## Supplementary Materials:

***Table S1.*** *Parameters trialled in macroalgae decellularization protocols*

| | **Chemical treatment** | | |
|---|---|---|---|
| **Parameter** | SDS | $NaCO_2$ / NaClO | Triton X-100 / NaClO |
| Concentration (%) | 0.1, 0.5, 10 | 3 / 0.3 | 1 / 0.1 |
| Time (days) | 0.5, 2, 5, 6, 8 | 1 | 1, 14, until cleared |
| Temp ($^oC$) | 20 | 60 | 20, 60 |

***Table S2.*** *Pigment clearance from Durvillaea poha differs with chemical treatment*

| | Pigment clearance (%)* | | |
|---|---|---|---|
| **Treatment protocol** | **Blade** | **Palm** | **Stipe** |
| 0.1% SDS; 20ºC; 2 days[#] | 18.4 | 18.8 | 19.4 |
| 0.1% SDS; 20ºC; 8 days[#] | 17.3 | 14.4 | -9.5 |
| 0.5% SDS; 20ºC; 0.5 days - extended to 6 days[†] | 23.4 | 17.0 | 4.2 |
| 3% $NaCO_3$ / 0.3% NaClO; 60ºC; 1 day[§] | 25.8 | -34.6 | -64.3 |
| 10% SDS; 20ºC; 5 days; followed by 1% Triton X-100 / 0.1% NaClO; 60ºC; 1 day[§] | 76.6 | 61.2 | 25.0 |
| 10% SDS; 20ºC; 5 days; followed by 1% Triton X-100/0.1% NaClO; 20ºC; until cleared[§] | 87.1 | 89.3 | 86.4 |

** Pigment clearance is presented as the mean percentage reduction in mean gray value relative to native; n ≤ 3. Adapted from [#]Modulevsky et al., 2016, [†]Modulevsky et al., 2014, or [§]Adamski et al., 2018.*

***Table S3.*** *DNA clearance from macroalgae species differs with chemical treatment*

| | **DNA clearance (%)*** | | |
|---|---|---|---|
| **Treatment Protocol** | ***D. poha*** | ***U. lactuca*** | ***E. radiata*** |
| 10% SDS; 20ºC; 5 days; followed by 1% Triton X-100 / 0.1% NaClO; 20ºC; until cleared | 76.2 | - | - |
| 10% SDS; 20ºC; 5 days; followed by 1% Triton X-100 / 0.1% NaClO; 20ºC; 14 days | 97.8 | - | - |
| 1% Triton X-100 / 0.1% NaClO; 20ºC; 5 days | - | 84.0 | 64.5 |
| 1% Triton X-100 / 0.1% NaClO; 20ºC; 7 days | - | 81.5 | 78.0 |
| 1% Triton X-100 / 0.1% NaClO; 20ºC; 10 days | - | 69.3 | 80.3 |
| 1% Triton X-100 / 0.1% NaClO; 20ºC; 14 days | - | 81.6 | 93.7 |

