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INTERFACIAL ADHESION AND VISCOELASTIC BEHAVIOR OF VDBD PLASMA-TREATED PINE SEED SHELL REINFORCED POLYESTER COMPOSITES

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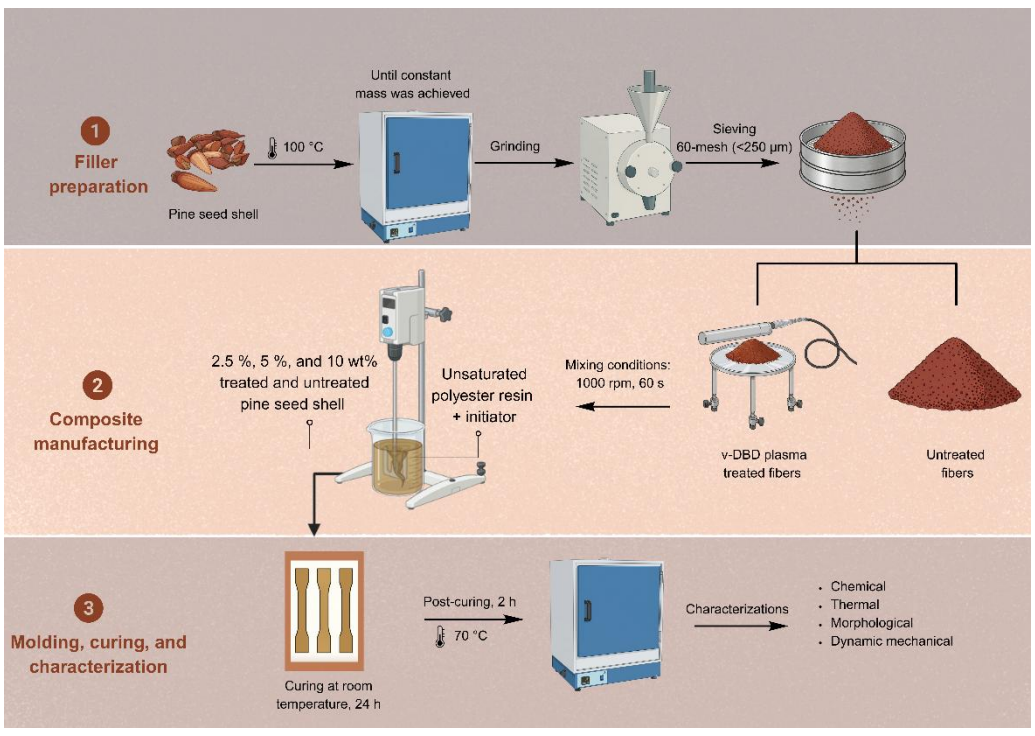
Introduction

The agroforestry residue from the seed shell of *Araucaria angustifolia*, native to southern Brazil, stands out as a promising filler for composite manufacturing. However, as with other natural reinforcements, optimizing the compatibility between the filler and the polymer matrix is essential.

Objectives

This study investigates the compatibilization of pine seed shells as a sustainable reinforcement in unsaturated polyester composites through non-thermal plasma treatment using Volumetric Dielectric Barrier Discharge (VDBD)

Methodology



Results and Discussion

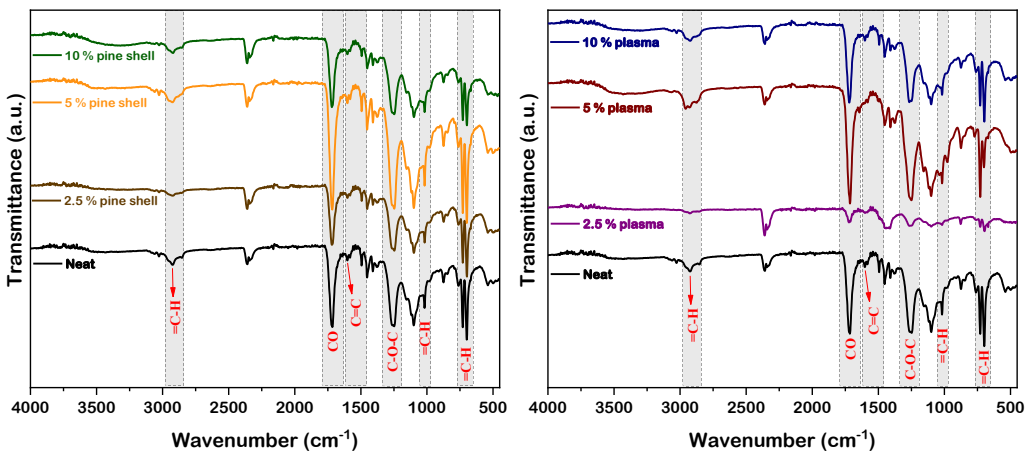
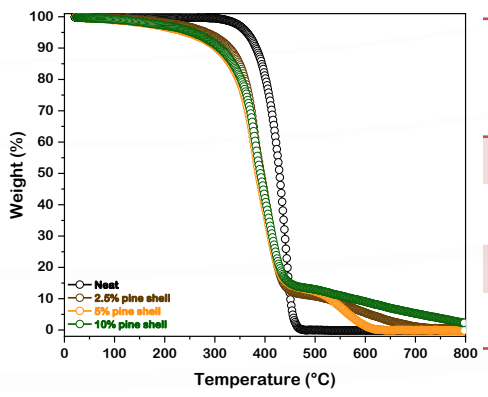


Figure 1. FTIR spectra of the composites with untreated pine shell and composites with plasma-treated pine shell.



