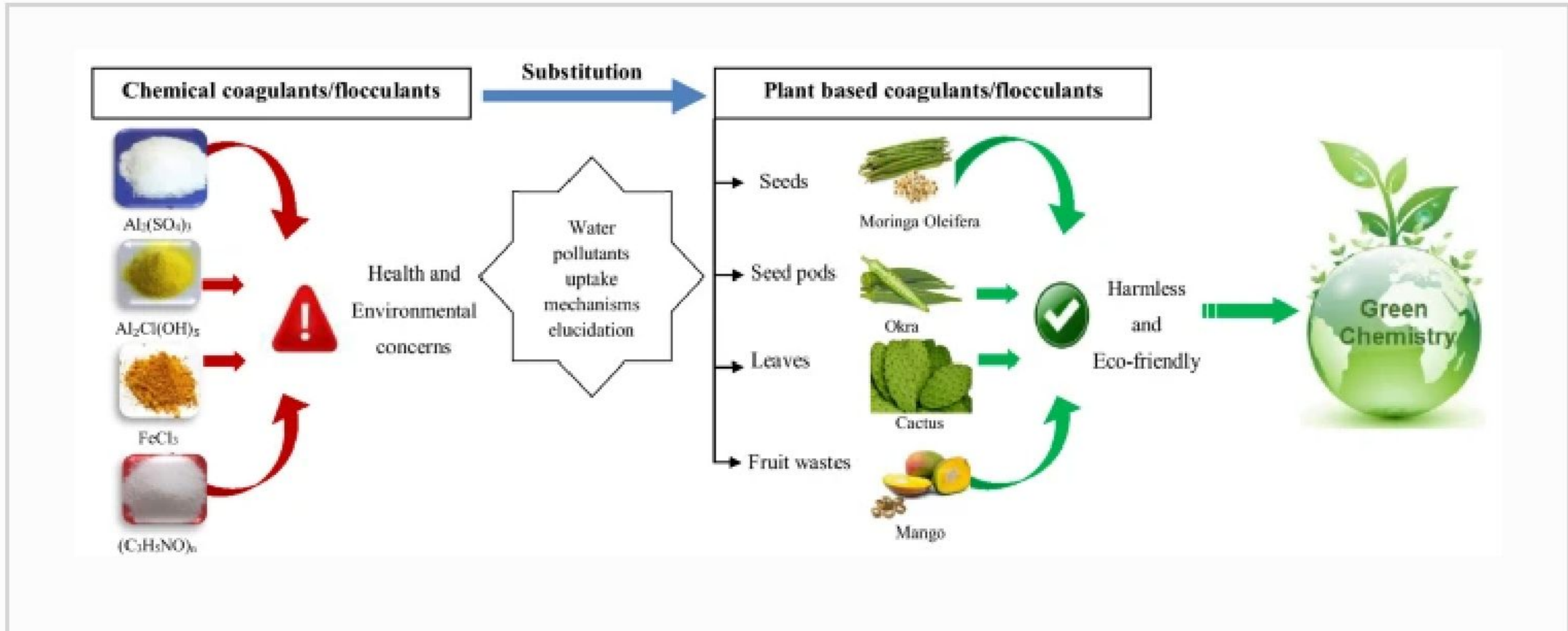


## Synthesis of natural coagulant from *Anacardium occidentale* and application to remove metallic pollutants from water

Authors: Thaíse S. Borges, Luciano M. Queiroz, Sérgio L. C. Ferreira, Nádia M. José



