Development and characterization of new biocomposite based on PTFE, TiO_2 and Luffa cylindrica fibers

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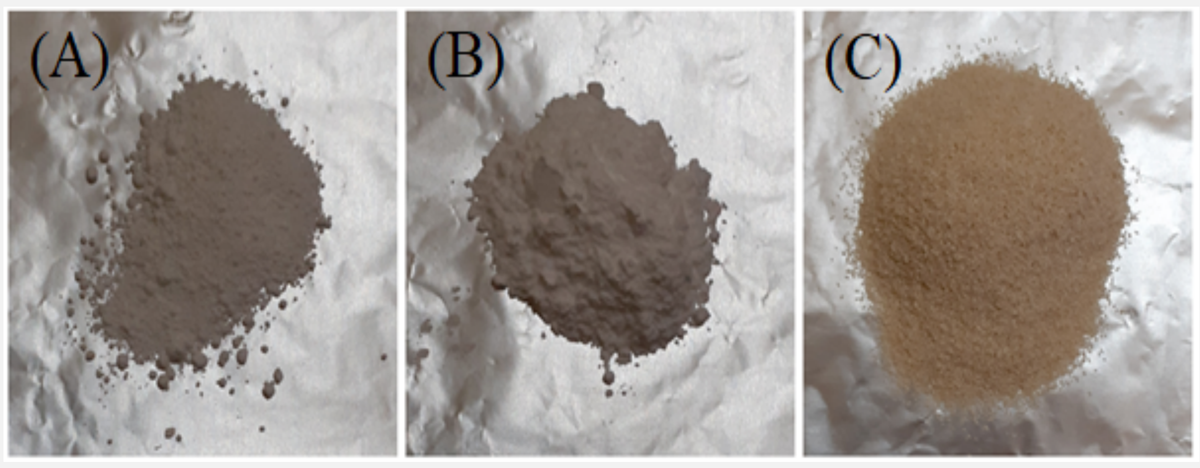
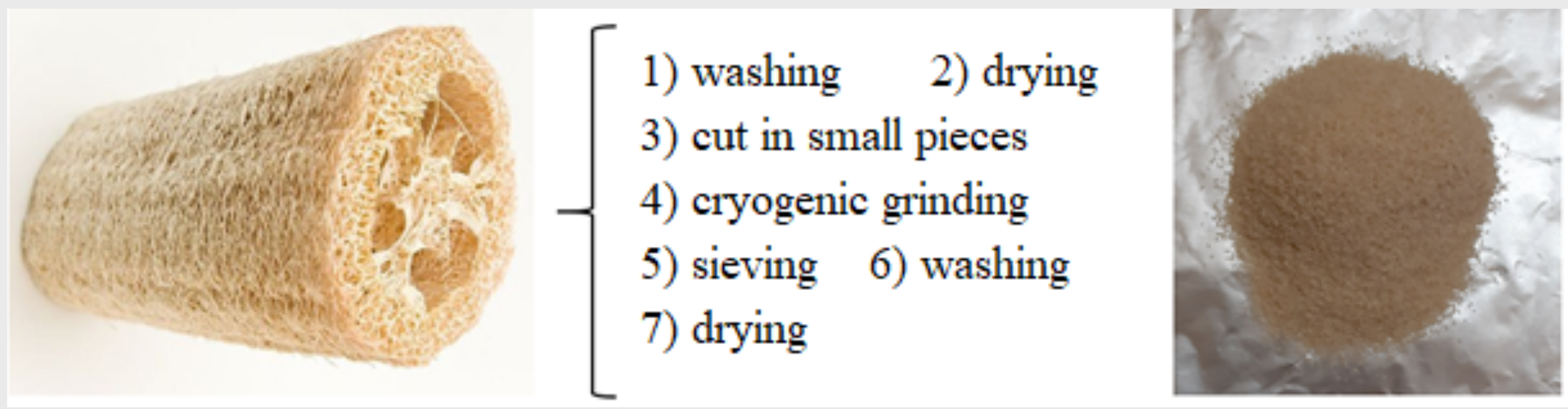
Context and objectives

The objective of this research is to develop and characterize the granulometric, structural, and thermal properties of a new biocomposite material composed of Luffa Cylindrica fibers as a reinforcing agent in a fluoroplastic polytetrafluoroethylene (PTFE) polymer matrix with varying mass fractions (percent) and titanium dioxide (TiO2) nanoparticles as a photocatalytic agent.

