# Supplementary Materials

This Supplementary Materials contains:

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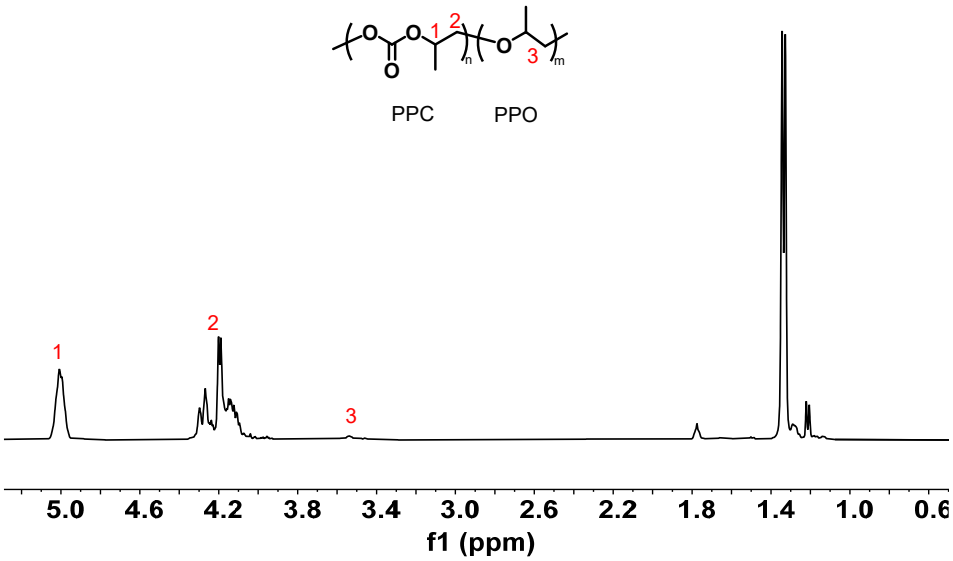