# OVERVIEW



Othmani et al., 2020

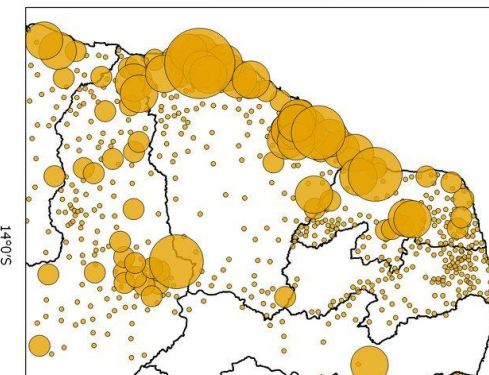
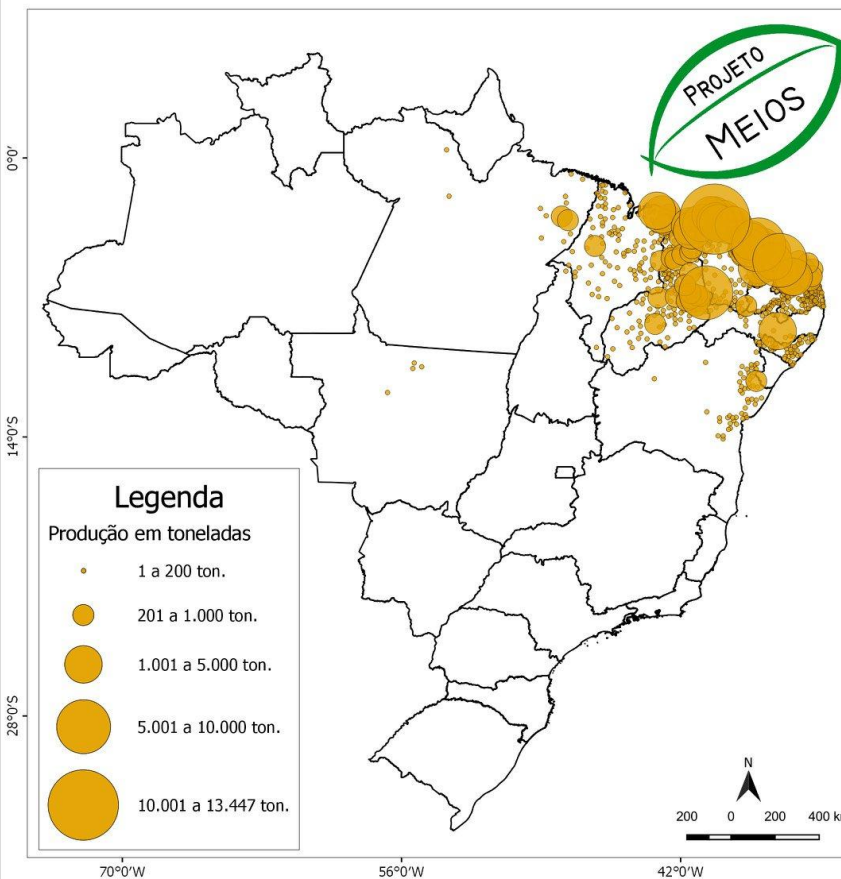
**Natural and Bio-based Coagulants and Flocculants**

# OVERVIEW

## *Anacardium occidentale* in Brazil



Brasil  
Produção de castanha de caju em toneladas. 2018



### Principais Produtores

Ceará	83.019 ton.
Piauí	25.179 ton.
Rio Grande do Norte	18.265 ton.

Organização: Projeto Meios - projetomeios@gmail.com  
Sistema de coordenadas geográficas / datum SIRGAS 2000  
Fonte: IBGE - Instituto Brasileiro de Geografia e Estatística  
PAM - Produção Agrícola Municipal (2018)

# OBJECTIVE



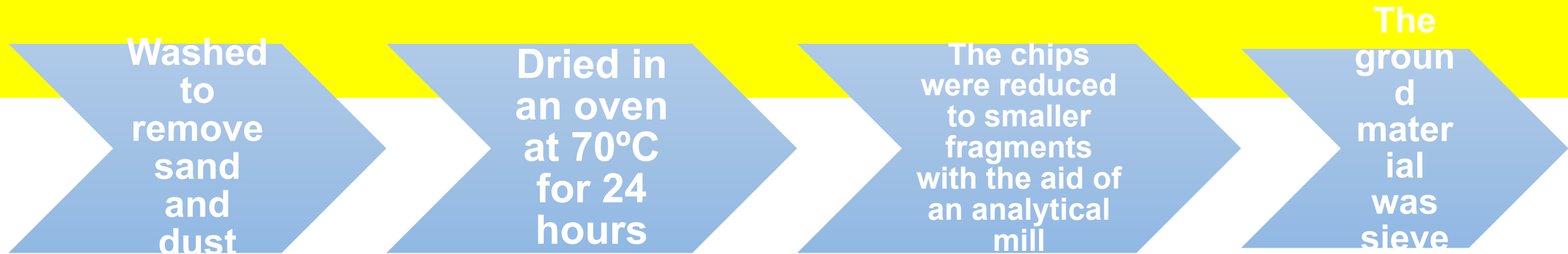
The aim of this study is to present the process of synthesizing and obtaining a natural coagulant from tannins extracted from the *Anacardium occidentale* bark and the results of its use to remove metallic species from water.

The raw material was the bark of the *Anacardium occidentale*

**GOAL** 

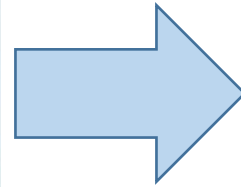
# Methodology

The chips were removed from the bark of the *Anacardium occidentale* between 25 cm from the base and 1.30 m high carefully in order to not to reach the vascular cambium



The fraction that passed through the 1.00 mm sieve (16 mesh) and which was retained in the 0.25 mm sieve (60 mesh) was selected. The powder obtained was stored in a desiccator avoiding moisture and protected from the light.