***** *DNA clearance is presented as the percentage reduction in ng DNA/mg tissue relative to native; n = 1.*

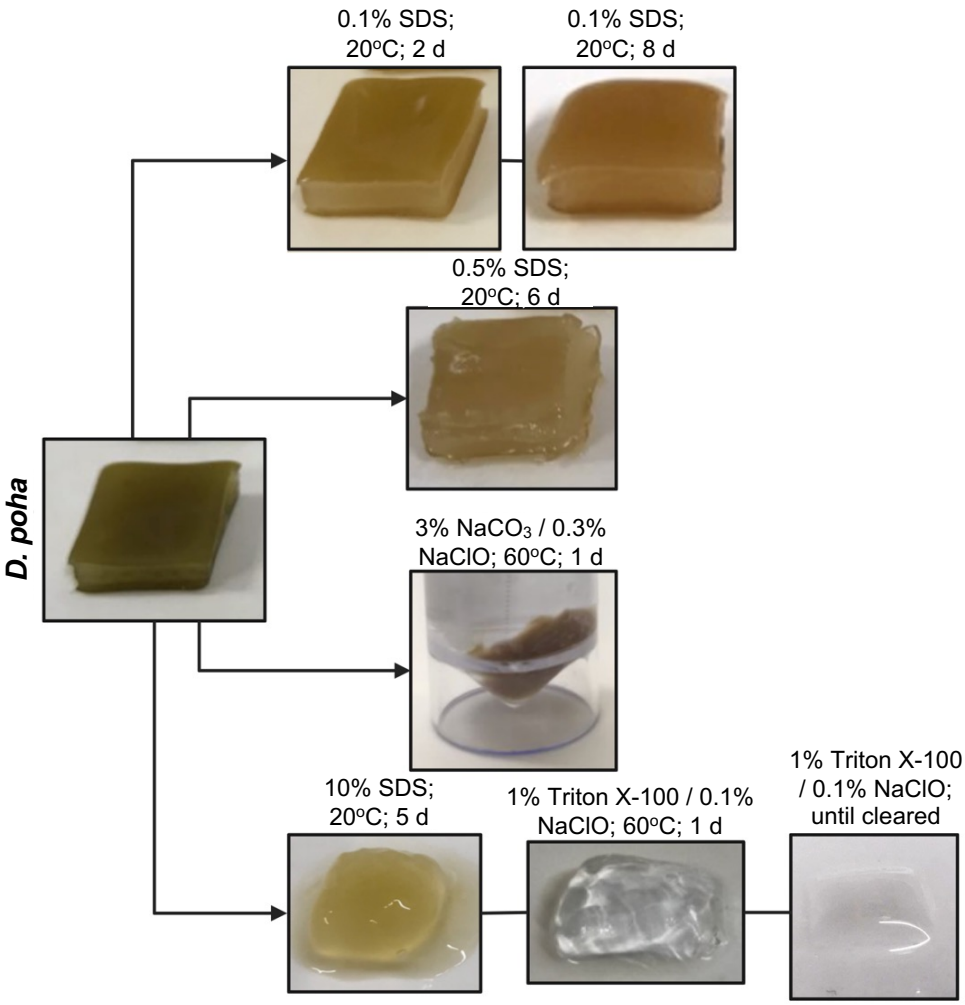



***Figure S1.*** *Treatment parameters trialled in the decellularization of Durvillaea poha. Macroscopic images of D. poha blade samples illustrate differences in their structural integrity and pigment clearance relative to chemical treatment.*

