

Supplementary Materials: Highly stable and nontoxic Lanthanum-treated activated palygorskite for the removal of lake water phosphorus

Bhabananda Biswas and Ravi Naidu

1. Material's state after calcination

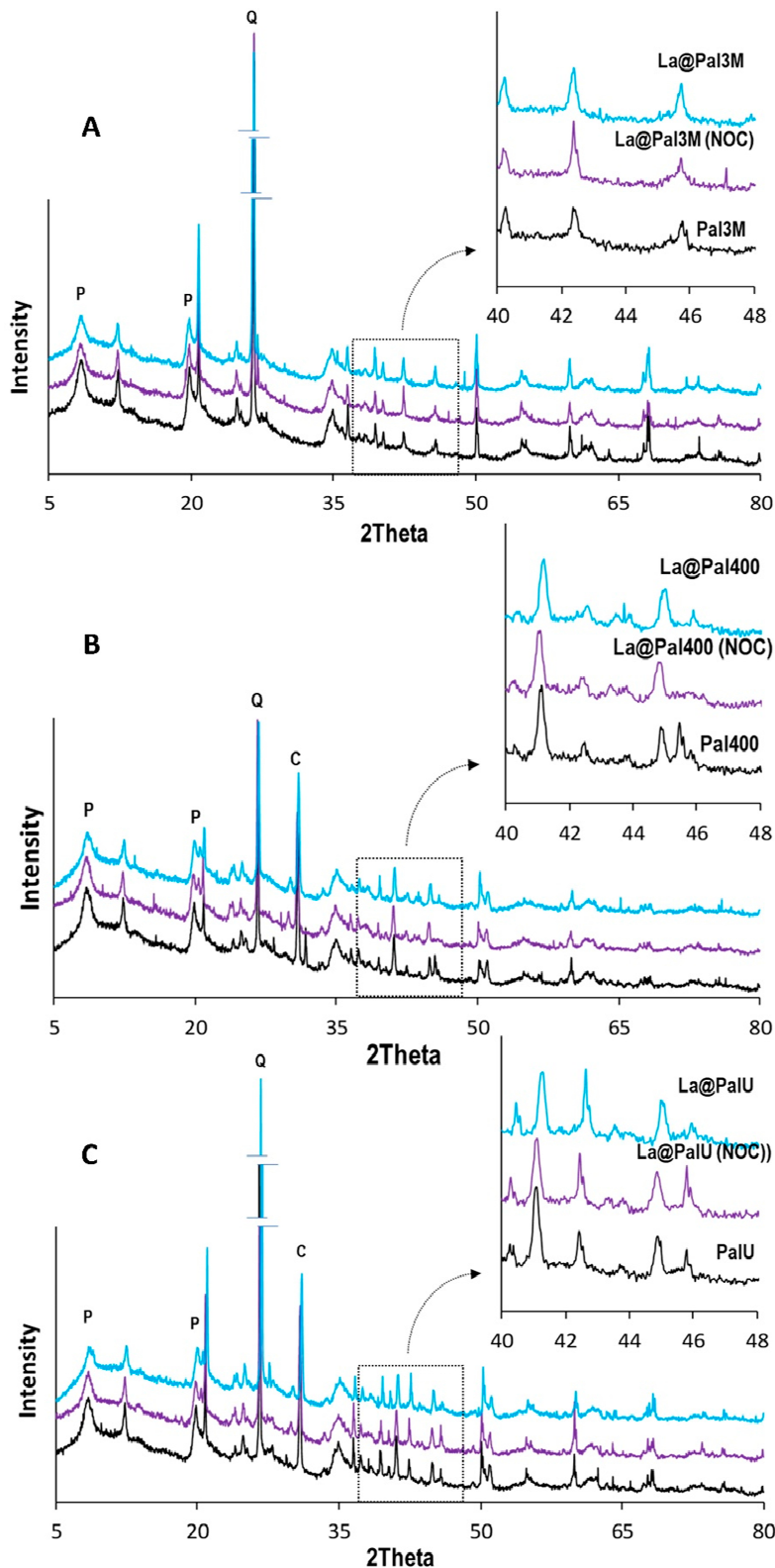


Figure S1. XRD of raw and modified palygorskites. A, PalU and its modifications, B, Pal400 and its modifications, and C, Pal3M and its modifications. NOC = non-calcinated. In the peak annotation: P = palygorskite, Q = quartz, C = carbonate material. Inset figure is presented to reveal if any noticeable mineral phase of lanthanum oxides are available.