# Methodology



**Raw Material**

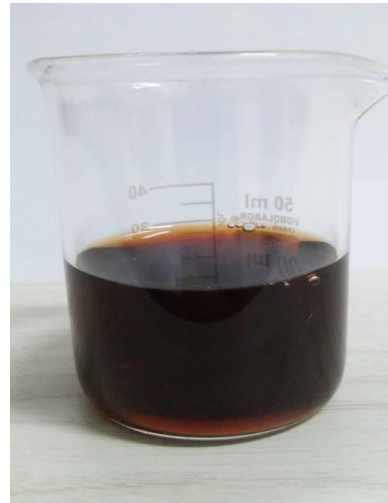
Scanning Electron  
Microscopy

Fourier transform  
infrared spectroscopy

TGA/DTG

Differential Scanning  
Calorimetry (DSC)



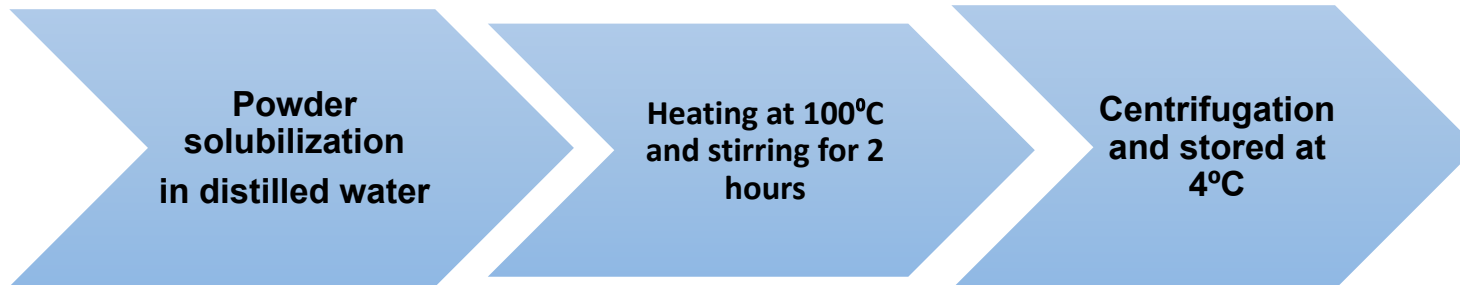


**2 Extractions**



**2 g of PCAO produced  
25 mL of extract with  
*Anacardium  
occidentale* tannins  
(EAOT).**

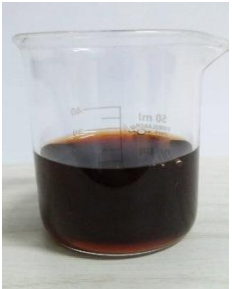
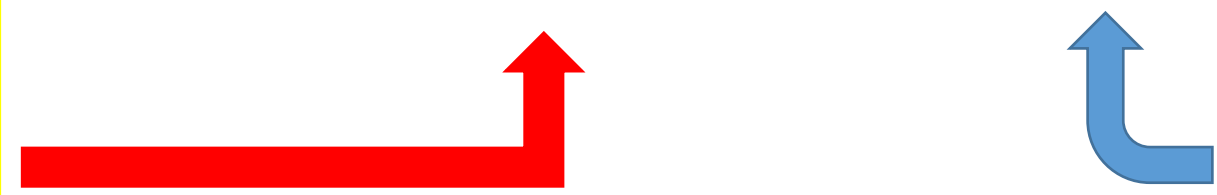
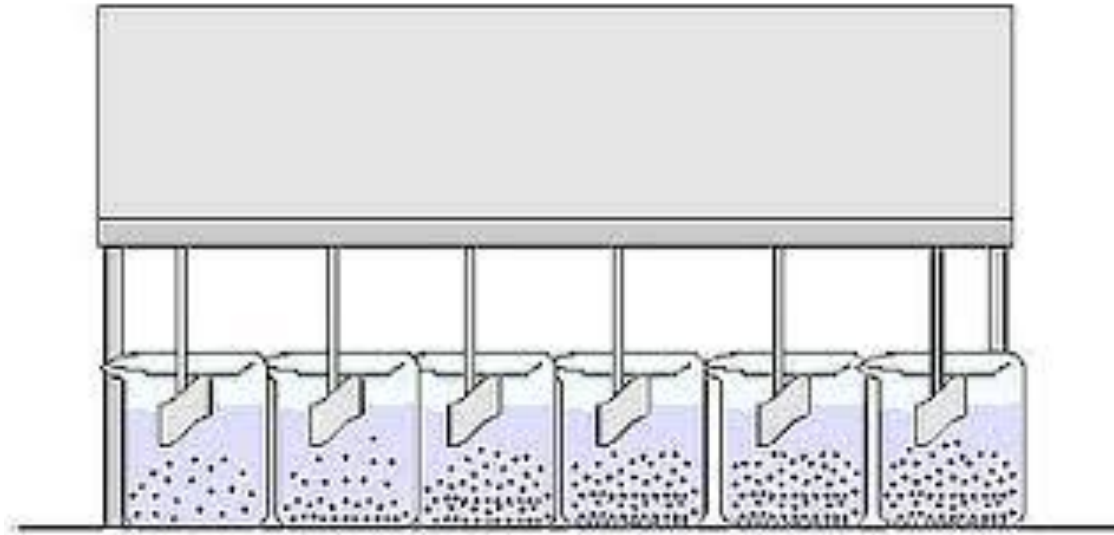
## Tannin Extraction



