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Figures

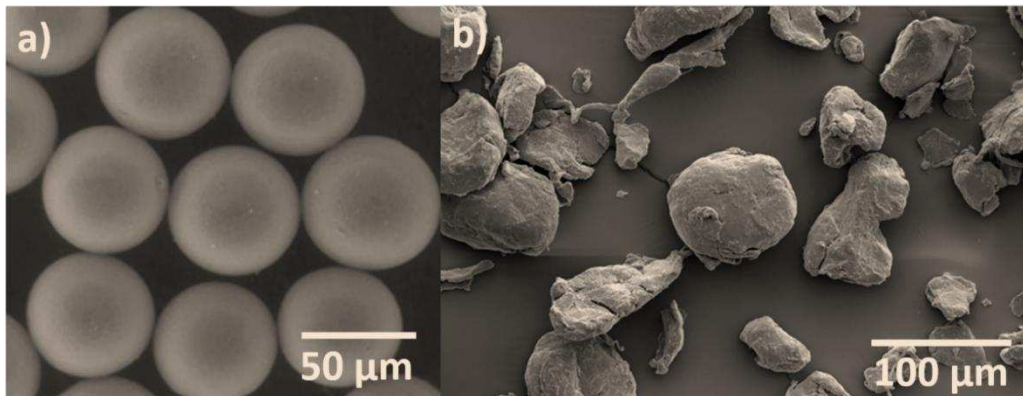


Figure 1. SEM of a) polyethylene microspheres; and b) polypropylene particles.

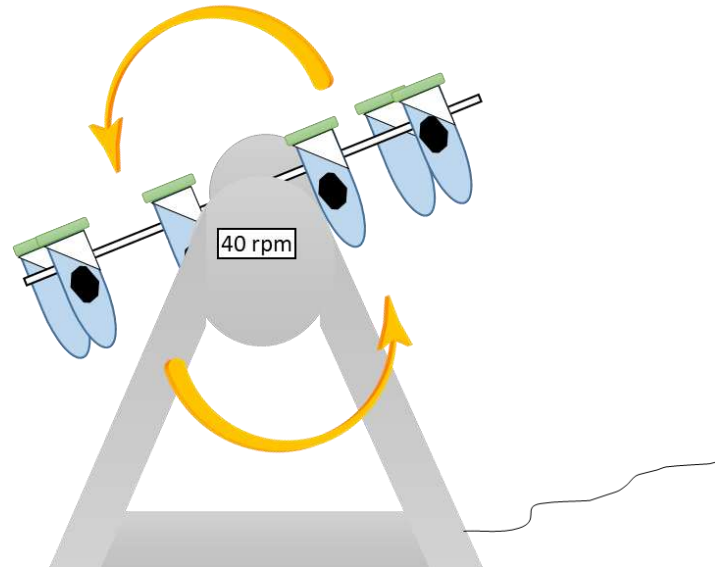


Figure 2. Illustration of the benchtop setup to study particle deposition and retention from bulk solution onto fabrics. The tubes rotate through 360° to mimic simplistically the tumbling action that occurs within a washing machine.