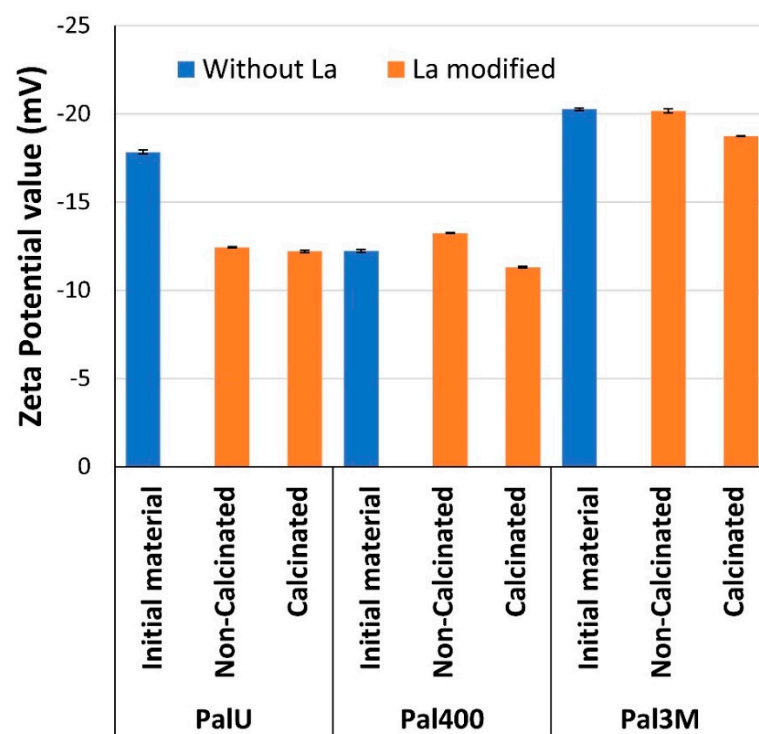


Figure S2. Zeta potential of raw and its modified materials with and without calcination.