# Methodology

## Tests for the removal of metals from water

**Synthetic Water (18.2 MΩcm)+**  
**Barium**  
**Cadmium**  
**Chromium**  
**Copper**  
**Manganese**  
**Lead**  
**Strontium**  
**Zinc**  
**Concentration = 4.0 mol.L<sup>-1</sup>**

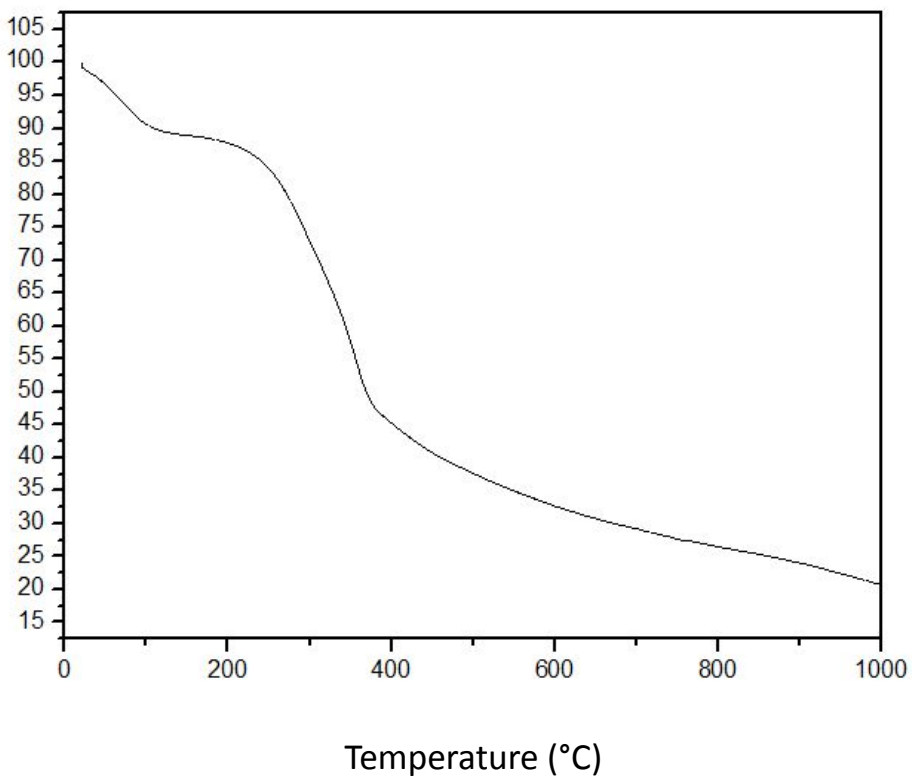


**Dosages of tannin extracts 0.5; 1.0; 2.0; 3.0; 4.0 and 5.0 mL**

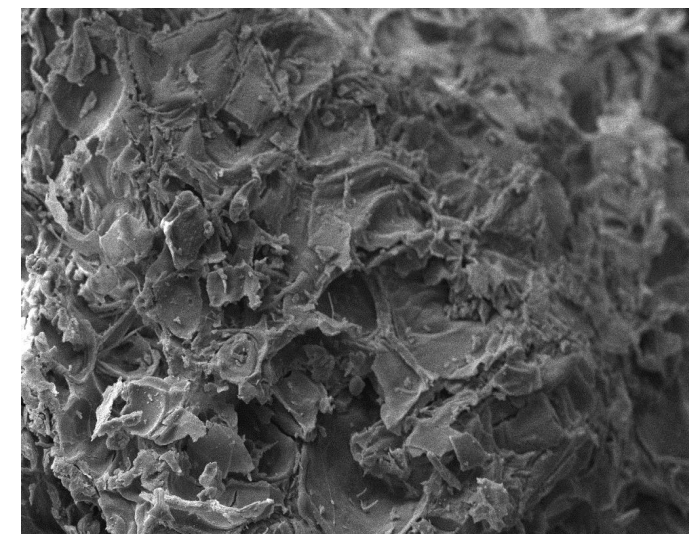
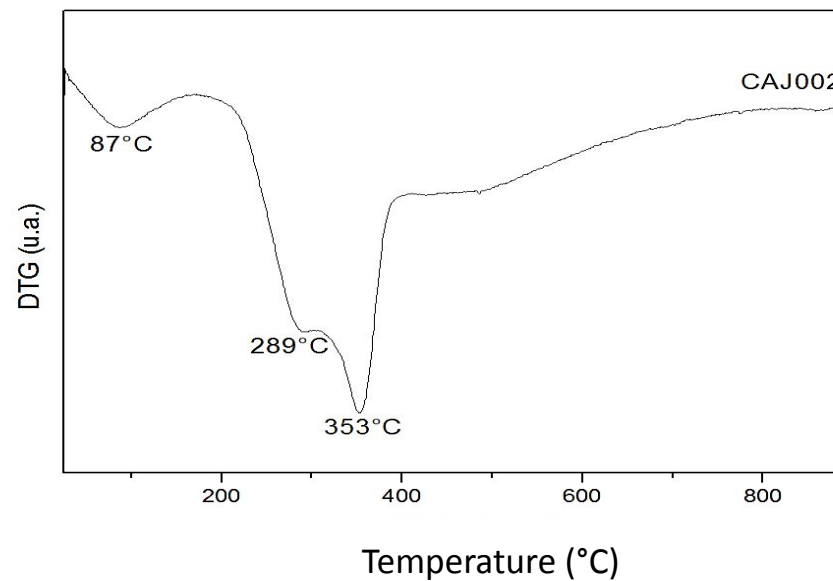