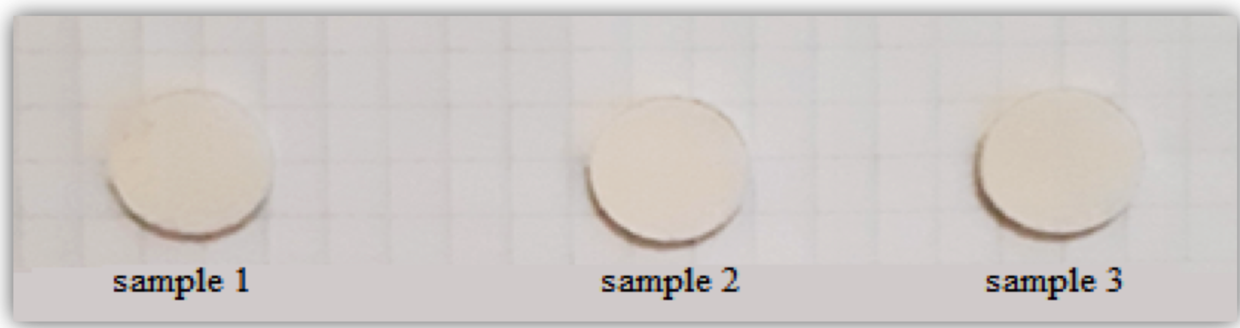
Experimental methodology



Grinded materials were employed in this investigation.
(a) Degussa P25 TiO2. (b) Polytetrafluorethylene (PTFE).
(b) (c) Luffa Cylindrica fibers



(a) Preparation steps of Luffa Cylindrica fibers

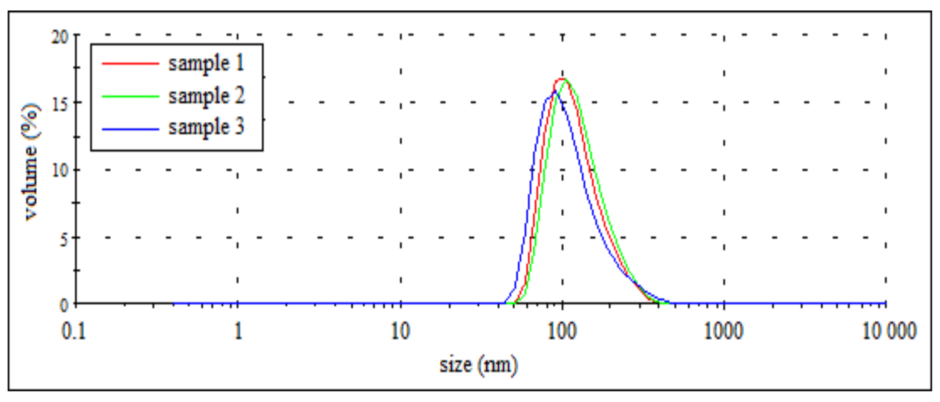


Sample number	PTFE (%)	TiO_2 (%)	LC fibers (%)
1	65	5	30
2	70	5	25
3	60	5	35

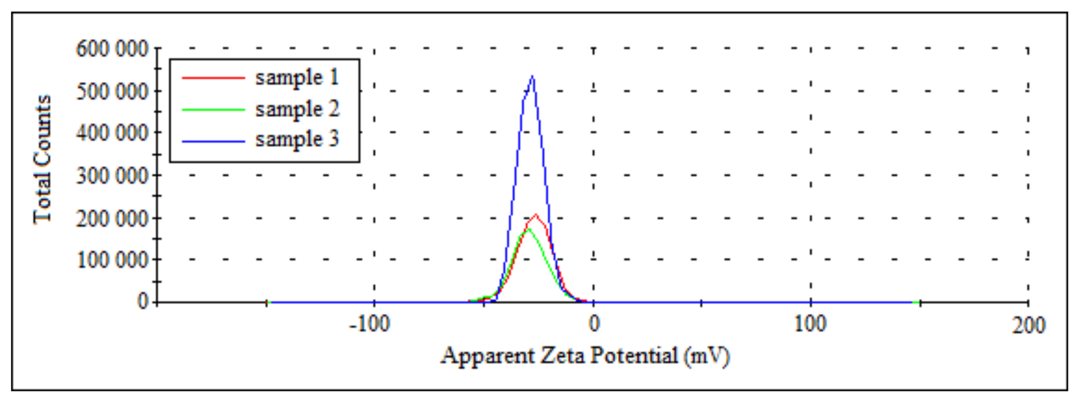
Results & Discussion

The different analysis techniques show that:

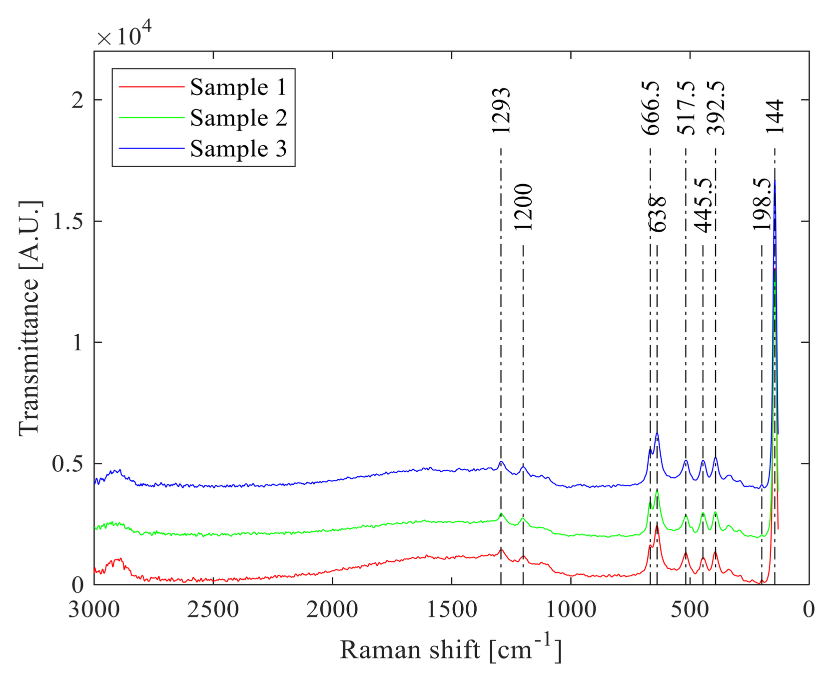
- The granulometry yields centred peaks at 91.28, 105.7 and 91.28 nm with similar associated polydispersity indexes of 16.6%, 16.8% and 15.8% for mass fraction specification 1, 2 and 3 respectively. Their zeta potential are -25.8, -29.2 and -27.5 mV for configuration 1, 2 and 3 respectively.
- FTIR-spectra and Raman-spectra highlight the presence of specific bands of the cellulose, hemicellulose and the PTFE. Moreover, Raman-spectra show vibrations bands attributed to the presence of anatase and rutile phases of TiO2, with corresponding peaks of vasym (CF2) and v (C–C).
- the thermal degradation properties are similar for samples 1 and 2, and outperform the ones of the sample 3. In conclusion, the sample 2 offer the most interesting properties compared to the other tested.