**Figure S1.** $^{1}$H NMR spectrum of synthesized PPC.

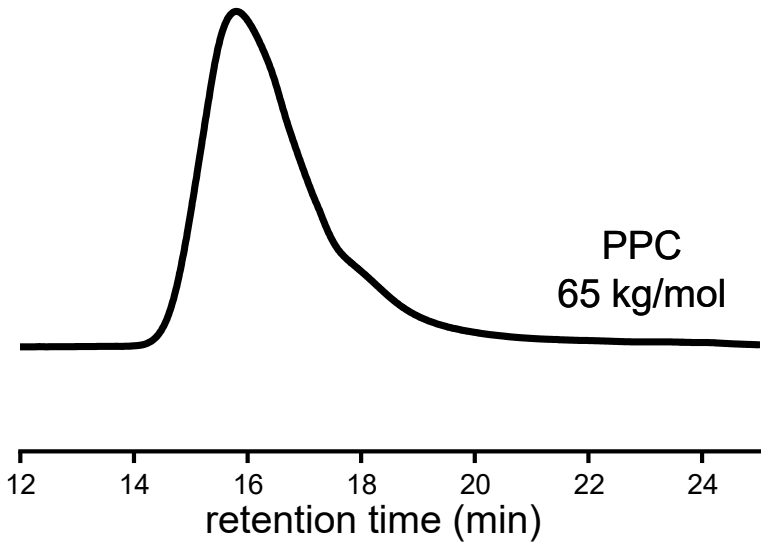


**Figure S2.** GPC curve for synthesized PPC.

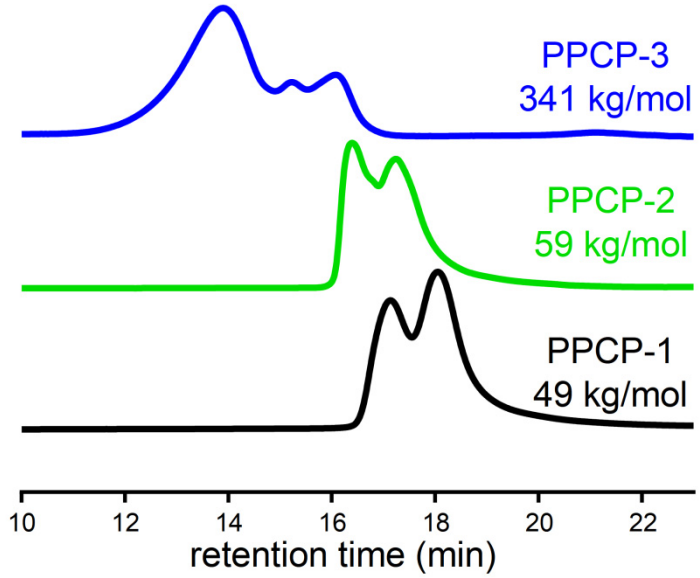


**Figure S3.** GPC curves for synthesized PPCP-1, PPCP-2 and PPCP-3.

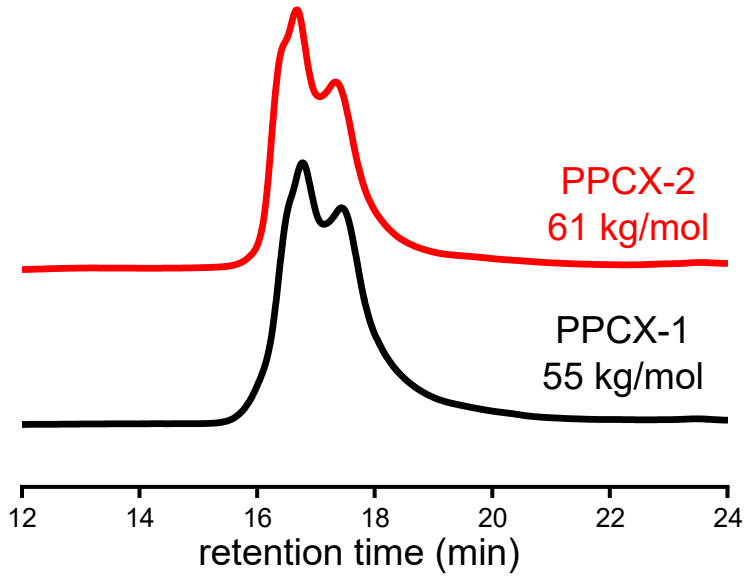


**Figure S4.** GPC curves for synthesized PPCX-1 and PPCX-2.

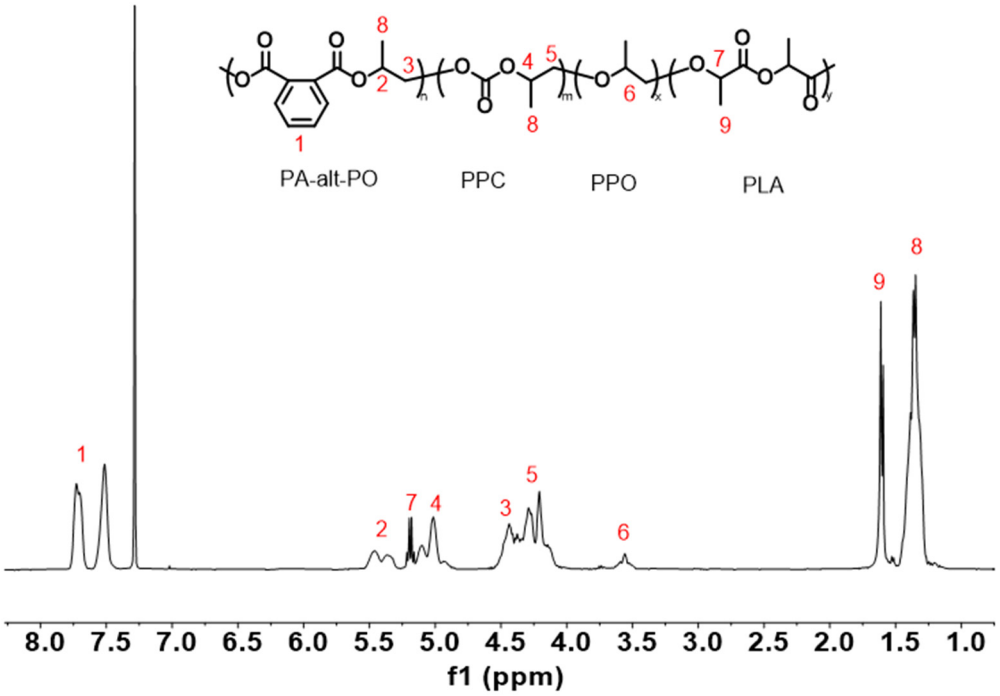


**Figure S5.** $^{1}$H NMR spectrum of synthesized PPCPLA.

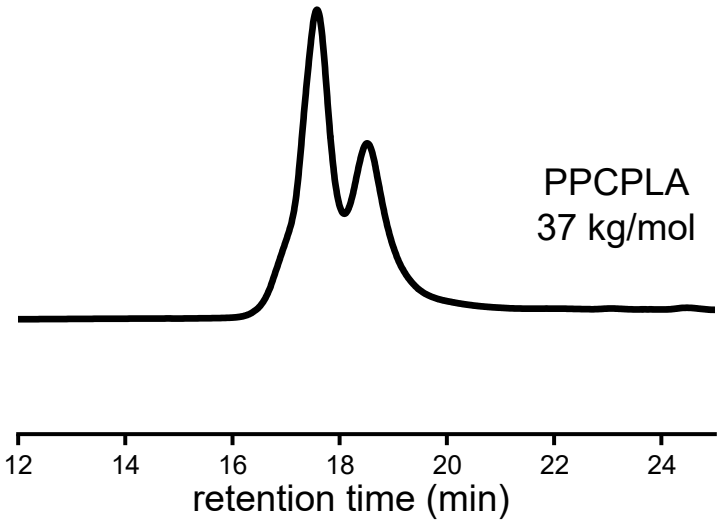