## Raw Material

TG



Lignin (%)	Cellulose (%)	Hemicellulose (%)
43.1	27.2	9.6



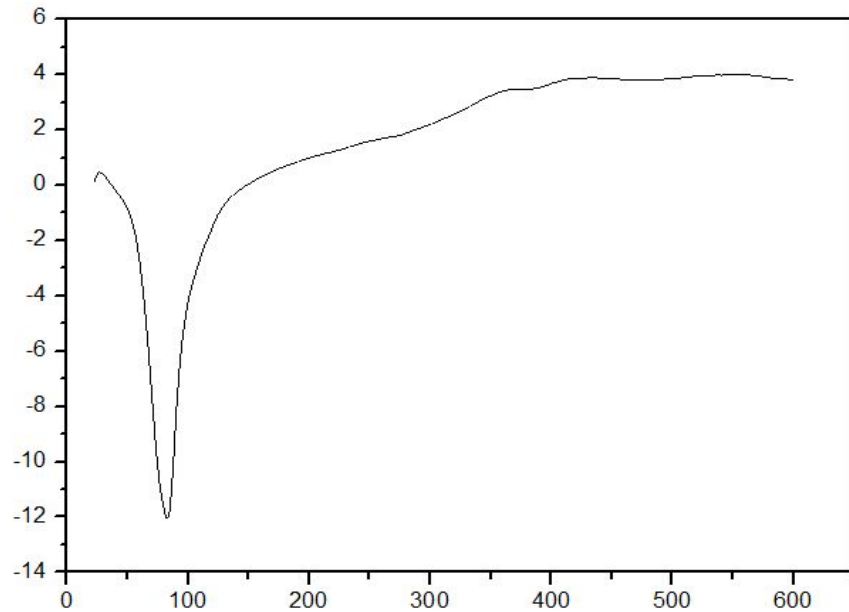
SEM