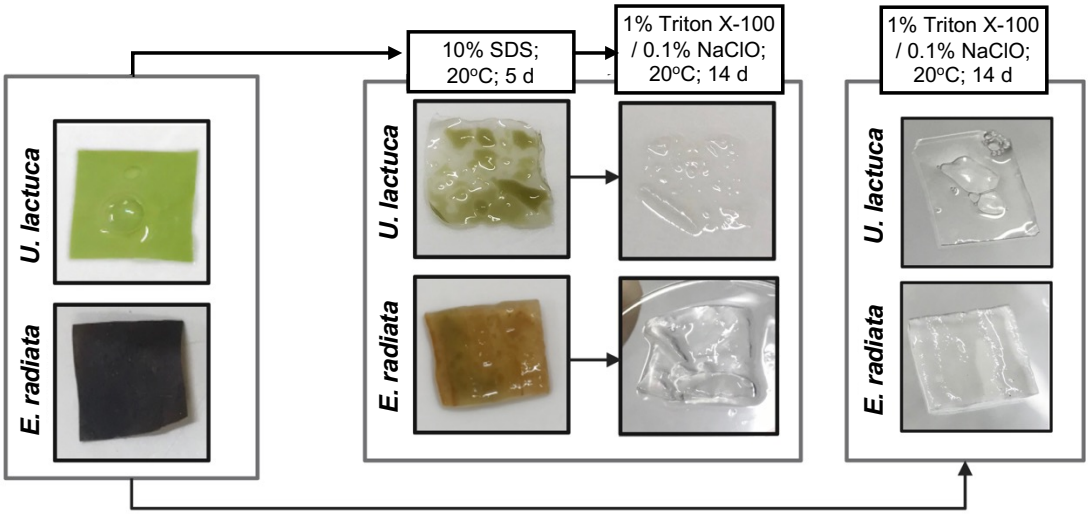



***Figure S2.*** *Treatment parameters trialled in the decellularization of Ulva lactuca and Ecklonia radiata. Macroscopic images of macroalgae samples illustrate differences in their structural integrity and pigment clearance relative to chemical treatment.*

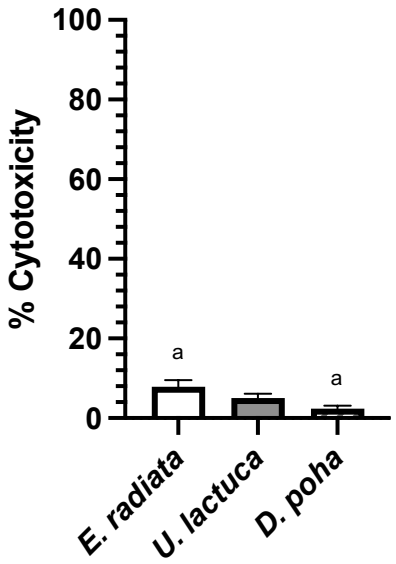



***Figure S3.*** *Macroalgae matrices are biocompatible with human dermal fibroblasts. Durvillaea poha, Ulva lactuca and Ecklonia radiata matrices were seeded with BJ/5Ta cells, with lactate dehydrogenase activity in the conditioned media measured after 24 hours. Data is presented as the mean percentage ± SEM relative to a cytotoxic control; n = 3. Means that differ significantly share letters ($p \leq 0.05$).*

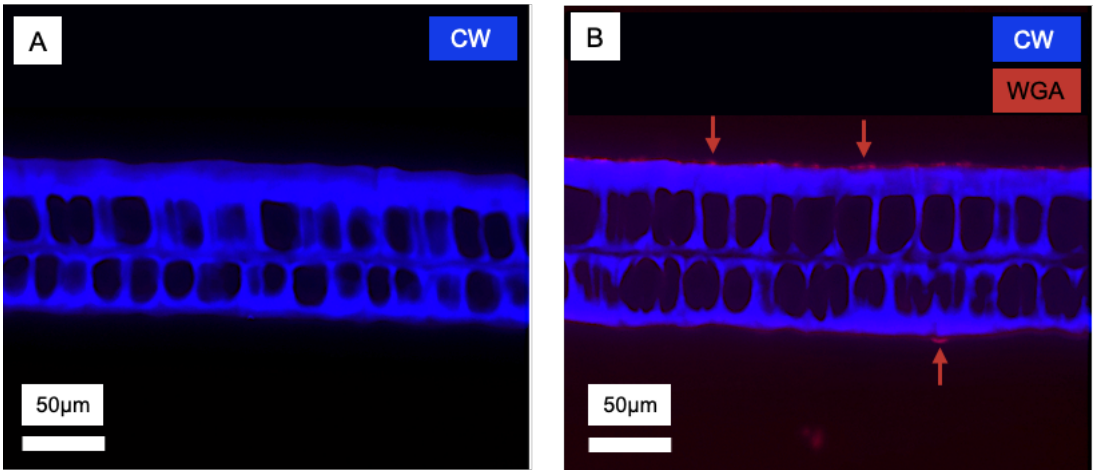



***Figure S4.*** *Wheat germ agglutinin stains glycans on the surface of Ulva lactuca scaffolds in the absence of cells. Representative images of fixed and paraffin-embedded sections of U. lactuca scaffolds after staining with (**A**) calcofluor white (CW; blue) alone or (**B**) in combination with wheat germ agglutinin (WGA; red). Red arrows show surface glycans. Scale bars are as indicated.*