

---

---

## LIST OF FIGURES

<b>Figure</b>	<b>Title</b>	<b>PageNo.</b>
2.1	classification of natural fibers	12
2.2	Structure of natural fiber	13
2.3	Date Palm Trees	22
3.1	Date palm leaf	26
3.2	Date palm leaf fibers	27
3.3	Single fiber specimen for tensile testing	31
3.4	The tensile strengths of DPL fibers with different chemical treatments	32
3.5	FTIR spectra of DPL fibers	33
3.6	XRD of treated and untreated DPL fibers	34
3.7	Surface morphology of date palm leaf fibers	39
3.8	Micro compounder	40
3.9	Micro injection moulding machine	41
3.10	Tensile strengths of PVA/DPL composites at different fiber loadings	42
3.11	Tensile strengths of PVP/DPL composites at different fiber loadings	43
4.1	FTIR of DPL fibers, PVA, and PVA/DPL (28 wt%) composites	49
4.2	FTIR of DPL fibers, PVP, and PVP/DPL (26 wt%) composites	50
4.3	Comparative XRD curves of PVA and PVA/DPL (28 wt%) composite	51
4.4	Comparative XRD curves of PVP and PVP/DPL (26 wt%) composite	51

---

---

4.5	SEM of treated DPL fiber and PVA/DPL (28 wt%) composites	52
4.6	SEM of treated DPL fiber and PVP/DPL (26 wt%) composites	53
4.7	Flexural strength of PVA/DPL composite at different fiber loadings	56
4.8	Flexural strength of PVP/DPL composite at different fiber loadings	56
4.9	Impact strength of PVA/DPL composite at different fiber loadings	58
4.10	Impact strength of PVP/DPL composite at different fiber loadings	58
4.11	Comparison of tensile strengths	59
4.12	Comparison of flexural strengths	60
4.13	Comparison of impact strengths	60
4.14	DMTA results of PVA/DPL (28 wt%) composites	62
4.15	DMTA results of PVP/DPL (26 wt%) composites	63
4.16	DSC curve of PVA/DPL (28 wt%) composite	64
4.17	DSC curve of PVP/DPL (26 wt%) composite	65
4.18	TGA of PVA/DPL (28 wt%) composite	66
4.19	TGA of PVP/DPL (26 wt%) composite	66
4.20	Complex viscosity of PVA/DPL composites	67
4.21	Complex viscosity of PVP/DPL composites	67
4.22	Shear storage and Shear loss modulus of PVA/DPL composites	68
4.23	Shear storage and Shear loss modulus of PVP/DPL composites	68

4.24	Moisture absorption of PVA/DPL composites at different fiber loadings	70
4.25	Moisture absorption of PVP/DPL composites at different fiber loadings	71
4.26	Biodegradation of PVA/DPL composites at different fiber loadings	75
4.27	Biodegradation of PVA/DPL composites at different fiber loadings	76
4.28	Bar chart showing the tensile strength of PVA/DPL composite (28 wt% fiber loading) after exposure to the degradation conditions	77
4.29	Bar chart showing the tensile strength of PVP/DPL composite (26 wt% fiber loading) after exposure to the degradation conditions	77
4.30	Conductivity property of PVP/DPL composite	78
5.1	Flow chart of various wear mechanisms	80
5.2	Schematic representations of the abrasion wear mechanism	80
5.3	Schematic representations of the adhesive wear mechanism	81
5.4	Schematic representations of the erosive wear mechanism	82
5.5	Schematic representations of the surface fatigue wear mechanism	82
5.6	PIN ON DISC type wear testing machine	85
5.7	Effect of specific wear rate on variations of load of PVA/DPL composite at 0.392 m/s, (b) 0.471 m/s and (c) 0.549 m/s	98
5.8	Effect of specific wear rate on variations of load of PVP/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	100

---

---

5.9	Effect of friction coefficient on variations of load of PVA/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	102
5.10	Effect of friction coefficient on variations of load of PVP/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	103
5.11	Effect of weight loss on variations of load of PVA/DPL composite at 0.392 m/s, 0.471 m/s and (c) 0.549 m/s	105
5.12	Effect of weight loss on variations of load of PVP/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	107
5.13	Effect of specific wear rate on variations of sliding distance of PVA/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	117
5.14	Effect of specific wear rate on variations of sliding distance of PVP/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	118
5.15	Effect of weight loss on variations of sliding distance of PVA/ DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	121
5.16	Effect of weight loss on variations of sliding distance of PVP/DPL composite at 0.392 m/s, 0.471 m/s and 0.549 m/s	122
5.17	SEM micrographs of worn surfaces (at 10 N) of 28 wt% PVA/DPL composite 0.392 m/s, 0.471 m/s, 0.549 m/s	124
5.18	SEM micrographs of worn surfaces (at 10 N) of 26wt% PVP/DPL composite 0.392 m/s, 0.471 m/s, 0.549 m/s	126
5.19	Wear track profiles of counter-face surfaces ( <i>a</i> , <i>c</i> , and <i>e</i> ) and PVA/DPL composites ( <i>b</i> , <i>d</i> , and <i>f</i> ) at three different fiber loadings	128
6.1	Details of erosion test rig	133
6.2	Schematic diagram of erosion test rig	134
6.3	Variation of erosion rate of PVA/DPL composites as a function of cumulative weight of impinging particle at different impingement angles (15–90°)	143

6.4	Variation of erosion rate of PVP/DPL composites as a function of cumulative weight of impinging particle at different impingement angles (15–90°)	145
6.5	Influence of impingement angle ( $\alpha$ ) on steady-state erosion rate PVA/DPL composites	151
6.6	Influence of impingement angle ( $\alpha$ ) on steady-state erosion rate PVP/DPL composites	153
6.7	Bar chart showing influence of impact velocity on the steady state erosion rate of PVA/DPL composites	154
6.8	Bar chart showing influence of impact velocity on the steady state erosion rate of PVP/DPL composites	154
6.9	Variation of steady-state erosion rate of PVA/DPL composites as a function of impact velocity (45–109 m/s)	157
6.10	Variation of steady-state erosion rate of PVP/DPL Composites as a function of impact velocity (45–109 m/s)	159
6.11	Erosion efficiency as a function of impact velocity for PVA/DPL composites	165
6.12	Erosion efficiency as a function of impact velocity for PVP/DPL composites	165
6.13	SEM images of the eroded surfaces of 28% of PVA/DPL composites	167
6.14	SEM images of the eroded surfaces of 28% of PVP/DPL composites	169