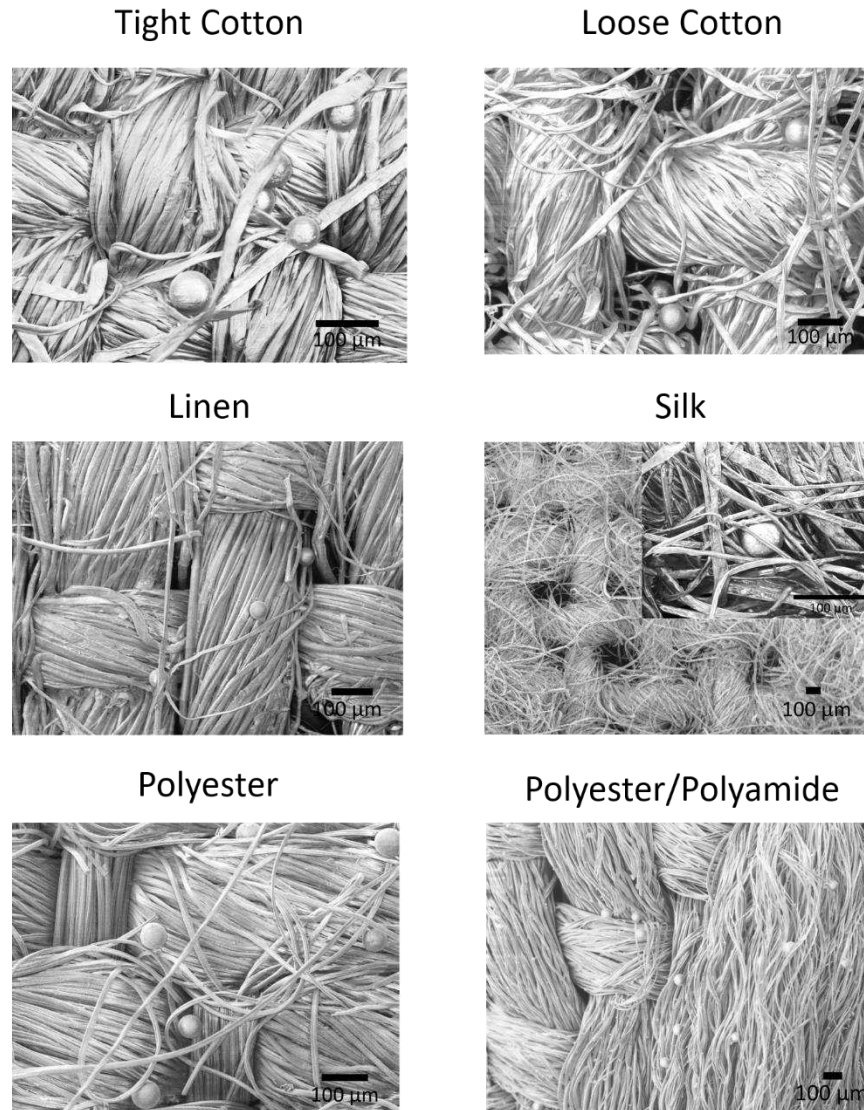


Figure 3. SEM of fabrics used in this study illustrating their structural characteristics and the locations where spherical polyethylene particle deposition occurs after the tumbling process. The tumbling and rinse cycle was conducted at 40 rpm for 10 min (Scale bar = 100 μm).