**Figure S6.** DSC curve for PPCPLA.

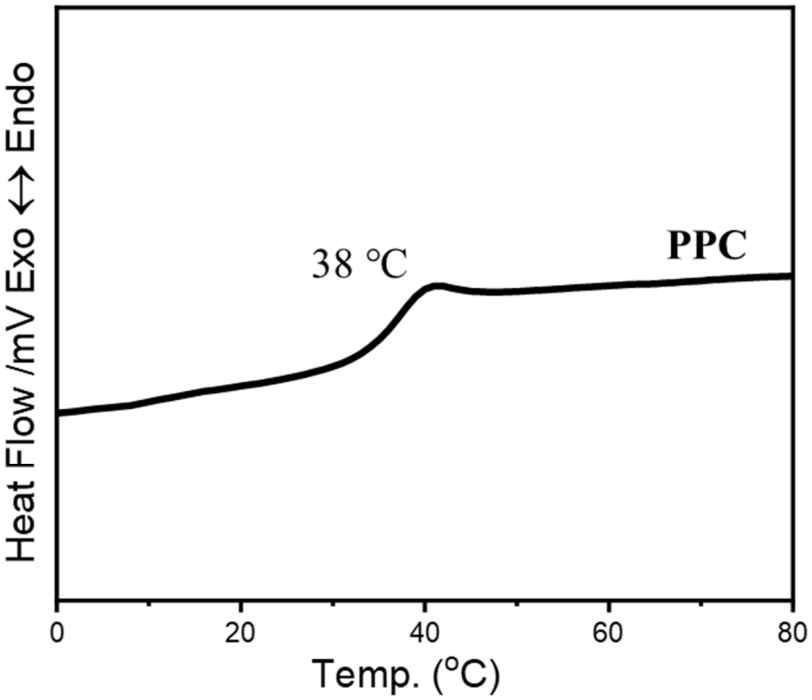


**Figure S7.** DSC curve for synthesized PPC.

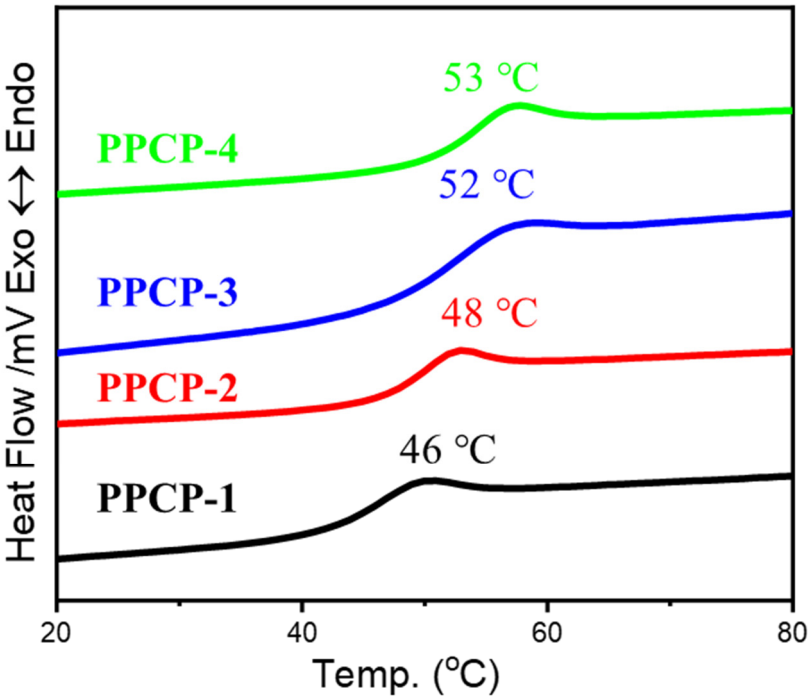


**Figure S8.** DSC curves for synthesized PPCP.

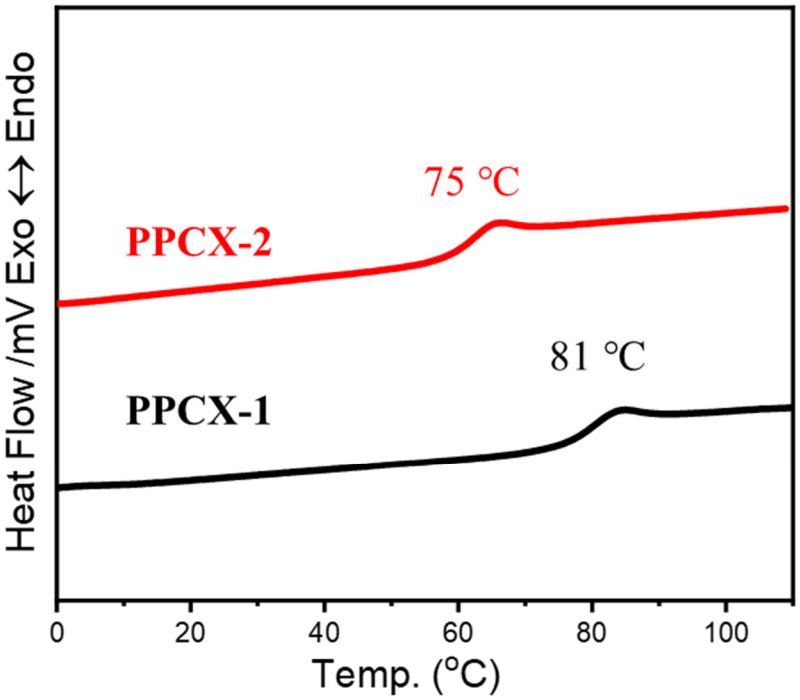


**Figure S9.** DSC curves for synthesized PPCX.

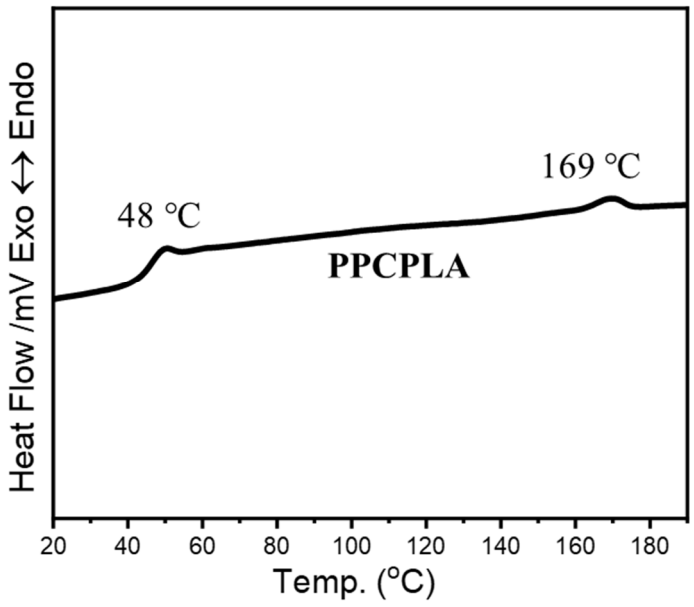


**Figure S10.** DSC curve for synthesized PPCPLA.

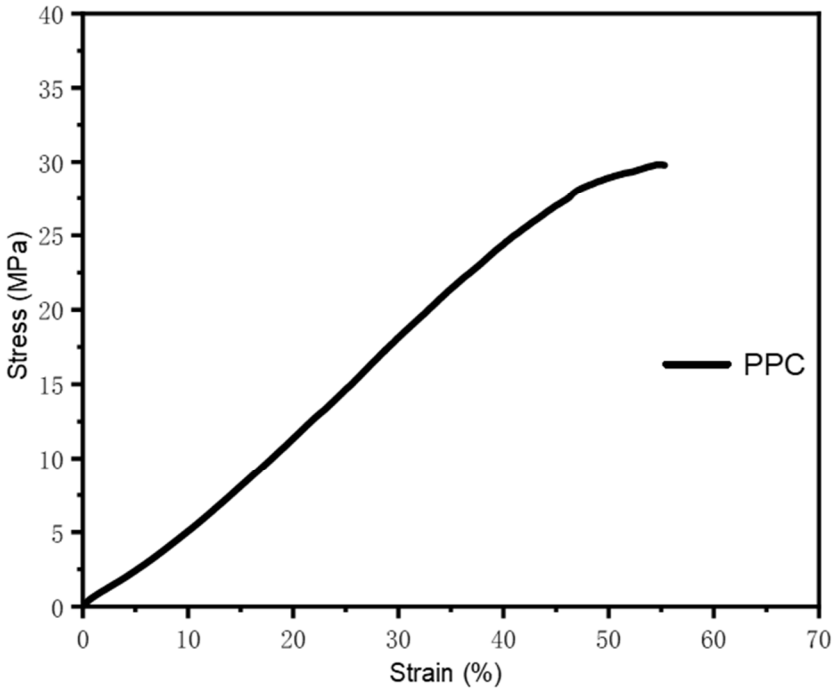


