Enhancing Surface Properties and Pulverization of Coir and Banana Fibres through Chemical Treatment and Ball Milling

Shashi Sony[1], Samrat Mukhopadhyay[1] and Vijay Kumar baheti[1]

[1] *Indian Insititute of Technology Delhi, New Delhi India, e-mail:* soniiitd1995@gmail.com

Abstract: The study explored the influence of chemical treatment on the properties of natural fibers, specifically focusing on coir and banana fibers, followed by their pulverization. Chemical agents such as caustic soda, potassium permanganate, and silane were utilized to modify the surface characteristics of the fibers by removing non-cellulosic constituents [1]. Subsequently, ball milling was employed to refine the fibers, and a comparative analysis was conducted between treated and untreated fibers. The findings revealed that NaOH treatment effectively eliminated lignin and enhanced the tensile strength of the fibers, whereas silane and permanganate treatments showed minimal impact on tensile strength. Moreover, chemical treatment facilitated defibrillation during milling, reducing particle size to 200–350 nm by silane treatment. These chemically modified and pulverized fibers exhibited improved properties suitable for diverse applications such as composites, insulation, and packaging, thereby contributing to sustainable development by efficiently utilizing natural resources.

Keywords: *Ball milling, Banana fiber, Chemical modification, Coir fiber, Ligno cellulosic fiber, Natural fiber.*

Table 1 Sample codes used in this study

S.No.	*Sample codes for fibers*		*Sample codes for pulverized fiber*	
1.	UCF	Untreated coir fiber	UCP	Untreated coir particle
2.	NCF	NaOH-treated coir fiber	NCP	NaOH-treated coir particle
3.	KCF	$KMnO_4$-treated coir fiber	KCP	$KMnO_4$-treated coir particle
4.	SCF	Silane-treated coir fiber	SCP	Silane-treated coir particle
5.	UBF	Untreated banana fiber	UBP	Untreated banana particle
6.	NBF	NaOH-treated banana fiber	NBP	NaOH-treated banana particle
7.	KBF	$KMnO_4$-treated banana fiber	KBP	$KMnO_4$-treated banana particle
8.	SBF	Silane-treated banana fiber	SBP	Silane-treated banana particle

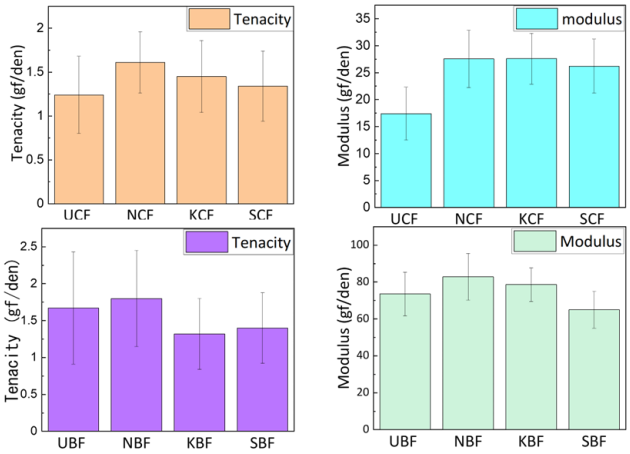

Figure 1 Mechanical properties of chemically treated fibers

ACKNOWLEDGMENT*: The authors are thankful to the Central Research Facility (CRF-IITD) for providing FESEM, SEM, and DLS facilities.*

REFERENCES

[1] Muensri P, Kunanopparat T, Menut P, Siriwattanayotin S. Effect of lignin removal on the properties of coconut coir fiber/wheat gluten biocomposite. Compos Part A Appl Sci Manuf 2011;42:173–9.

[2] Satyanarayana KG, Kulkarni AG, Rohatgi PK. Structure and properties of coir fibers. Proc Indian Acad Sci Sect C Eng Sci 1981;4:419–36.

[3] Rout J, Misra M, Tripathy SS, Nayak SK, Mohanty AK. The influence of fiber treatment on the performance of coir-polyester composites. Compos Sci Technol 2001;61:1303–10.

[4] Zhou F, Cheng G, Jiang B. Effect of silane treatment on microstructure of sisal fibers. Appl Surf Sci 2014;292:806–12.