

## Supporting Information

### Biopolymers as Sustainable Metal Bio-Adhesives

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**Table S1.** Effect of amount of alginate (pull test, 4 cm diameter plates).<sup>a</sup>

| Entry | Mass [mg] | Sample 1 [kg] | Sample 2 [kg] | Sample 3 [kg] |
|-------|-----------|---------------|---------------|---------------|
| 1     | 25        | 28.5          | 3.5           | 28.5          |
| 2     | 50        | 18.5          | 23.5          | 28.5          |
| 3     | 75        | 28.5          | 28.5          | 18.5          |
| 4     | 100       | 28.5          | 28.5          | 28.5          |

<sup>a</sup>Conditions: Mass of alginate solution (7 wt.% in H<sub>2</sub>O) used, metal = brass. \* Withstood maximum load without adhesive failure.

**Table S2.** Effect of drying time (pull test, 4 cm diameter plates).<sup>a</sup>

| Entry | Time [h] | Sample 1 [kg] | Sample 2 [kg] | Sample 3 [kg] |
|-------|----------|---------------|---------------|---------------|
| 1     | 6        | 1             | 6             | 6             |
| 2     | 24       | 13.5          | 13.5          | 21            |
| 3     | 48       | 26            | 28.5          | 28.5          |
| 4     | 168      | 28.5          | 28.5          | 28.5          |

<sup>a</sup>Conditions: 7 wt.% alginate in H<sub>2</sub>O, metal: brass, 1.5 min pulling time, 2.5 kg increase starting from 1 kg to 28.5 kg.

**Table S3.** Effect of metal and surface area (pull test, 4 cm diameter plates).<sup>a</sup>

| <b>Entry</b> | <b>Metal</b> | <b>1<sup>st</sup> run</b><br><b>[kg]</b> | <b>2<sup>nd</sup> run</b><br><b>[kg]</b> | <b>3<sup>r</sup>d run</b><br><b>[kg]</b> |
|--------------|--------------|--|--|--|
| 1            | Al           | 28.5                                     | 28.5                                     | 28.5                                     |
| 2            | Brass        | 28.5                                     | 28.5                                     | 28.5                                     |
| 3            | Cu           | 28.5                                     | 28.5                                     | 28.5                                     |

|   |      |      |      |      |
|---|------|------|------|------|
| 4 | SST  | 28.5 | 28.5 | 28.5 |
| 5 | HDPE | 28.5 | 28.5 | 28.5 |
| 6 | Fe   | 28.5 | 28.  | 28.5 |
| 7 | Ti   | 28.5 | 28.5 | 28.5 |

<sup>a</sup>Conditions: 7 wt.% alginate in H<sub>2</sub>O, 100 mg/sample, 1.5 min pulling time, 2.5 kg increase starting from 1 kg to 28.5 kg.

**Table S4.** Effect of metal and surface area (pull test, 2 cm diameter plates).<sup>a</sup>

| Entry | Metal | 1 <sup>st</sup> run<br>[kg] | 2 <sup>nd</sup> run<br>[kg] | 3 <sup>rd</sup> run<br>[kg] |
|-------|-------|-----------------------------|-----------------------------|-----------------------------|
| 1     | Al    | 28.5                        | 28.5                        | 28.5                        |
| 2     | Brass | 26                          | 26                          | 28.5                        |
| 3     | Cu    | 28.5                        | 28.5                        | 28.5                        |
| 4     | HDPE  | 11                          | 18.5                        | 13.5                        |
| 5     | Fe    | 28.5                        | 26.5                        | 28.5                        |
| 6     | Ti    | 28.5                        | 28.5                        | 18.5                        |

<sup>a</sup>Conditions: 7 wt.% alginate in H<sub>2</sub>O, 100 mg/sample, 1.5 min pulling time, 2.5 kg increase starting from 1 kg to 28.5 kg.