# Results

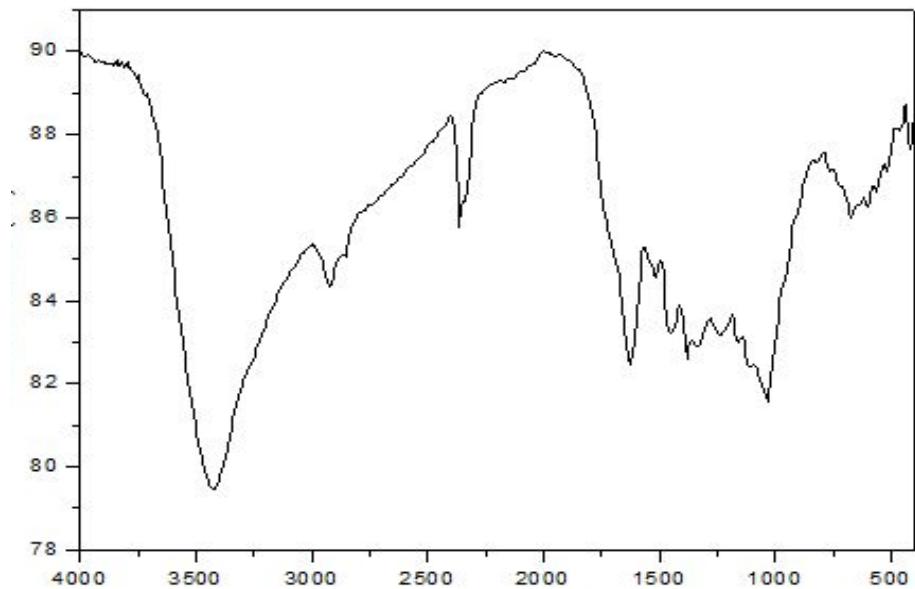
## Raw Material



DSC



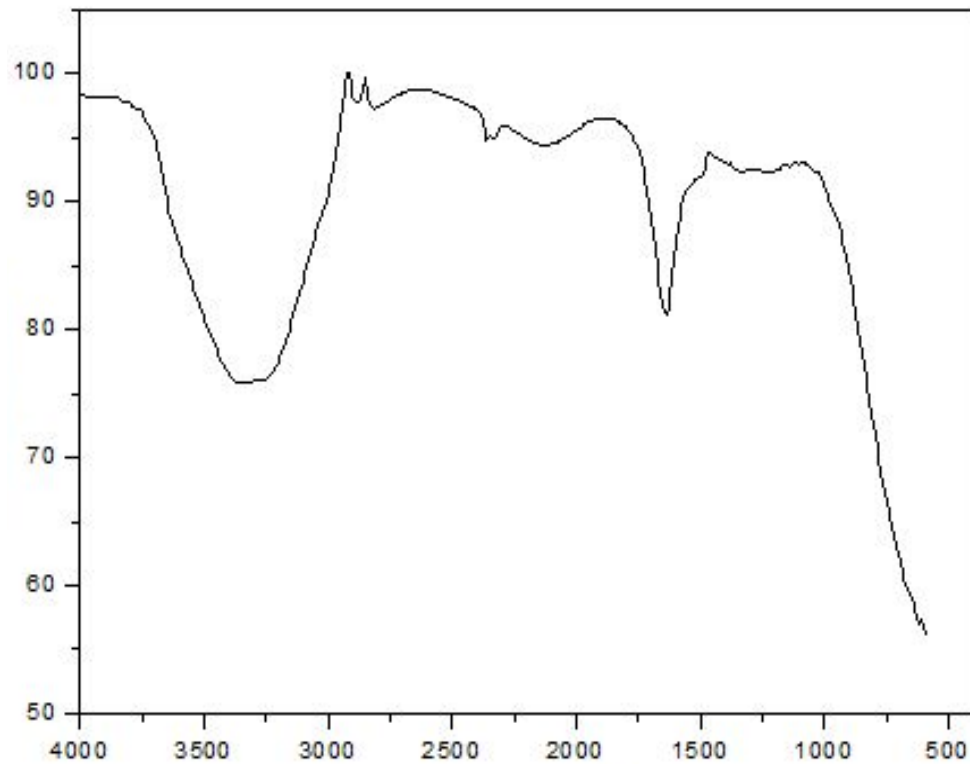
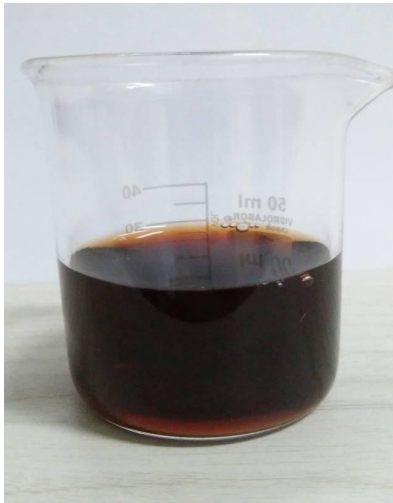
FTIR



