

Supporting Information 1.

Chemical Analysis

Table 1. Molecular vibration mode and its corresponding wavenumber for neat CA formulations

Vibration ↓ Sample →	Appearance	Neat CA 2.5wt% Wavenumber (cm ⁻¹)	Neat CA 5wt.% Wavenumber (cm ⁻¹)	Neat CA 10wt.% Wavenumber (cm ⁻¹)
O-H Stretching	Strong broad	3472	3475	3475
C-H Stretching	Medium	2930	2929	2929
C=O Stretching	Strong	1735	1736	1741
CH ₂ Bending	Medium	1435	1431	1431
O-H Bending	Medium	1367	1368	1370
C-O-C Stretching	Strong	1220	1221	1221
C-O Stretching	Strong	1161	1159	1161
-C-OH- Bending	Medium	1033	1031	1031
-C-O Stretching	Strong	901	901	901

Table 2. (a). Molecular vibration and its corresponding wave number for *Mimosa Pudica* Seeds and MPH particles

Vibration ↓ Samples →	Appearance	Mimosa Pudica Seed (cm ⁻¹)	Mimosa Pudica Hydrogel (MPH) Powder (cm ⁻¹)
-OH Stretching	Strong Broad	3280	3280
-CH Stretching	Medium	2930	2930
C=O Stretching	Strong	-	1743
-NH ₂ Stretching	Medium	1638	1638
-CH ₃ bending	Medium	1398	1322
C-O Stretching	Medium	1162	1162
C-N Stretching	Strong	1034	1034
O-C=O Stretching	Medium	869	869

Table 2. (b). Molecular vibration and its corresponding wave number for optimized 5wt.% CA and Modified CA/MPH membrane

Vibration ↓ Sample→	Appearance	Neat CA 5wt% Wavenumber (cm ⁻¹)	MCA-1 Wavenumber (cm ⁻¹)	MCA-2 Wavenumber (cm ⁻¹)	MCA-3 Wavenumber (cm ⁻¹)
O-H Stretching	Strong broad	3475	3480	3480	3480
C-H Stretching	Medium	2929	2930	2930	2930
-C≡N Stretching	Medium	-	2160	2160	2160
C=O Stretching	Strong	1736	1730	1730	1730
CH ₂ Bending	Medium	1431	1430	1430	1430
O-H Bending	Medium	1368	1370	1370	1370
C-O-C Stretching	Strong	1221	1220	1220	1220
C-O Stretching	Strong	1159	1160	1160	1160
-C-OH- Bending	Medium	1031	1030	1030	1030
C-O Stretching	Strong	901	901	901	901

Biodegradation test:



Fig.1. Experimental setup for soil burial test

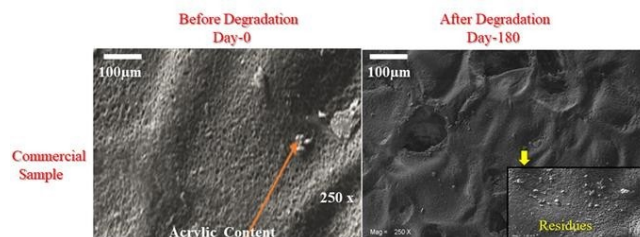


Fig.2. Degradation SEM image of commercial sample as control

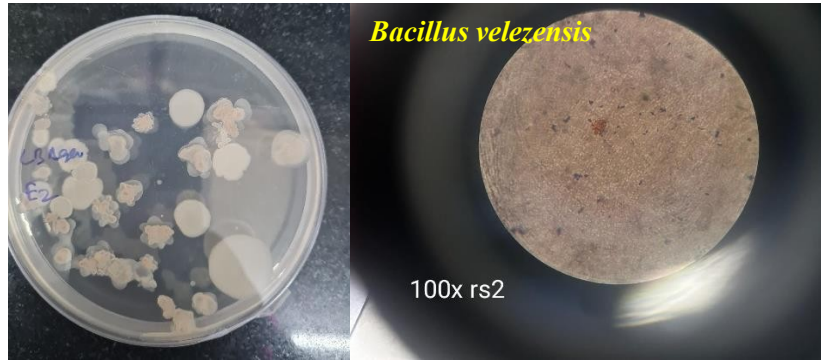


Fig.3. Isolation of genomic DNA (Left), and Identification of bacteria responsible for degradation of commercial samples (Right).