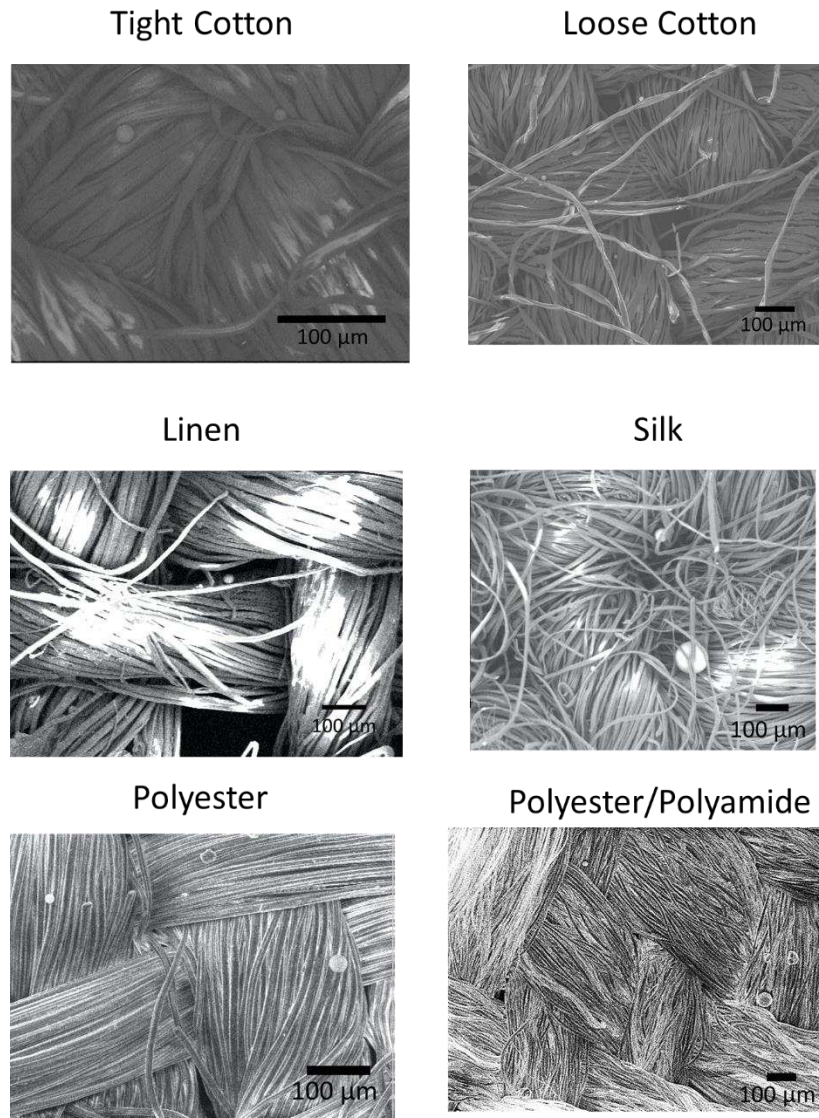


Figure 4. SEM of the fabrics illustrating the locations where irregular polypropylene particle deposition of the particles occurs after the tumbling process. The tumbling and rinse cycle was conducted at 40 rpm for 10 min. (Scale bar = 100 μm).