**Figure S11.** Stress-strain curve of synthesized PPC at a stretching rate of 50 mm/min.

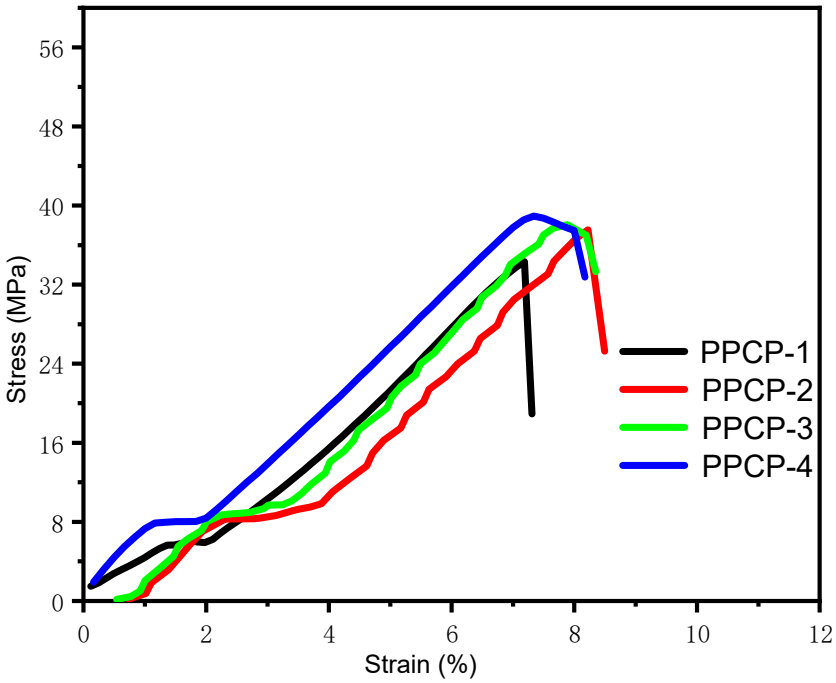


**Figure S12.** Stress-strain curves of synthesized PPCP at a stretching rate of 5 mm/min.

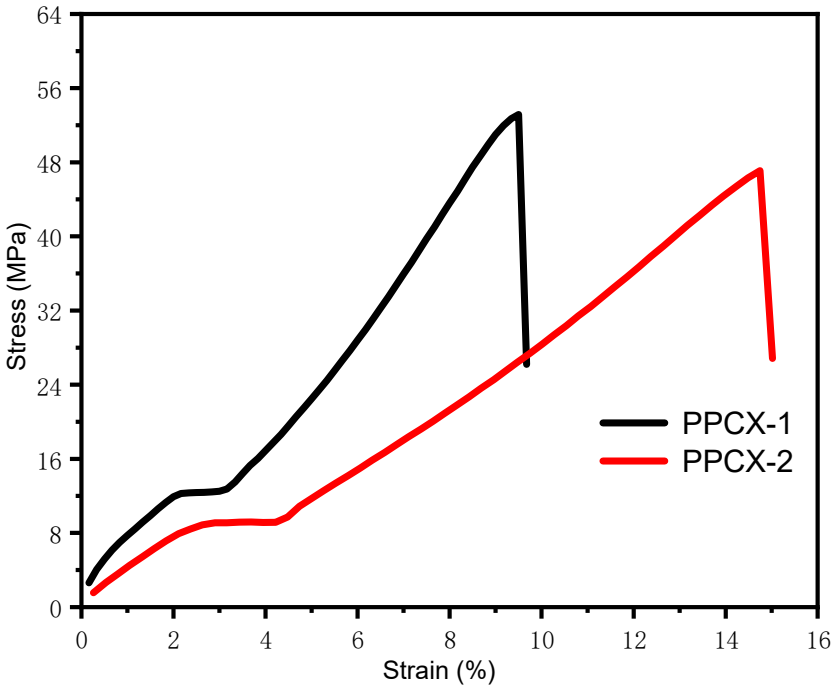


**Figure S13.** Stress-strain curves of synthesized PPCX at a stretching rate of 5 mm/min.

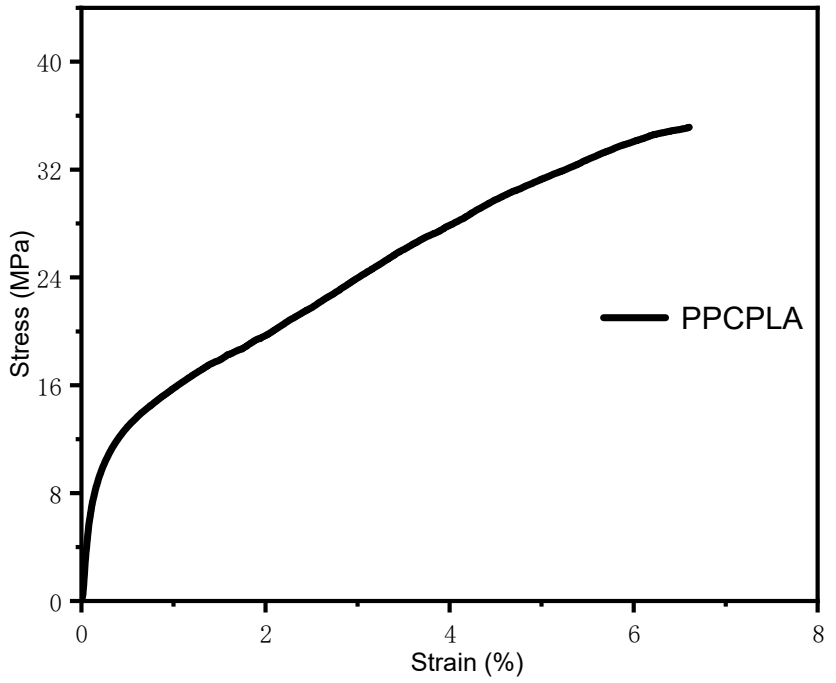


**Figure S14.** Stress-strain curve of synthesized PPCPLA at a stretching rate of 50 mm/min.

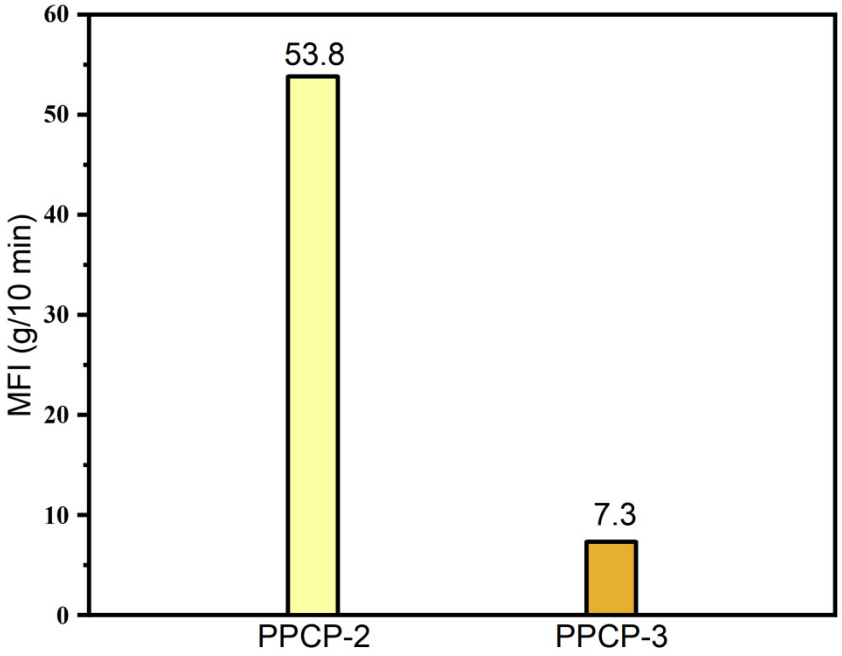


