

ANNEXURE

LIST OF SUPPLEMENTARY FIGURES AND TABLES

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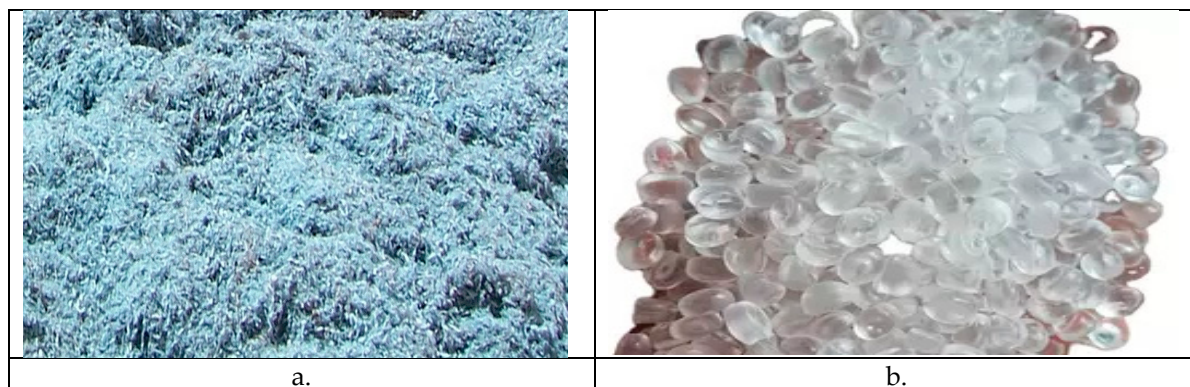


Figure S1. (a). Leather-shavings employed as reinforcing-particulates, and S1(b). Recycled EVA granules [Adapted from the reference 135]

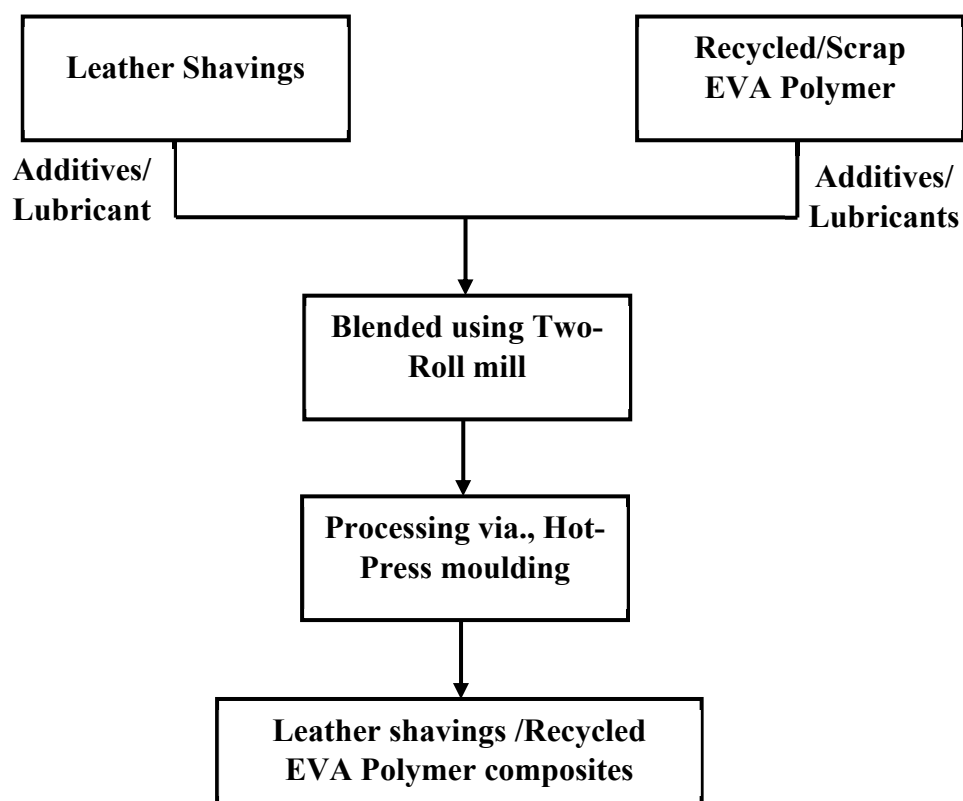


Figure S2. Process flow diagram for recycling thermoplastic elastomer and polymer composites from solid leather wastes.