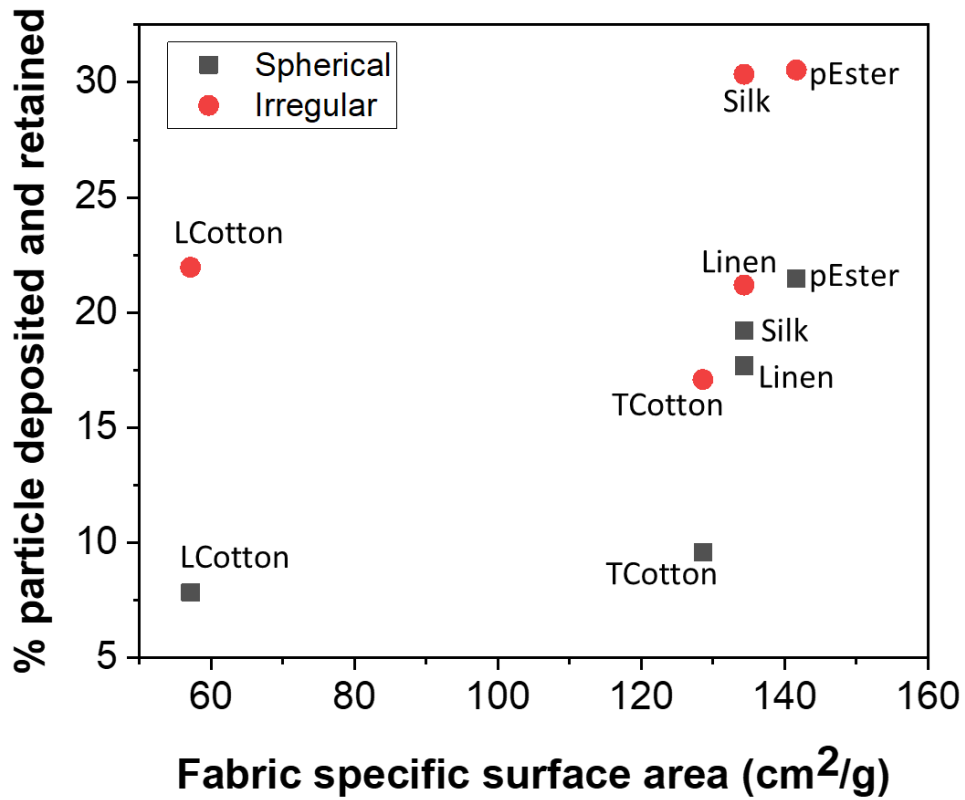


Figure 5. Impact of fabric specific surface area on the level of deposition and retention of spherical and irregular shaped particulates from the continuous phase. The fabrics are initially tumbled in the particulate dispersion for 10 min at 40 rpm followed by a cycle in clean water. The points are annotated with the corresponding fabric materials.

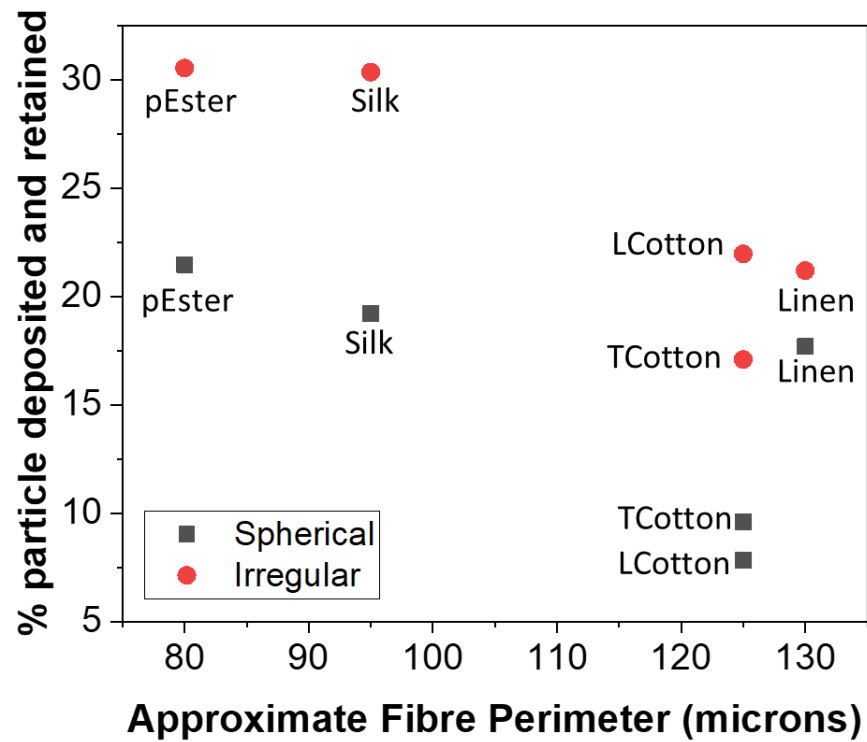


Figure 6. The effect of fibre perimeter on the level of particles deposited and retained onto the fabrics from the bulk continuous phase. The fabrics are tumbled in the presence of particles at 40 rpm for 10 min followed by a rinse cycle. The points are annotated with the corresponding fabric materials.

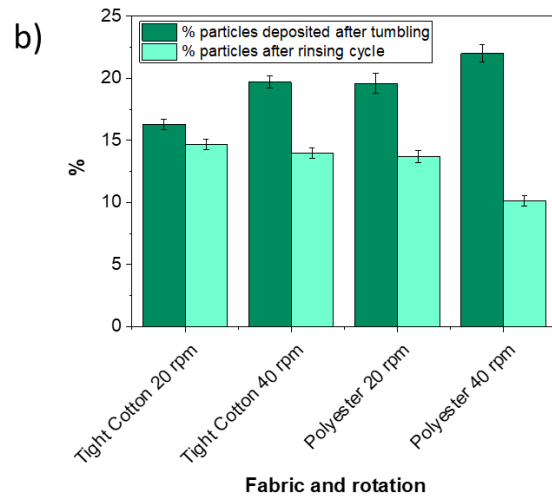
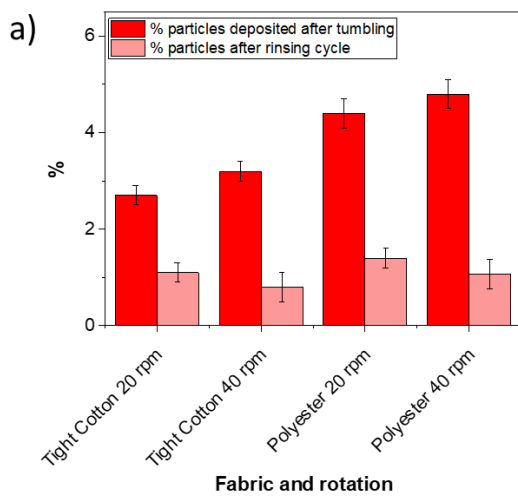