During the commercial sample degradation, *Bacillus velezensis* bacteria are responsible for the degradation which is confirmed from the isolation of bacteria experiment.



Fig.4. Seed germination test for commercial sample incorporated soil showing the decrement in plant growth.

Mould growth resistance:

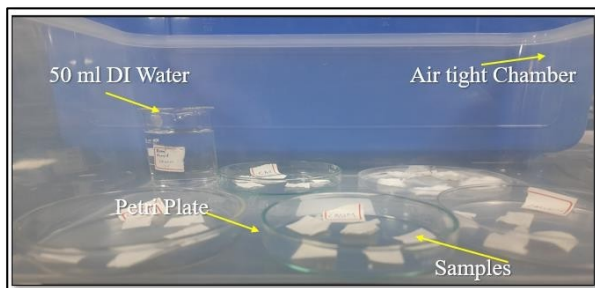


Fig.5. Experimental setup for Mould growth resistance test

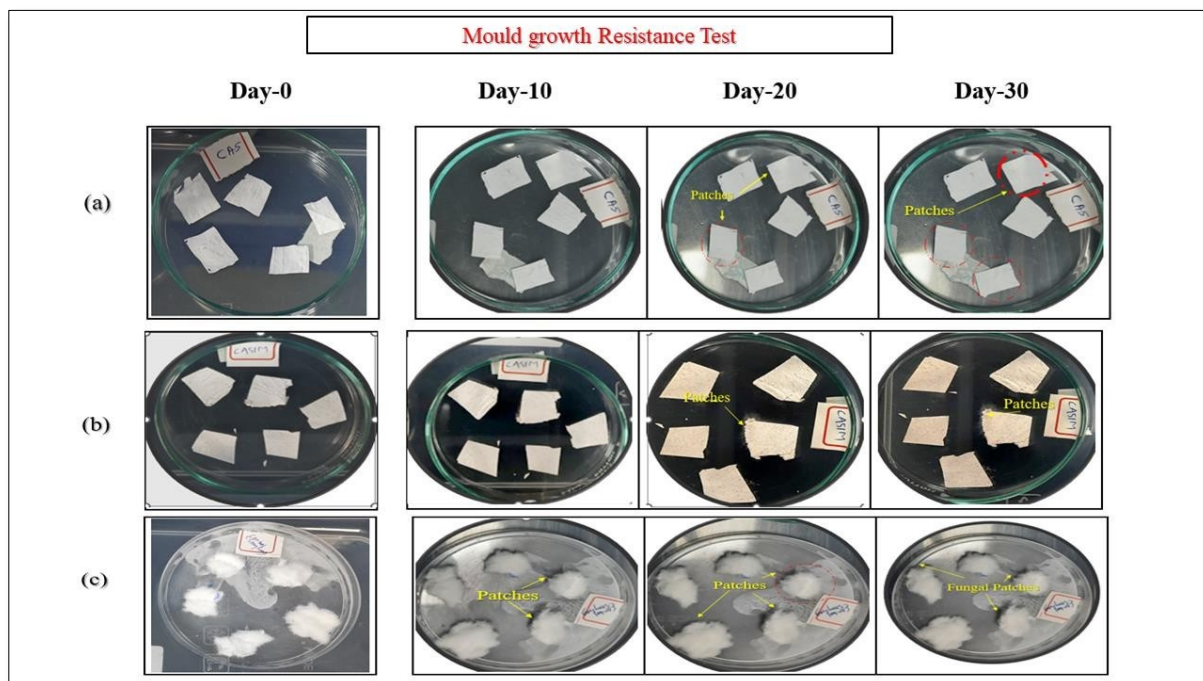


Fig.6. (a) Mould growth resistance test images of Neat CA, (b) Optimized MCA-2 (CA/MPH membrane) and (c) Commercial sample (Stayfree Secure Wings Sanitary pads)