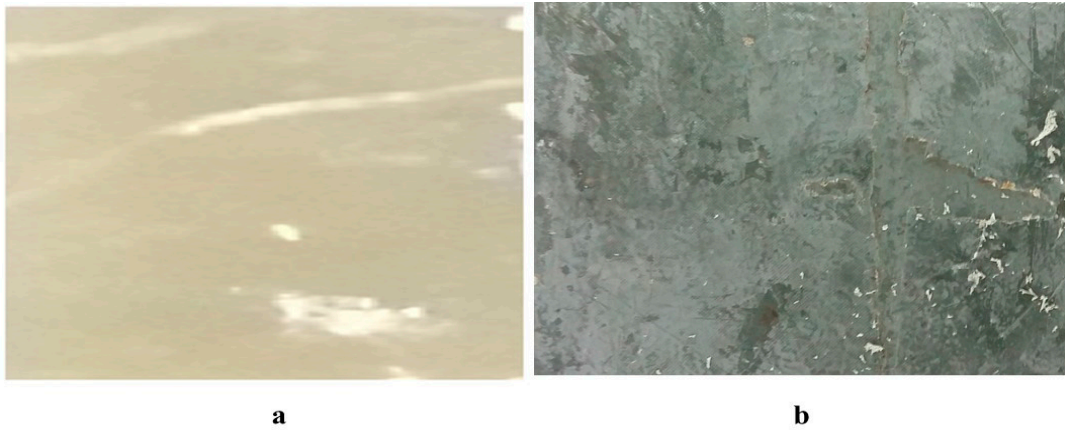


Figure S3. (a). “Neat recycled-EVA polymeric-composites [Adapted from the reference 135]”, and S3(b). “Leather-shavings/recycled EVA-polymeric composites”.