Figure 7. Influence of rotation speed on particle deposition and retention (based on mass balance analysis) after the 10 minute tumbling and rinse cycles onto tight cotton and polyester fabrics using a) spherical and b) irregular shaped particles.

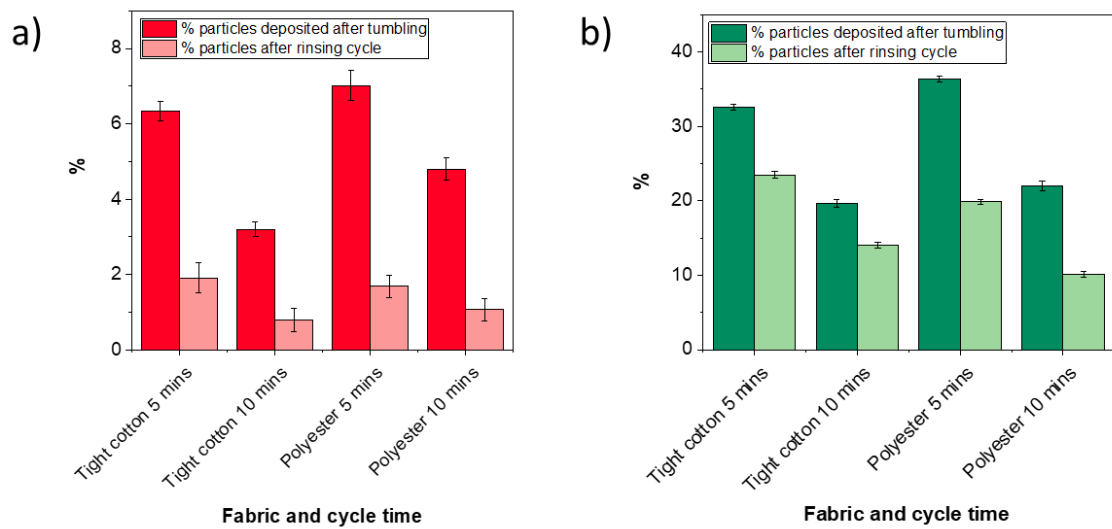


Figure 8. Influence of rotation time on particle deposition and retention (based on mass balance analysis) after the tumbling and rinse cycles at 40 rpm, onto tight cotton and polyester fabrics using a) spherical and b) irregular shaped particles.

