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Dataset for natural organic matter treatment by tailored biochars

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The dataset presented here are collected for tailoring biochars from pinecone biomass through chemical modification for the adsorption of natural organic matter (NOM) from lake water. The data includes schematics, figures and tables. The characterization of biomass and tailored biochars by Brunauer, Emmett and Teller surface area measurement (BET), thermogravimetric analysis (TGA), energy dispersive X-ray (EDX) along with the adsorption of NOM from lake water by the tailored bichars and the desorption using alkaline solution are provided. This is complimentary dataset for the experimental set-up and data gathered related to the article [1] on biochar fabrication and lake water treatment. See this article [1] for further information and discussion.

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Specifications Table

<table>
<thead>
<tr>
<th>Subject area</th>
<th>Environmental Chemistry</th>
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<tbody>
<tr>
<td>More specific subject area</td>
<td>Biochar fabrication and water treatment though adsorption process</td>
</tr>
<tr>
<td>Type of data</td>
<td>Table, image, graph, figure</td>
</tr>
<tr>
<td>How data was acquired</td>
<td>Brunauer, Emmett and Teller surface area measurement (BET) (Tristar II-Micromeritics USA), thermogravimetric analysis (TGA) (TA instruments — TGA Q500 USA), energy dispersive X-ray (EDX) (JEOL JSM-7500FA analytical field emission scanning electron microscope), adsorption and desorption batch experiments, spectrophotometer (UV-1201 Shimadzu)</td>
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<tr>
<td>Data format</td>
<td>Raw and analyzed</td>
</tr>
<tr>
<td>Experimental factors</td>
<td>Adsorbent dosage, pH, desorption and re-adsorption percentage</td>
</tr>
<tr>
<td>Experimental features</td>
<td>Adsorption batch tests were conducted to collect NOM adsorption data in different water pH. Desorption data were gathered through batch experiments with deionized water, 3 mM NaOH, and 30 mM NaOH</td>
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<tr>
<td>Data source location</td>
<td>Lake water samples were collected from Lake Pitkäjärvi, Espoo, Finland (60° 15’ 10.8” N, 24° 44’ 49.2” E)</td>
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<tr>
<td>Data accessibility</td>
<td>Data is with this article [1]</td>
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</table>

Value of the data

- This dataset is complimentary for experimental design and data gathered for the article [1] on biochar fabrication and lake water treatment
- It provides the steps involved in tailoring biochar from biomass
- BET and TGA and EDX data for characterizing the tailored biochars and biomass
- NOM desorption data from the spent biochar using alkaline solutions and NOM reabsorption data by the regenerated biochar from the lake water
- Further illustrations for the readers of this article [1].

1. Data

Two methods illustrated in Fig. 1 were used to tailor four types of biochars, see for the complete fabrication process in Ref. [1]. The absorbance data measured for lake water samples was converted to concentration data using the CODMn calibration curve, depicted in Fig. 2. Thermogravimetric analysis of the pinecone biomass measured by TGA is displayed in Fig. 3a. Nitrogen adsorption-desorption isotherms for pinecone biomass and pristine biochar are given in Fig. 3b. Fig. 3c shows the EDX analysis of the tailored biochar (TB-N-I) [1]. Fig. 4a illustrates the optimized adsorbent dose for NOM adsorption from lake water by the tailored biochars. The shift of pH for the batch solutions before and after adsorption with optimized adsorbent under 24 h contact time and room temperature is given in Fig. 4b. The desorption data using alkaline solutions and re-desorption kinetics of NOM from lake water by tailored biochar (TB-N-I) [1] are given in Fig. 5 a and b, respectively.

2. Experimental design, materials and methods

Lake water samples were collected from Lake Pitkäjärvi in Espoo, Finland. The concentration of NOM was calculated via UV absorbance measurement on a UV-1201 Shimadzu-spectrophotometer (254 nm wavelength). Table 1 compiles the kinetic and isotherm models used for modeling kinetics and isotherm of NOM adsorption, see for more discussion in Ref. [1]. The materials were characterized by Brunauer, Emmett and Teller surface area measurement (BET) (Tristar II-Micromeritics USA), thermogravimetric analysis (TGA) (TA instruments — TGA Q500 USA), and energy dispersive X-ray (EDX) (JEOL JSM-7500FA analytical field emission scanning electron microscope) [1]. Adsorption and desorption batch experiments were conducted on a shaker (150 rpm) at room temperature. The
Fig. 1. Schematic illustration of steps involved in tailoring mesoporous biochars from pinecone biomass for NOM adsorption from lake water.

Fig. 2. Lake water calibration curve.
adsorbent dose was optimized within the range 0.1–1 g/L. The shift of pH was observed by adjusting the solution pH at values 2, 4, 8, and 10 using HCl and NaOH. The solution pH was re-measured after adsorption. After the desired contact time, the solutions were filtrated through Sartorius Minisart 0.45 μm filters for the CODMn concentration measurement. The desorption data were determined with three desorption solutions, deionized water, 3 mM NaOH, and 30 mM NaOH at several time intervals from below 1 min to 24 h.
We thank Aino Peltola for her help with NOM measurements at analytical water laboratory, Aalto University. The first author would like to acknowledge the financial support from Doctoral School of Aalto University and Foundation for Aalto University Science and Technology.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