# Results

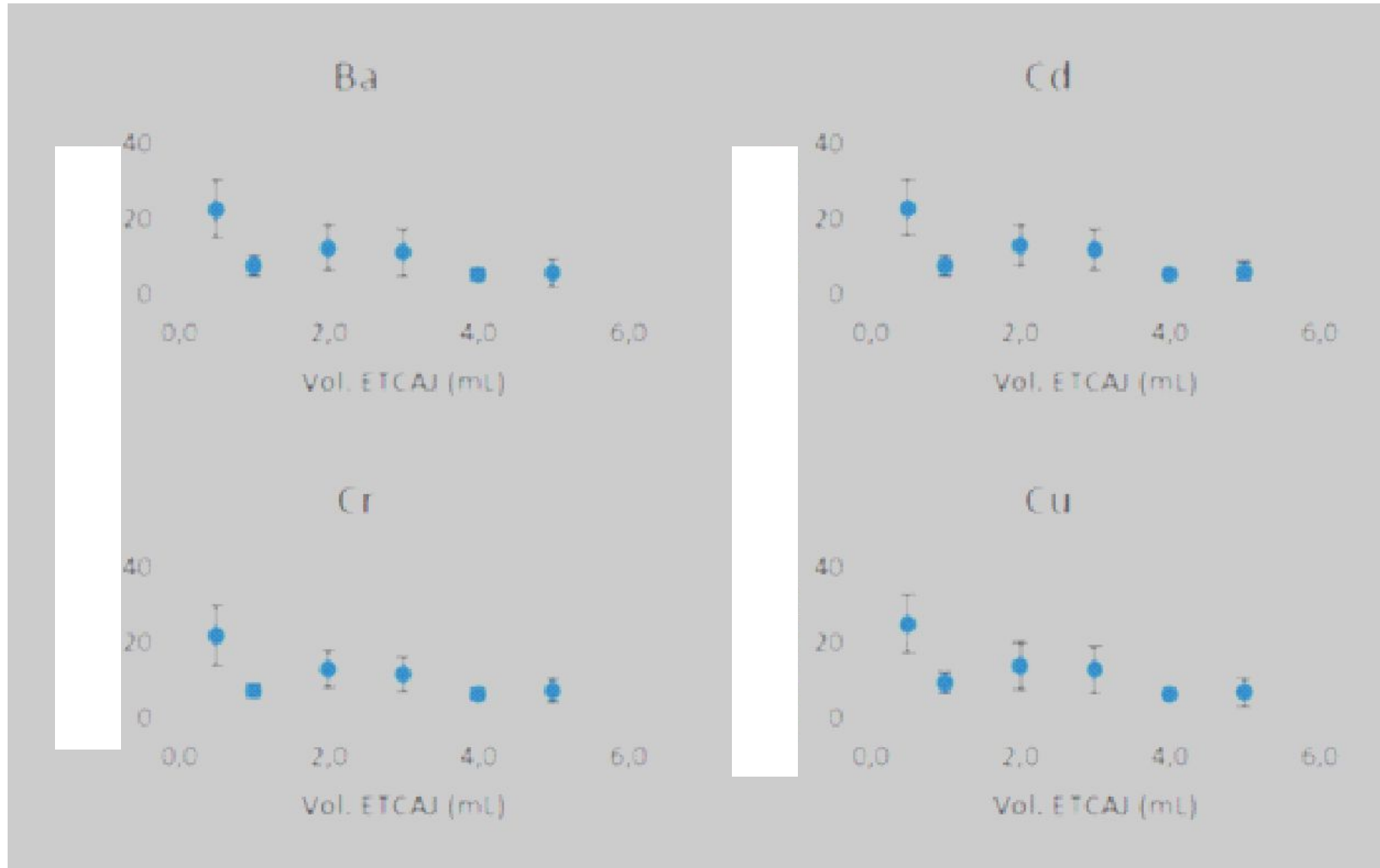
## Tannins Extract

The EAOT density was approximately equal to  $1.0 \text{ g.cm}^{-3}$ .