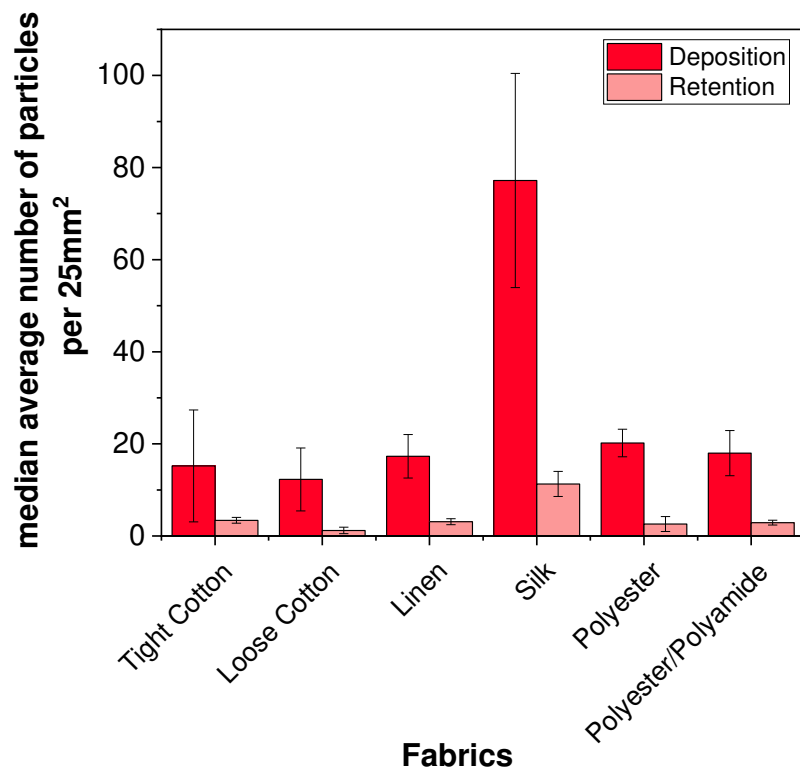


Figure 9. Median number of particle depositions on fabric front side per 25 mm² after tumbling and rinsing cycle. Each cycle is performed for 10 min at 40 rpm.

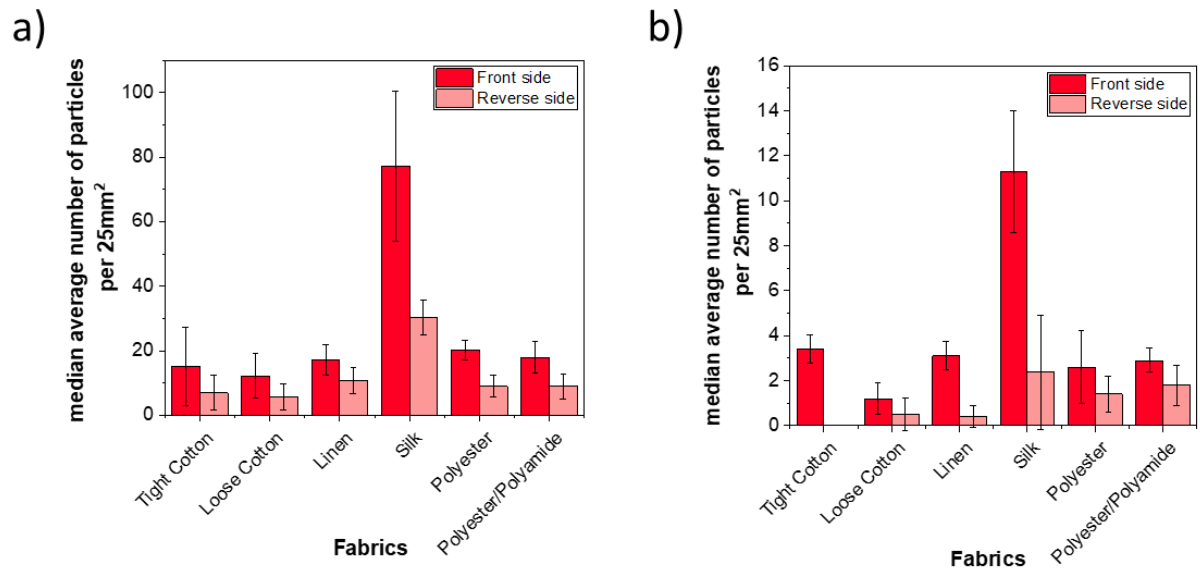


Figure 10. Median number of particles counted on fabric front and reverse side per 25 mm² after a) tumbling (deposition) and b) rinsing cycle (retention). Each cycle is performed for 10 min at 40 rpm.