Sample	T_{peak} (°C)	Residual (%)
Neat	440	0.018
2.5% pine shell	379	0.440
5% pine shell	379	0.075
10% pine shell	382	2.253

Figure 2. TGA profiles and thermal degradation peak temperatures of neat and composites reinforced with pine shell.

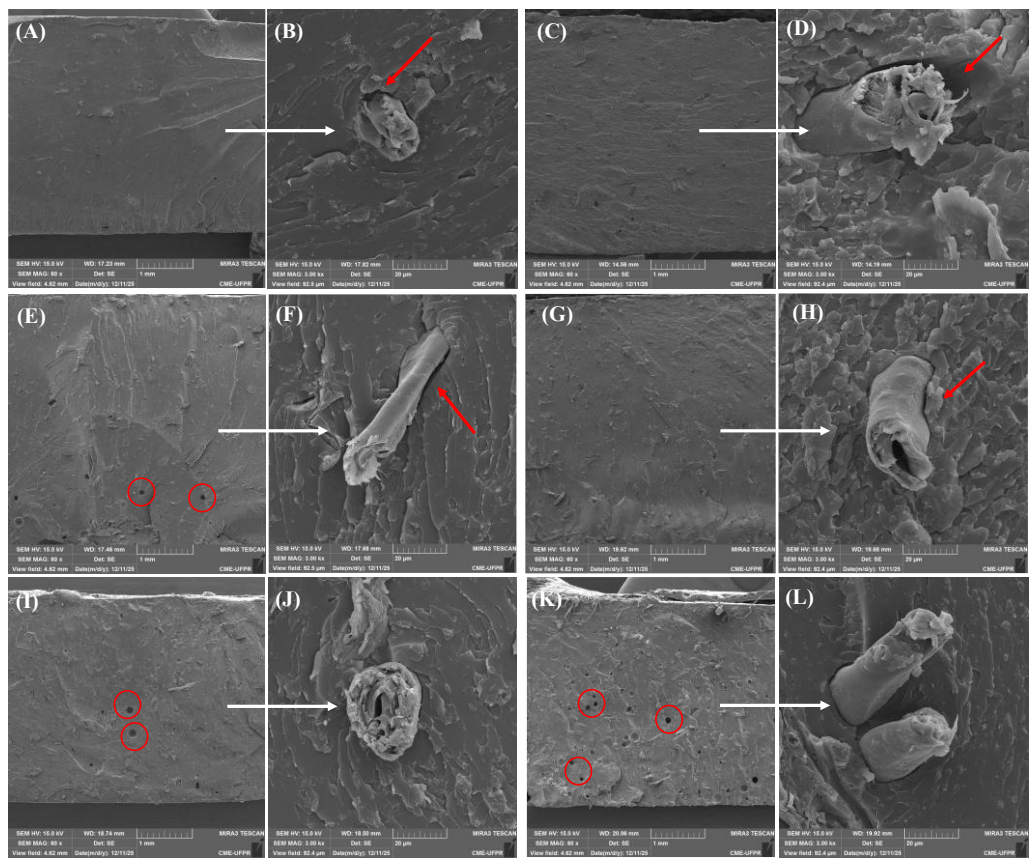


Figure 3. SEM micrographs of the (A), (B) 2.5%, (E), (F) 5%, and (I), (J) 10% untreated, and (C), (D) 2.5%, (G), (H) 5%, and (K), (L) 10% plasma-treated composites.

Table 1 - Dynamic mechanical data for the composites with untreated pine shell and composites with plasma-treated pine shell

Sample	N † (mol.m³)	A ‡	r §	C ¶
Neat	$872_{\times}10^2$	-	-	-
2.5 % pine shell	$740_{\times}10^2$	0.06	-2.31	0.98
5 % pine shell	$770_{\times}10^2$	0.13	-0.95	0.98
10 % pine shell	$940_{\times}10^2$	0.27	-0.51	0.81
2.5% plasma	$750_{\times}10^2$	0.16	-1.65	0.87
5% plasma	$1_{\times}10^3$	0.22	0.70	0.84
10% plasma	$990_{\times}10^2$	0.36	-0.54	0.83

† (N) entanglement density; ‡ (A) adhesion factor; § (r) reiforcement efficiency fator; ¶ (C) effectiveness coefficient

Conclusions

Plasma treatment improved chemical compatibility between the filler and polyester matrix
The 5% plasma-treated composite showed the best reinforcement efficiency (r = 0.70)

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