

Table S1. The recommended solution for optimized condition of pectin/PLA bilayer film

Number	PLA (g, w/v)	Pectin (g, w/v)	Desirability
1	<u>2.90</u>	<u>1.96</u>	<u>0.85</u>
			<u>Selected</u>

Table S2. The acceptable range and validation results for optimized pectin/PLA bilayer film

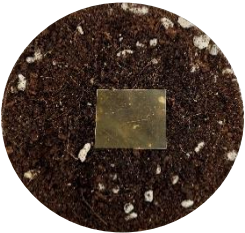



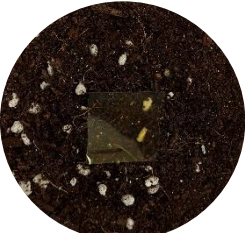



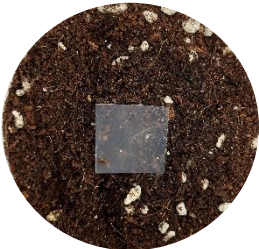
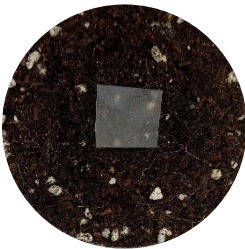

Test	Predictions	95% CI		95% PI		Validation
		Low	High	Low	High	Experimental value
<b>TS (mPa)</b>	6.76	6.31	7.22	5.57	7.96	7.038 ± 0.69
<b>EAB (%)</b>	428.38	402.52	454.24	360.94	495.82	462.633 ± 137.95
<b>WVP (g/msPa)</b>	1.55 x 10 <sup>-10</sup>	1.27 x 10 <sup>-10</sup>	1.82 x 10 <sup>-10</sup>	8.34 x 10 <sup>-11</sup>	2.26 x 10 <sup>-10</sup>	1.45 x 10 <sup>-10</sup> ± 4.58 x 10 <sup>-11</sup>
<b>OP (g/ms)</b>	9.62 x 10 <sup>-8</sup>	6.65 x 10 <sup>-8</sup>	1.26 x 10 <sup>-7</sup>	1.87 x 10 <sup>-8</sup>	1.74 x 10 <sup>-7</sup>	2.79 x 10 <sup>-7</sup> ± 9.20 x 10 <sup>-8</sup>
<b>Solubility (%)</b>	26.83	24.58	29.06	20.99	32.65	23.53 ± 5.20

\* CI = confidence interval; PI = prediction interval; TS = Tensile strength; EAB = Elongation at break; WVP = Water vapor permeability, OP = Oxygen permeability

Table S3. Light transmission properties of optimized bilayer film as comparison to single film layer

Wavelength (nm)	200	280	350	400	500	600	700	800	Opacity (A.mm <sup>-1</sup> )
<b>Optimized pectin/PLA</b>	0.38 ± 0.02 <sup>a</sup>	1.66 ± 0.03 <sup>a</sup>	3.18 ± 0.03 <sup>a</sup>	1.53 ± 0.22 <sup>a</sup>	0.89 ± 0.13 <sup>a</sup>	1.22 ± 0.29 <sup>a</sup>	0.84 ± 0.06 <sup>a</sup>	0.88 ± 0.01 <sup>a</sup>	21.08 ± 5.51 <sup>a</sup>
<b>Pectin</b>	0.43 ± 0.05 <sup>a</sup>	1.47 ± 0.01 <sup>b</sup>	2.36 ± 0.12 <sup>b</sup>	0.73 ± 0.04 <sup>c</sup>	0.41 ± 0.01 <sup>b</sup>	0.27 ± 0.00 <sup>b</sup>	0.23 ± 0.01 <sup>b</sup>	0.24 ± 0.01 <sup>c</sup>	3.84 ± 0.03 <sup>b</sup>
<b>PLA</b>	0.22 ± 0.06 <sup>b</sup>	0.77 ± 0.02 <sup>c</sup>	1.51 ± 0.02 <sup>c</sup>	1.16 ± 0.00 <sup>b</sup>	0.77 ± 0.00 <sup>a</sup>	0.42 ± 0.00 <sup>b</sup>	0.23 ± 0.01 <sup>b</sup>	0.34 ± 0.00 <sup>b</sup>	1.82 ± 0.07 <sup>b</sup>

Table S4. Biodegradability rate of optimized bilayer film as comparison to single film layer over 2 weeks period

Biodegradation rate (%)	0 day	3 days	7 days	14 days
Optimized pectin/PLA	0% 	$38.69 \pm 1.48\%$ 	$68.69 \pm 5.76\%$ 	$71.32 \pm 4.26\%$ 
Pectin	0% 	$100.00 \pm 0.00\%$ 	$100.00 \pm 0.00\%$ 	$100.00 \pm 0.00\%$ 
PLA	0% 	$1.89 \pm 1.28\%$ 	$3.36 \pm 2.79\%$ 	$6.82 \pm 0.87\%$ 