**Table S5.** Effect of metal and surface area (peel test, 4 cm diameter plates).<sup>a</sup>

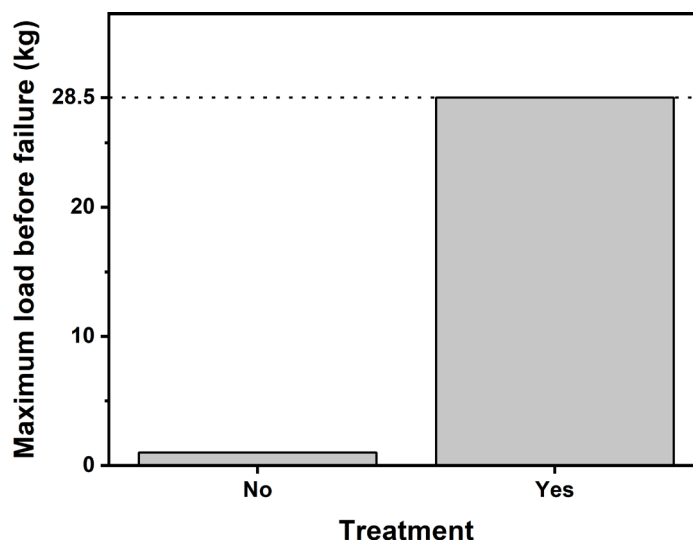
| Entry | Metal | 1 <sup>st</sup> run<br>[kg] | 2 <sup>nd</sup> run<br>[kg] | 3 <sup>rd</sup> run<br>[kg] |
|-------|-------|-----------------------------|-----------------------------|-----------------------------|
| 1     | Al    | 18.5                        | 28.5                        | 21                          |
| 2     | Brass | 21                          | 18.5                        | 26                          |
| 3     | Cu    | 28.5                        | 28.5                        | 28.5                        |
| 4     | SST   | 8.5                         | 8.5                         | 18.5                        |
| 5     | HDPE  | 11                          | 11                          | 11                          |
| 6     | Fe    | 11                          | 13.5                        | 6                           |
| 7     | Ti    | 13.5                        | 8.5 <sup>a</sup>            | 6                           |

<sup>a</sup>Conditions: 7 wt.% alginate in H<sub>2</sub>O, 100 mg/sample, 1.5 min pulling time, 2.5 kg increase starting from 1 kg to 28.5 kg.

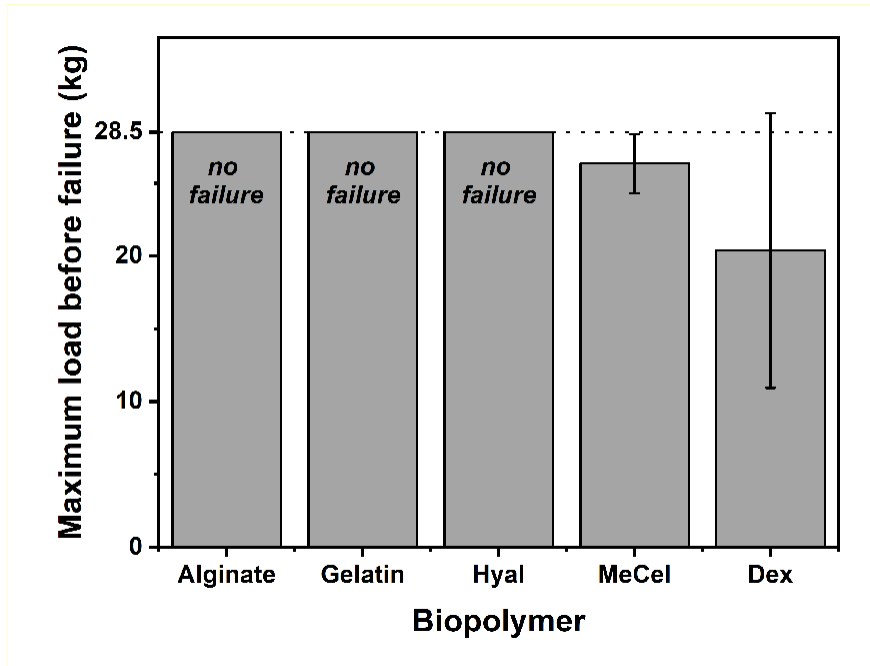
**Table S6.** Effect of metal and surface area (peel test, 2 cm diameter plates).<sup>a</sup>

| Entry | Metal | 1 <sup>st</sup> run<br>[kg] | 2 <sup>nd</sup> run<br>[kg] | 3 <sup>rd</sup> run<br>[kg] |
|-------|-------|-----------------------------|-----------------------------|-----------------------------|
| 1     | Al    | 3.5                         | 1                           | 1                           |
| 2     | Brass | 1                           | <1                          | <1                          |
| 3     | Cu    | 1                           | <1                          | 3.5                         |
| 5     | HDPE  | <1                          | <1                          | <1                          |
| 6     | Fe    | 3.5                         | <1                          | <1                          |
| 7     | Ti    | 6                           | 6                           | 6                           |

<sup>a</sup>Conditions: 7 wt.% alginate in H<sub>2</sub>O, 100 mg/sample, 1.5 min pulling time, 1 kg increase starting from 1 kg to 28.5 kg.



**Figure S1.** Effect of treatment on adhesive failure (pull test, 4 cm diameter brass plates).



**Figure S2.** Effect of treatment on adhesive failure (pull test, 4 cm diameter brass plates).