```
Preparation of test sediment samples
     + Marine sediments 300 g (wet weight)
     + Milli-Q water 500 mL
     (+ 1.0, 0.50, and 0.25 % Na<sup>+</sup>-Alg ag 20 mL for spike recovery tests)
Step 1. Enzymatic treatment to remove cellulose, lipids, proteins, and pectin
    + Amylase 0.80 g (27 °C, 30 min, pH 6.0)
     + Cellulase 0.80 g (50 °C, 30 min, pH 6.0)
    + Protease 0.80 g (50 °C, 30 min, pH 5.5)
                                                  The pH was adjusted with
     + Pectinase 0.80 g (38 °C, 30 min, pH 4.2) 1.0 mol L<sup>-1</sup> HCl and 3.0 mol L<sup>-1</sup> NaOH ag
Step 2. Gelation of Na<sup>+</sup>-Alg and acidification to remove non-targeted
          compounds
    + 10 % CaCl<sub>2</sub> aq 100 mL
    + 5.0 mol L<sup>-1</sup> HCl 15 mL (adjust pH to 1.0)
       (Leave overnight)
 Centrifugation and recovery of precipitate
     + 0.10 mol L<sup>-1</sup> HCl 40 mL to precipitates in each tubes
 Centrifugation and recovery of precipitate
Step 3. Alkaline extraction to dissolve alginate gel
    + 8.0 % EDTA-2Na aq 500 mL, stir for 1.5 h (pH 4.0)
       (Leave overnight)
    + 3.0 mol L<sup>-1</sup> NaOH ag (adjust pH to 5.0), stir for 1.5 h
        (Leave overnight)
 Centrifugation and recovery of supernatant
Step 4. Gelation of Na<sup>+</sup>-Alg into Ca<sup>2+</sup>-Alg
    + 30 % CaCl<sub>2</sub> ag 100 mL
       (Leave overnight)
 Centrifugation and recovery of precipitate
Step 5. Hydrochloric acid washing to remove oligosaccharides
    + 0.1 mol L<sup>-1</sup> HCl 20 mL to precipitates in each tubes and shake \leftarrow
                                                                                    Repeat until almost
                                                                                    all oligosaccharides
 Centrifugation and recovery of precipitate
                                                                                    are removed
Step 6. Collection of Na<sup>+</sup>-Alg
    + 1.0 % NaHCO<sub>3</sub> aq 20-100 mL, 60°C, stir for 1.5 h
        (Leave overnight)
 Centrifugation and recovery of supernatant
Step 7. Prepare the solution for colorimetric analysis
     + Milli-Q water to dilute 20-100-fold
Colorimetric analysis by m-hydroxydiphenyl method
```

Figure S1: A complete overview of the modified extraction protocol.