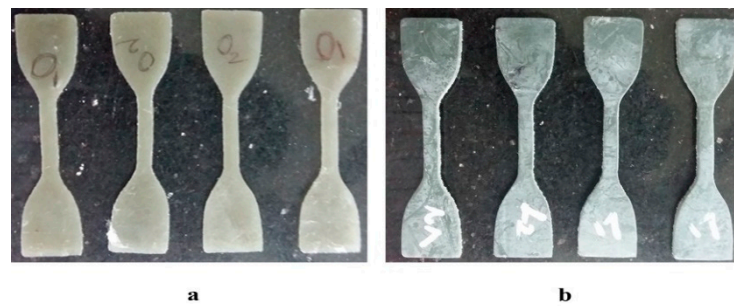
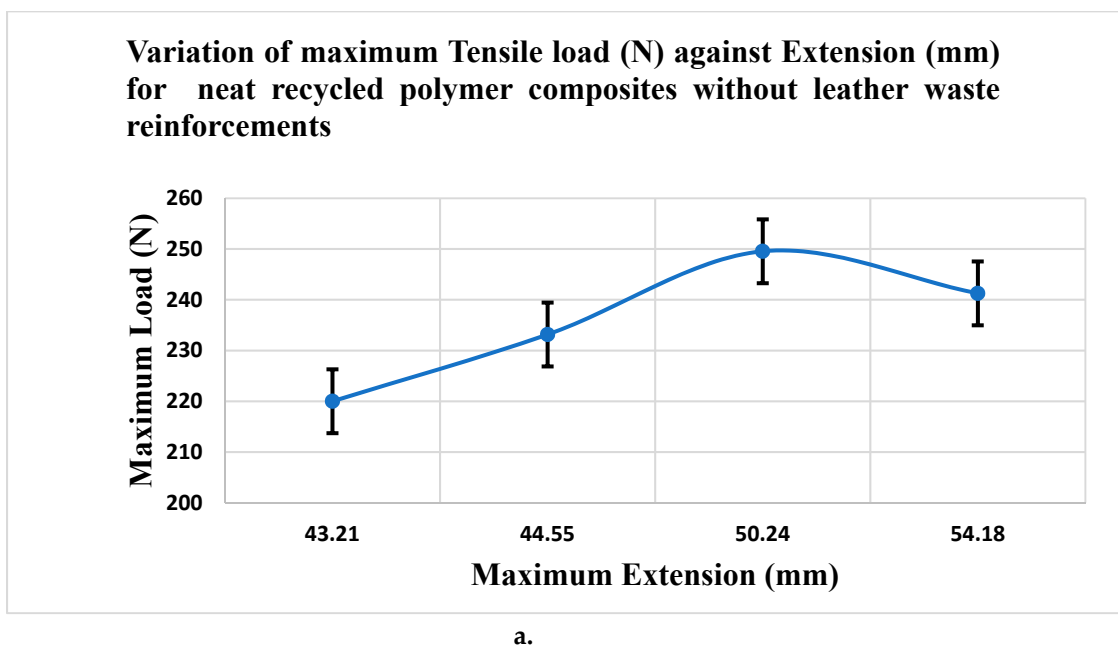
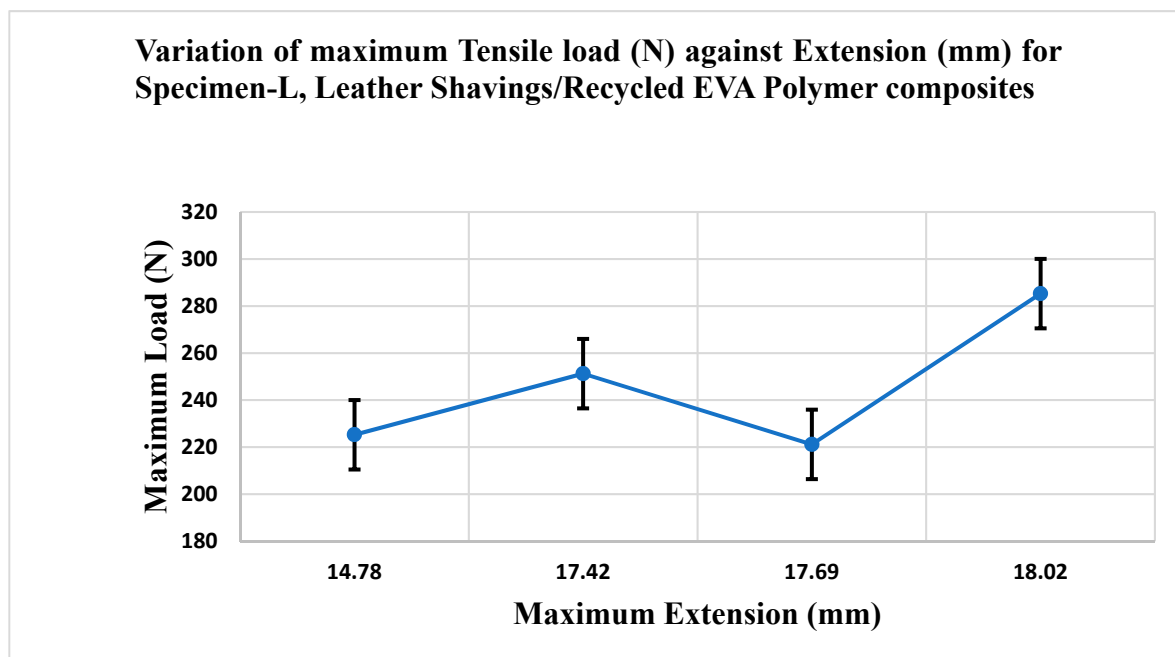


Figure S4. “Dumb-bell shaped’ Tensile Test Sample [Adapted from the reference 135]





b.