Tables

Table 1. Details of the textile fabrics and their properties used in this study.

Fabric Type	Weave Structure	Yarn Width (mm)	Yarn Density (#/cm)	Twists per cm	Fibre Structure
Tight Cotton	Plain	0.2	50/50	14	Staple
Loose Cotton	Plain	0.3	27/27	12.5	Staple
Linen	Plain	0.4	23/23	6	Staple
Silk	Plain	0.3	20/20	8	Cont. Filament
Polyester	Twill	0.2-0.3	47/37	10	Staple
Polyester/Polyamide	Honeycomb	0.4-0.5	-	0	Cont. Filament

Table 2. Changes in the average mass recorded after the tumbling and rinse cycles to determine the percentage of spherical/irregular shaped particles deposited and retained on the various fabrics studied. The tumbling and rinse cycle was conducted at 40 rpm for 10 min. Values in the bracket depict the associated standard deviation.

Spherical polyethylene particles				
	Average mass gain after tumbling (mg)	% of particles deposited during tumbling cycle	Average mass lost after rinsing (mg)	% of deposition lost after rinse cycle
Tight Cotton	2.7 (0.2)	10.8	0.3 (0.05)	11.1
Loose Cotton	2.3 (0.3)	9.3	0.4 (0.07)	15.7
Linen	4.8 (0.4)	19.3	0.4 (0.09)	8.3
Silk	5.8 (0.4)	23.2	1.0 (0.1)	17.2
Polyester	5.5 (0.2)	22.0	0.1 (0.03)	2.4
Polyester/Polyamide	2.9 (0.3)	11.7	0.5 (0.06)	17.0
Irregular polypropylene particles				
	Average mass gain after tumbling (mg)	% of particles deposited during tumbling cycle	Average mass lost after rinsing (mg)	% of deposition lost after rinse cycle

Tight Cotton	4.6 (0.3)	18.3	0.3 (0.09)	6.6
Loose Cotton	6.6 (0.3)	26.5	1.1 (0.1)	17.1
Linen	6.40 (0.4)	25.6	1.1 (0.2)	17.2
Silk	8.13 (0.5)	32.5	0.5 (0.06)	6.6
Polyester	9.8 (0.4)	39.2	2.2 (0.1)	22.1
Polyester/Polyamide	7.4 (0.3)	29.6	1.5 (0.2)	19.8

Table 3. Summary of the fibre cross-sectional shape and approximate fibre perimeter for the different fabrics used in this study.

Fabric	Hydrophilic/ Hydrophobic	Fibre Cross-sectional shape	Approximate Fibre Perimeter (microns)	Ref
Tight Cotton	Hydrophilic	Bean	125	43
Loose cotton	Hydrophilic	Bean	125	43
Linen	Hydrophilic	Polygonal	130	44
Silk	Hydrophobic	Rounded-triangular	95	44
Polyester	Hydrophobic	Circular	80	44
Polyester/Polyamide	Hydrophobic	Circular	80	44

Table 4. Changes in the average mass recorded after the tumbling and rinse cycles to determine the percentage of irregular shaped particles deposited and retained onto multiple fabrics simultaneously. The tumbling and rinse cycle was conducted at 40 rpm for 10 min.

Sample name	Fabrics	Average	% of particles	Average	% of initial
		mass gain after tumbling (mg)	deposited during tumbling cycle	mass lost after rinsing (mg)	particle retained after rinse
TM1	Linen	0.9	3.6	0.64	28.9
	Tight cotton	3.5	14	2.9	17.1
TM2	Linen	1.80	7.2	1.50	16.7
	Loose cotton	0.80	3.2	0.90	-
TM3	Linen	0.90	3.6	0.70	22.2
	Silk	2.00	8.0	1.44	28.0
TM4	Linen	1.60	6.4	1.00	37.5
	Polyester	0.80	3.2	0.70	12.5
TM5	Linen	0.60	2.4	0.40	33.3
	Polyester/Polyamide	4.20	16.8	3.60	14.3