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# THERMO-RHEOLOGICAL CHARACTERIZATION OF VEGETAL DIELECTRIC NANOFLUIDS DOPED WITH $TiO_2$ NANOPARTICLES FOR APPLICATION IN POWER TRANSFORMERS

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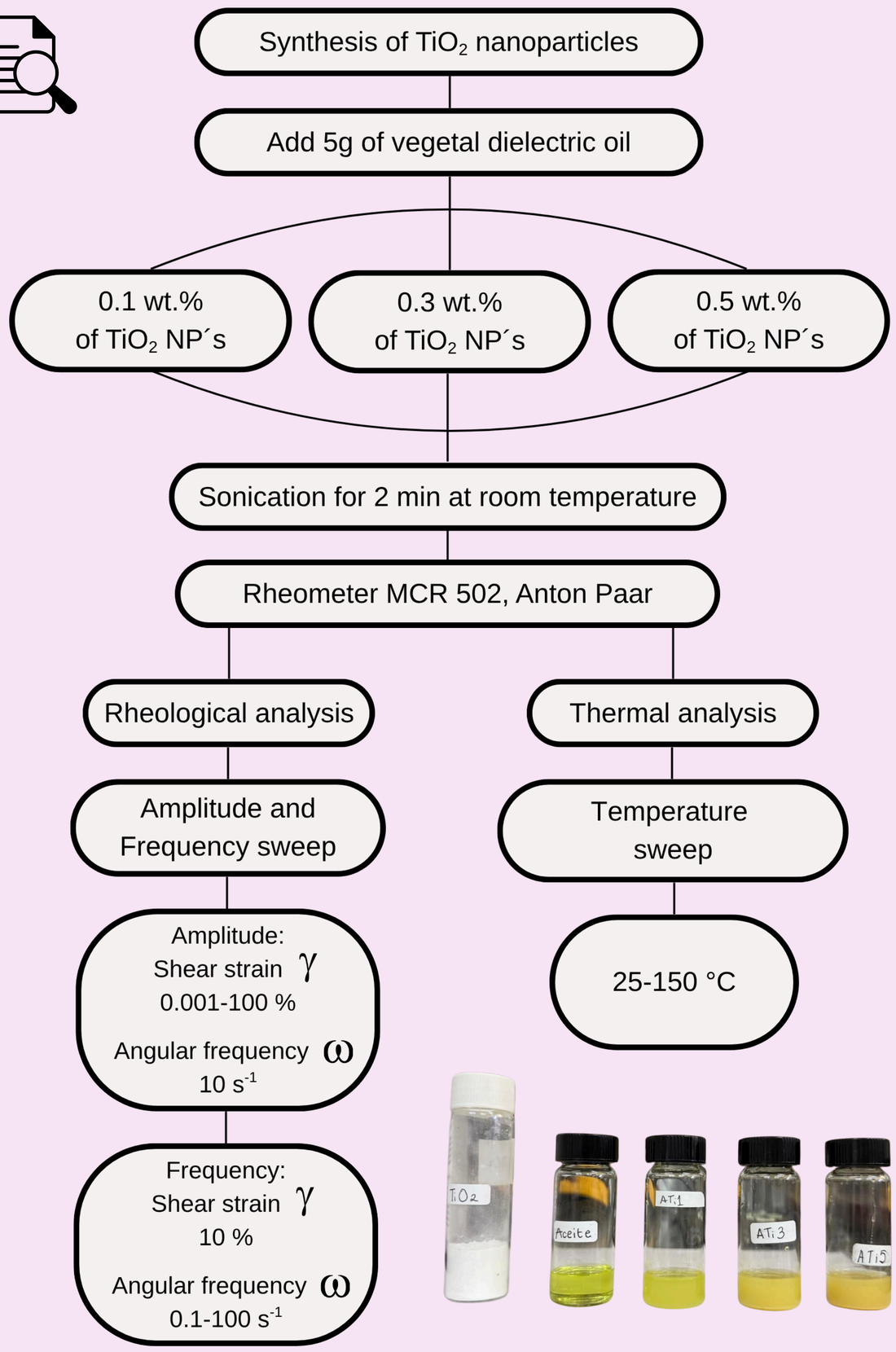
## INTRODUCTION

This study develops dielectric nanofluids based on vegetable oils with 0.1, 0.3 and 0.5 wt.% $TiO_2$ nanoparticles concentrations, aiming to enhance their performance as insulators and thermal dissipators in power transformers. Rheology analysis will guide the suitability of this nanofluids.