Figure S5. (a-b). "Variation of tensile load (N) against extension (mm) of recycled EVA polymer composites with or without leather shavings"

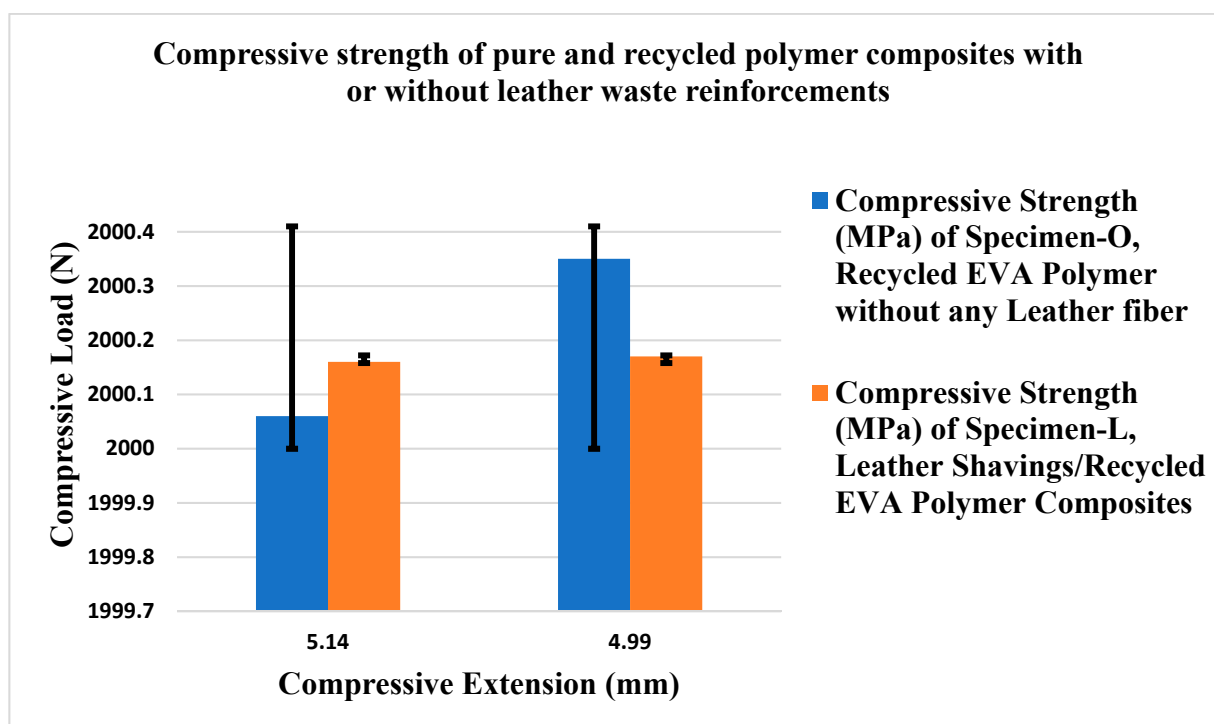


Figure S6. Comparison of "Compressive strength (MPa)" for "neat-recycled EVA", and "recycled-EVA polymer composites"

LIST OF SUPPLEMENTARY TABLES:

Table S1. Compositions of polymer composite samples in wt.-ratios

Samples	Weight ratios			Additives and Lubricants
	Recycled EVA polymers (Matrix)	Leather Shaving fibers (Reinforcing-constituents)	Recycled EVA polymers: Leather Shaving fiber composites (formulation in ratios)	
"Neat recyclable EVA material, free from leather fibers"	1	0	1:0	Zinc octadecanoate and Octadecanoic acid (Additives, two-percent by wt.) Paraffins, and Naphthalene oils (Lubricants/Oils, two-percent by wt.)
"Leather Shaving fibers/Recycled EVA polymer composites"	1	1	1:1	

Table S2. Standard test methods, equipment details with model/machine numbers, and standards were followed in this investigation.

