# Novel PLA Nanocomposite Bioplastic For Use In Packaging

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## BACKGROUND

**Plastic packaging** made of traditional plastics pollutes the environment (Rosenboom et al., 2022).

**PLA (polylactic acid)** is a leading biodegradable alternative – but its mechanical/thermal properties are lacking (Gbadeyan et


**Clay nanoparticles** increase strength of plastics (Uddin et al., 2024).

## Purpose

**How do different forms of clay nanoparticles work together to affect the thermal and mechanical properties of polylactic acid?**

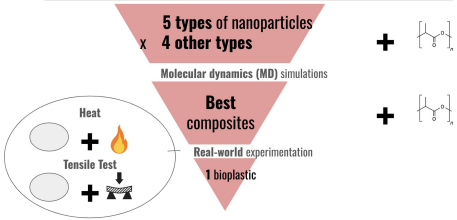
## Hypothesis

**Different types of clay nanoparticles will increase mechanical strength and stiffness, as well as thermal resilience of PLA – beyond that of composites with each individual type and of pure PLA.**

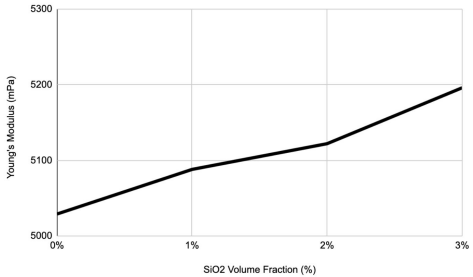
## INNOVATION


- **Molecular dynamics** simulations accurately predict properties of polymers (Nikzad et al., 2024).
- **Can they save time/resources?**

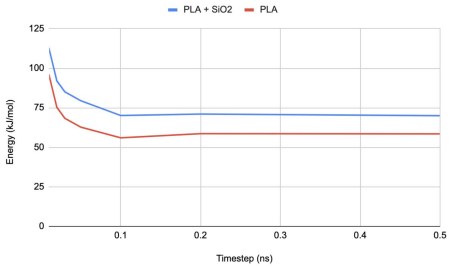
## METHODS




## Figure 1: Effect of volume fraction




## Figure 2: Simulation Equilibrium




## Table 1: Young's Modulus of PLA

| Young's Modulus (mPa) | |
|---|---|
| Experimental (Petsiuk et al., 2022) | Simulated |
| 1550 | 1491 |

## ANALYSIS

**Simulation** reached equilibrium in terms of energy.

**Young's Modulus** of PLA matched values from previous experiments.

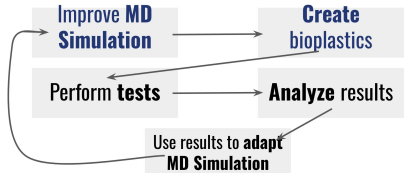
Young's Modulus vs. volume fraction of SiO2 forms a positive **trend**.

## CONCLUSIONS

If the simulation is accurate, silicate nanoparticles may improve Young's Modulus of **PLA**.

Simulation is **grounded** in reality.

## FUTURE STEPS




## IMPORTANT REFERENCES

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