**Figure S15.** MFI of synthesized PPCP-2 and PPCP-4.

**Table S1.** Results of biodegradation for synthesized $CO_2$-derived copolymers.

| Sample | $D_{45}$ [a] (%) | $D_{180}$ [b] (%) | $T_{90\%}$ [c] (days) |
|---|---|---|---|
| Cellulose | 79.4 | 99.9 | 83 |
| PPCP-1 | 35.9 | 90.9 | 178 |
| PPCP-2 | 33.5 | 88.6 | 189 |
| PPCP-3 | 24.5 | 86.9 | 202 |
| PPCX-1 | 20.1 | 76.6 | 223 |
| PPCX-2 | 27.9 | 81.7 | 215 |
| PPCPLA | 44.9 | 91.2 | 177 |

[a] The biodegradation rate of the sample on the 45th day. [b] The biodegradation rate of the sample on the 180th day [c] The number of days required for the biodegradation rate to reach 80%.

**Table S2.** Germination results of lettuce and radish seeds in sample compost and blank compost soils [a].

| Seed Type | Soil Type [b] | Average Germination Count | Average Germination Rate |
|---|---|---|---|
| Radish | 25% blank compost | 49.7 | 99.3% |
| Radish | 25% sample compost | 48.0 | 96.0% |
| Radish | 50% blank compost | 48.3 | 96.7% |
| Radish | 50% sample compost | 47.0 | 94.0% |
| Lettuce | 25% blank compost | 49.3 | 98.7% |
| Lettuce | 25% sample compost | 49.7 | 99.3% |
| Lettuce | 50% blank compost | 39.0 | 78.0% |
| Lettuce | 50% sample compost | 37.3 | 74.7% |

[a] Each result represents the average germination count from three independent experiments with 50 seeds per group. [b] 25% and 50% blank compost: mixture of blank compost and nutrient-rich humus soil at 25:75 and 50:50 weight ratio. 25% sample compost and 50% sample compost are prepared using sample compost.