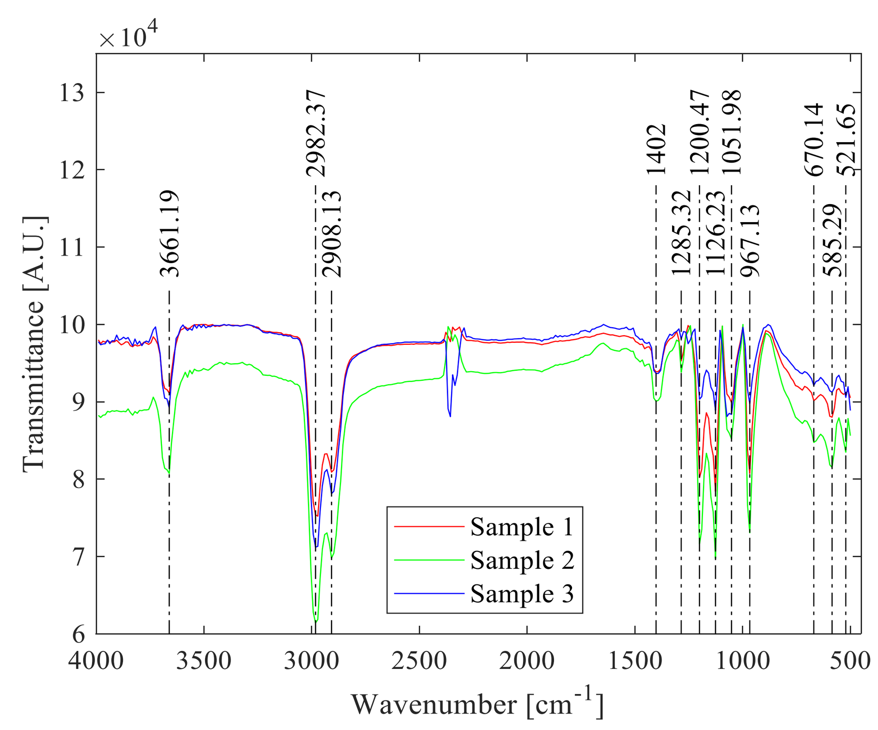
Particle size distribution of the three samples.



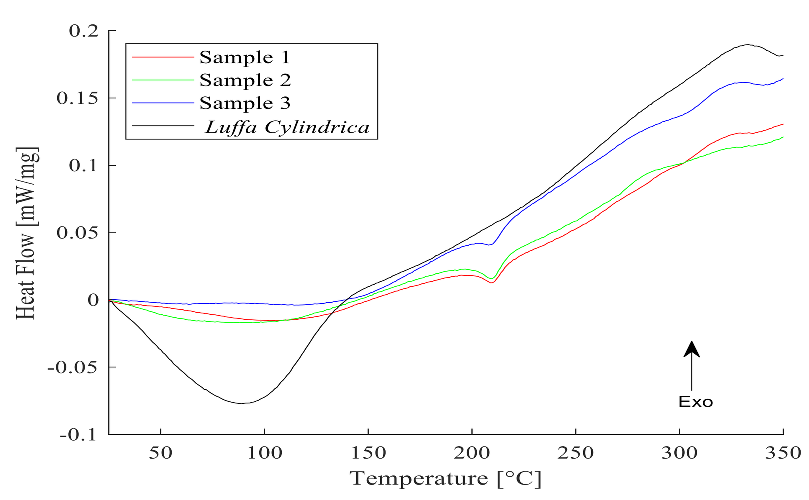
Apparent zeta potential distribution of the three samples



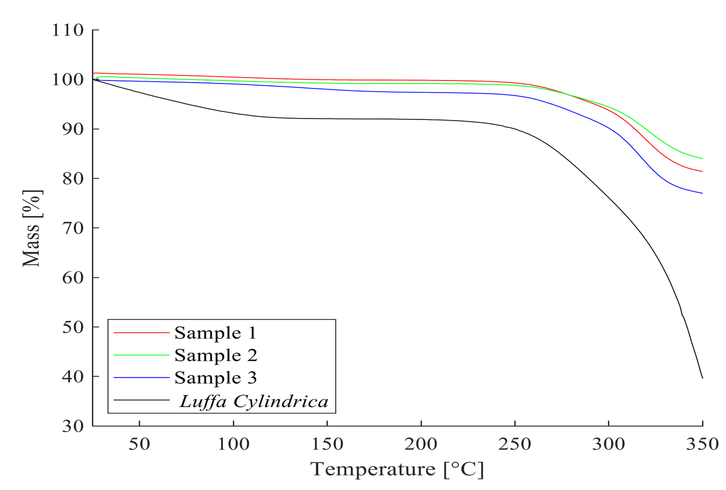
Raman-spectra for the three samples



Whole FTIR-spectra for the three samples



DSC-curves for the three samples and *LC* fibers



TGA-curves for the three samples and *LC* fibers

Conclusion

- Among all tested mass fraction, the sample 2 (70%PTFE: 5%TiO2: 25%LC) offers the most interesting characteristics with a reasonable stability of colloidal dispersion and thermal degradation.
- The further step of this work will be the characterization of this new biocomposite in terms of mechanical and tribological properties.