## METHODOLOGY




## RESULTS

### RHEOLOGICAL ANALYSIS

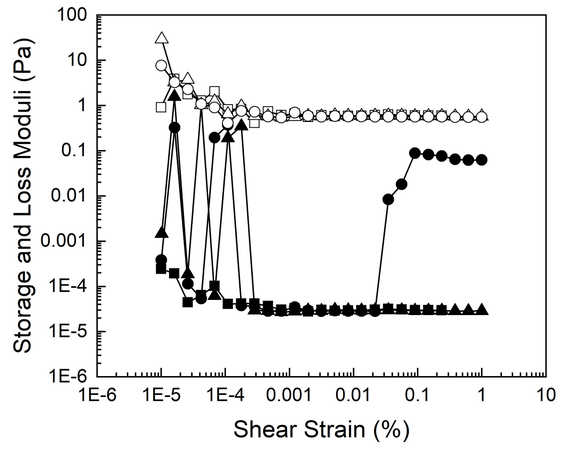
Storage Modulus

0.1 wt.% 0.3 wt.% 0.5 wt.%

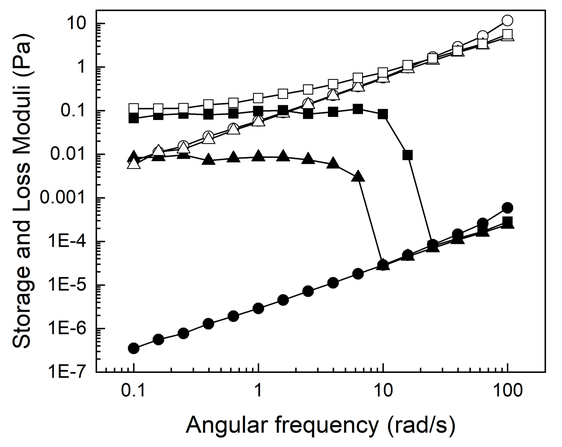
Loss Modulus

0.1 wt.% 0.3 wt.% 0.5 wt.%

#### Amplitude Sweep

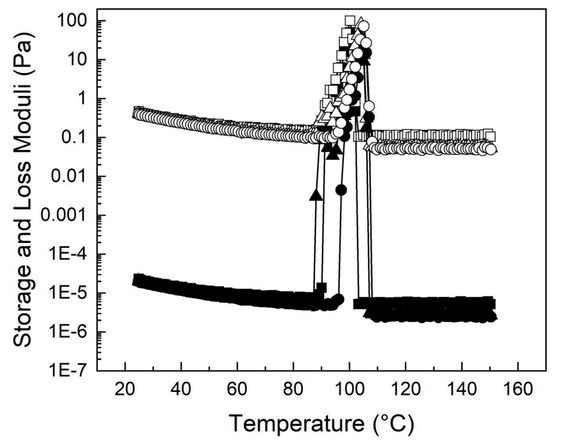



#### Frequency Sweep

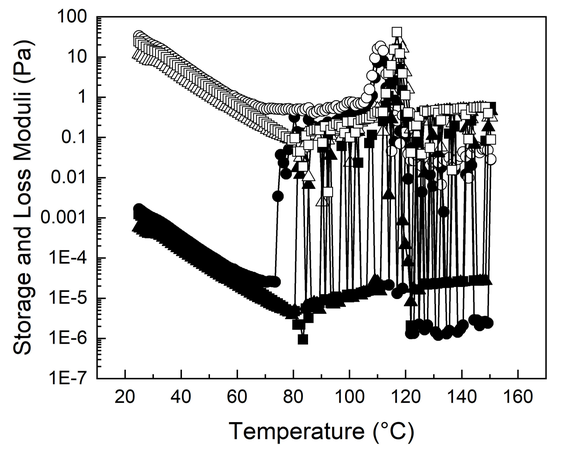



### THERMAL ANALYSIS

#### Amplitude Sweep




#### Frequency Sweep




## CONCLUSIONS

$TiO_2$ nanoparticle concentration was found to influence the rheological and thermal performance of the dielectric oil. Low concentrations (0.1 wt.%) enhanced time-dependent stability and preserved viscous behavior, while higher concentrations (0.3 and 0.5 wt.%) showed signs of agglomeration or sedimentation. A transient viscosity increase at ~80 °C to ~110 °C, attributed to partial evaporation, was followed by stable behavior up to 200 °C, indicating suitability for high-power transformer applications.

## REFERENCES

Siddique, Z. B., Basu, S., & Basak, P. (2021). Dielectric behaviour of natural ester-based mineral oil blend dispersed with $TiO_2$ and ZnO nanoparticles as insulating fluid for transformers. Journal of Molecular Liquids, 339, 116825.

## ACKNOWLEDGMENTS

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