

Oyster shell powder-loaded cellulose gel bead as a high-efficiency adsorbent for phosphorus recovery: Preparation, kinetics, isotherms and thermodynamic studies

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1. Oyster Shell (OS) and Oyster Shell Powder (OSP)

The oyster shells were harvested from the beach of Techeng Island in Zhanjiang. The collected oyster shells have been naturally washed by seawater, appearing clean and free from impurities, exhibiting a white color. These oyster shells required no further extensive treatment and were directly fed into a grinder for pulverization. After passing through a 100-mesh sieve, experimental-grade OSP was obtained. The OS and OSP was illustrated in Figure S1.

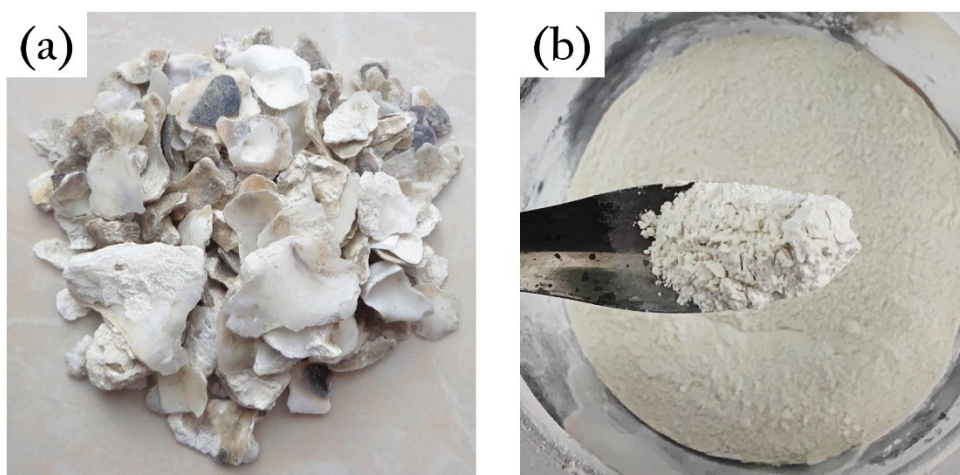


Figure S1. Optical images of (a) Oyster shell and (b) Oyster shell powder.

2. Kinetics of Phosphate Adsorption by Pure OSP

To investigate the effect of thermal treatment on the adsorption efficiency of oyster shell powder (OSP), we prepared both non-thermally treated OSP and OSP calcined at 1200°C for 2 hours as adsorbents. The typical adsorption experiment procedure is as follows. To a 250 mL conical flask, 0.1 g OSP or OSP₁₂₀₀ was added, then 150 mL of phosphorus solution with an initial concentration of 50 mg/L was added into the flask. The solution was stirred at room temperature, and was collected at intervals of 0.2, 0.5, 1, 2, 4, 6, 8, 10, 12, 15, 24, 36, and 48 h, and immediately filtered through a 0.45 μm aqueous filter membrane. The phosphate concentration in the filtrate was subsequently measured. All the experiments were performed in triplicate and the average values were operated. The adsorption of phosphate by OSP and OSP₁₂₀₀ was illustrated in Figure S2.

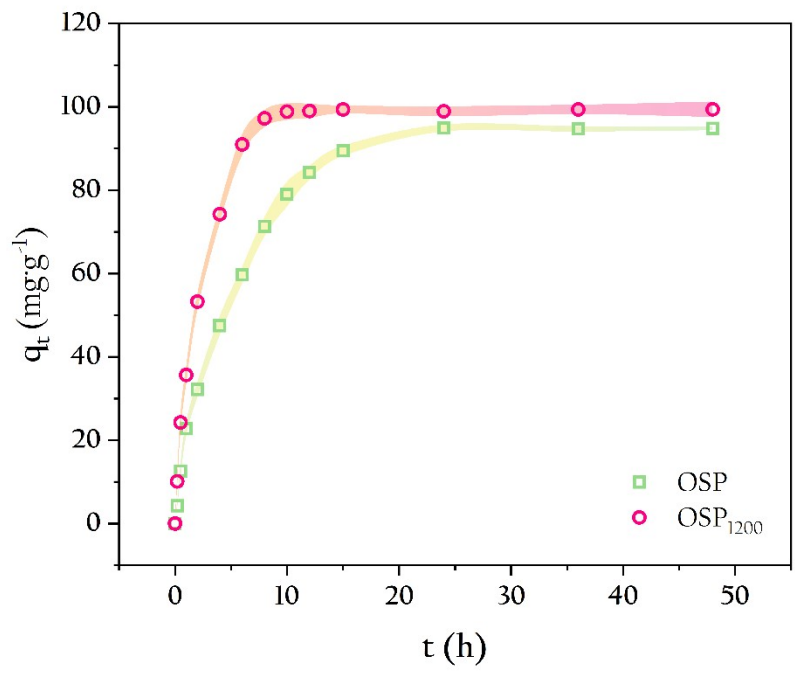


Figure S2. The kinetics data for phosphate adsorption onto OSP and OSP₁₂₀₀.