S.No.	Name of Experiments	"ASTM/ISO/SATRA TM Standards followed"
1	"Tensile Strength of Polymer using INSTRON equipment, model 3369J7257, with an optical extensometer"	"SATRA TM-137 1995"
2	"Compressive Strength of Polymer using INSTRON equipment, model 3369J7257, with an optical extensometer"	"ASTM D-3410"
3	"Tear Strength and Extension of Polymer using INSTRON equipment, model 3369J7257, with an optical extensometer"	"SATRA TM-218 1999/ISO 20344:2011"
4	"Adhesion Strength of Polymer"	"SATRA TM-401 2000"
5	"Compression set-constant relaxation method (CRT) stress"	"SATRA TM-64 1996"
6	"Abrasion resistance using Rotating Drum method, model STM-140, UK"	"ISO 20871:2001/TM-174:2016/ISO-20344 (8.3)/ISO 4649:20871"
7	"Density of Polymers by Displacement Volume"	ASTRA TM-134:2010/ ASTM-D-792-00"

8	"Hardness of Rubber and Durometer method Plastics"	"SATRA TM-205:2016/ISO 868:2013"
9	"Moisture content (%)"	"SATRA TM347:1996 and EN ISO 4684:2005"
10	"Detection of Chromium content using UV-Visible spectrophotometry"	"IUC 8 & 18 test standards"
11	"Thermogravimetric Analysis (TGA) TA Instruments, model Q-50"	"Powder form (1-5 gm)"
12	"Differential Scanning Calorimetry (DSC) TA Instruments, model Q-200"	"Powder form (1-5 gm)"
13	"Fourier-transform infrared spectroscopy- Attenuated total reflection (FTIR-ATR) using JASCO, FTIR-model 4700"	"Powder/Pellets form (1-5 gm)"
14	"Scanning Electron Microscopy (SEM Analysis) using Phenom world Proat an accelerating voltage of 10 kV"	"Powder form upto 32 mm (Ø)"
15	"Elemental Composition analysis using Thermo Fisher Scientific model Quanta200"	"Powder form (2-7 gm)"
16	"Phase identification and Structural analysis using wide-angle X-ray diffractometer (XRD), make with model name (Bruker AXS, ECO D8 Advance"	"Powder form (2-4 gm)"
17	"Atomic force Microscopy (AFM Analysis) using NT-MDT, Ireland model no. NTEGRA PRIMA"	"Measuring mode in air and liquid"

Table S3. Absorbance values obtained with phosphate buffer testing procedure

Specimen	Absorbance
"Blank"	0.0854
"Neat recycled EVA polymer without any leather shavings"	0.0081
"Recycled EVA polymer with leather shavings (1:1)"	0.0084
"Standard"	0.0788

Table S4. Absorbance values obtained with water testing procedure

Specimens	"Absorbance"
"Blank"	0.0204
"Neat recycled EVA polymer without any leather shavings"	0.0123
"Recycled EVA polymer with leather shavings (1:1)"	0.0172
"Standard"	0.0822

Table S5. Presence of functional group in neat recycled EVA without incorporating leather fiber reinforcements in FTIR analysis.

S. No.	FREQUENCY RANGE (cm ⁻¹)	FUNCTIONAL GROUP
1	3100-2914.88	C-H stretching vibrations
2	2869.56-2917.77	"C-H asymmetric and symmetric stretching of the methylene group (-CH ₂ -), respectively of EVA copolymers"
3	1739	Acetate
4	1701.87-1736.58	Vinyl-Acetate group due to Stretching vibrations of C=O
5	1432.85-1466.6	"C=C and due to the methylene stretch"
6	1464	CH ₂ group deformation bands
7	1371.14	CH ₃
8	1296.89	C-O
9	1130.08-1104.05	"Asymmetrical stretching vibration of the C-O band"
10	1123.33	C-O-C stretch mode
11	996.053	"Symmetric stretching vibration of the C-O-C"
12	810.92	Inner vibration of methylene group
13	Less than 700	CH ₂ (ethylene)
14	530-620	C=O

Table S6. Presence of functional group in Leather shavings/recycled EVA polymer composites in FTIR analysis.

S. No.	FREQUENCY RANGE (cm ⁻¹)	FUNCTIONAL GROUP
1	3200.15-3500.40	O-H in side chains and terminal groups
2	2914.88-2848.35	Absence of fatty substances
3	1641.13-1732.73	Amide (-NH)
4	1433.82-1461.78	-COO- group
5	1345.11-1378.85	-C-O- group
6	1204.33-1296.89	Deformation vibration of -C=O group
7	1175	C-N stretching (Leather Shaving fibers)
8	967.126-1051.01	-C-O-C- ether group
9	726.068-600	Cr-O Metallic ions (Cr)