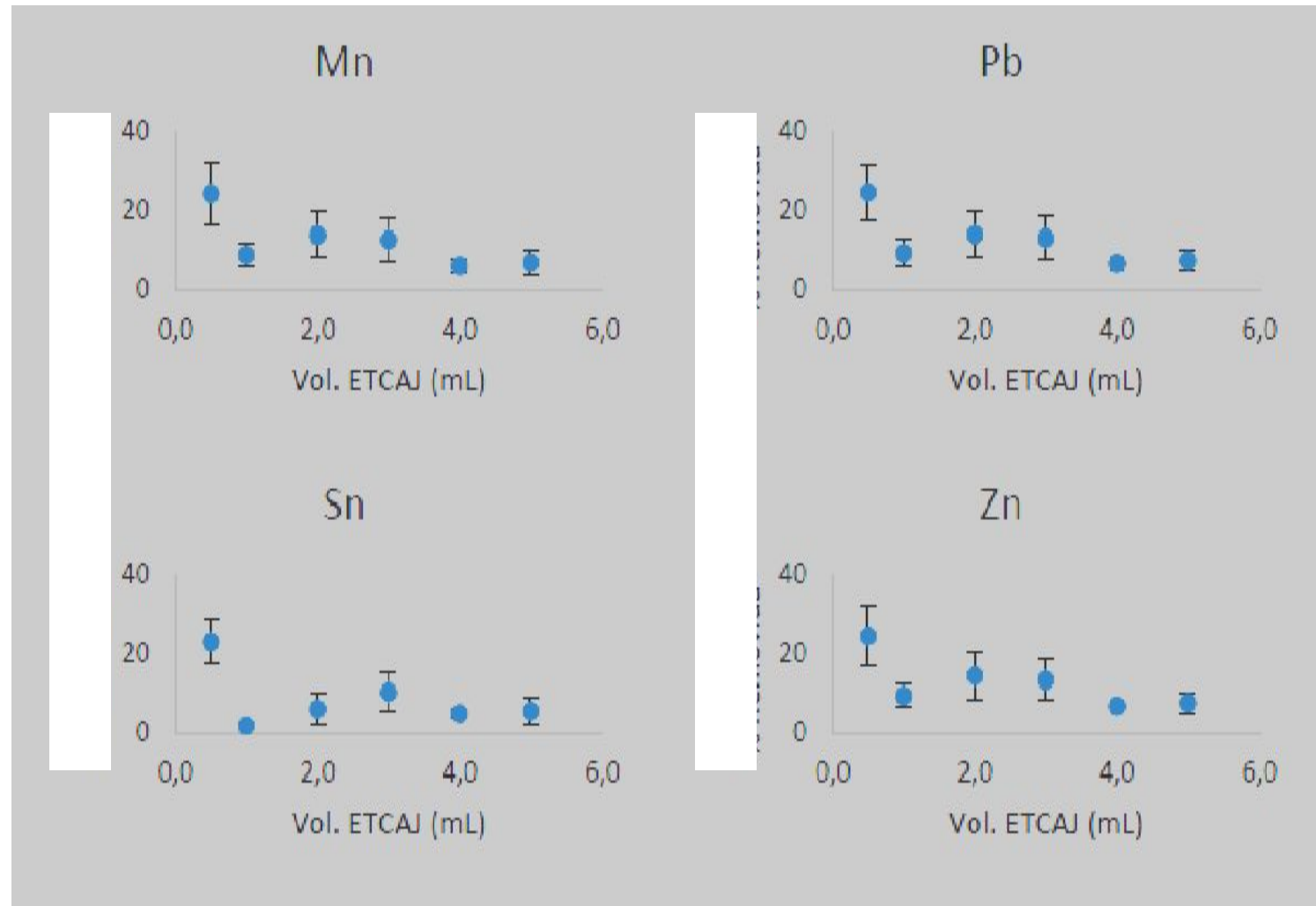


Analyte	Concentration mg.L-1
Ba	< Limit of detection
Cd	< Limit of detection
Cr	< Limit of detection
Cu	0.045 +/- 0.008
Mn	0.0209 +/- 0.0002
Pb	0.014 +/- 0.004
Sn	0.07 +/- 0.01
Zn	0.010 +/- 0.005

# Results



# Results



# Conclusions

- The preliminary tests revealed removal efficiencies of metallic species ranged between 2 and 25%. Among the investigated metals, the one that presented the lowest affinity with EAOT was Sn and Cu presented the highest affinity.
- Probably one of the problems with tannins in aqueous matrices is their solubility. Therefore, for use in industrial water treatment, tannins must be insolubilized/immobilized.

# Next Steps

- Obtain the removal efficiencies of metallic species by varying the pH x dosage pair.
- Investigate the possibility of immobilization of tannins in a vegetable fiber to remove metallic species



# References

Amante, B.; López-Grimau, V.; Smith, T. (2016) Valuation of oil extraction residue from *Moringa oleifera* seeds for water purification in Burkina Faso. *Desalination and Water Treatment*, v. 57 (6), p. 2743-2749 doi:[10.1080/19443994.2015.1047408](https://doi.org/10.1080/19443994.2015.1047408).

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<https://doi.org/10.1007/s10098-020-01858-3>





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**Thank You!!**

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