2. Microbial toxicity test using growth curve

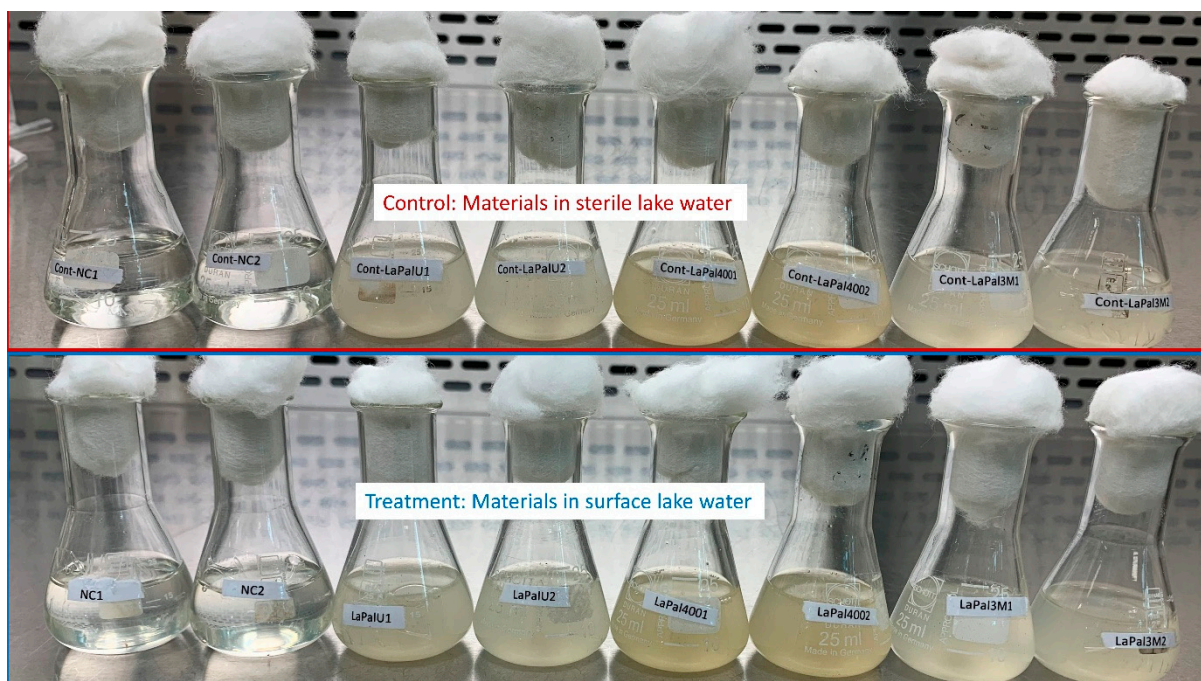


Figure S3. Culture media (lake water and sterile lake water) in the presence of materials (0.1% concentration w/v). Cont = Control, NC = No clay, PalU = unmodified palygorskite, Pal400 = palygorskite heated at 400 °C, Pal3M = palygorskite treated with 3M hydrochloride acid, LaPalU1 means lanthanum treated PalU replicate 1 and so on.

3. SEM, EDS and TEM images of the parent clay (palygorskite)

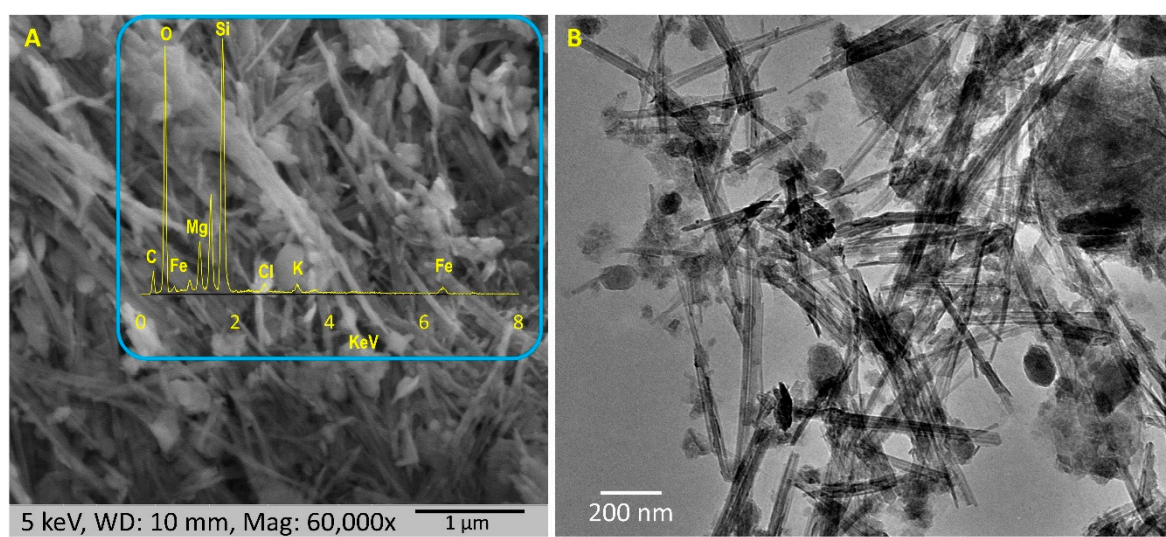


Figure S4. The SEM image and EDS profile (inset figure) of raw palygorskite (geological source: Western Australia) (A) and TEM image of the same. TEM images were obtained from the ethanol dispersed fine particles on the 200 mesh Cu (carbon-coated) grid. The accelerated voltage was 200 kV on a JEOL JEM-2100F-HR Transmission Electron Microscopy (Japan).

4. XPS model fitting of O 1s and C 1s

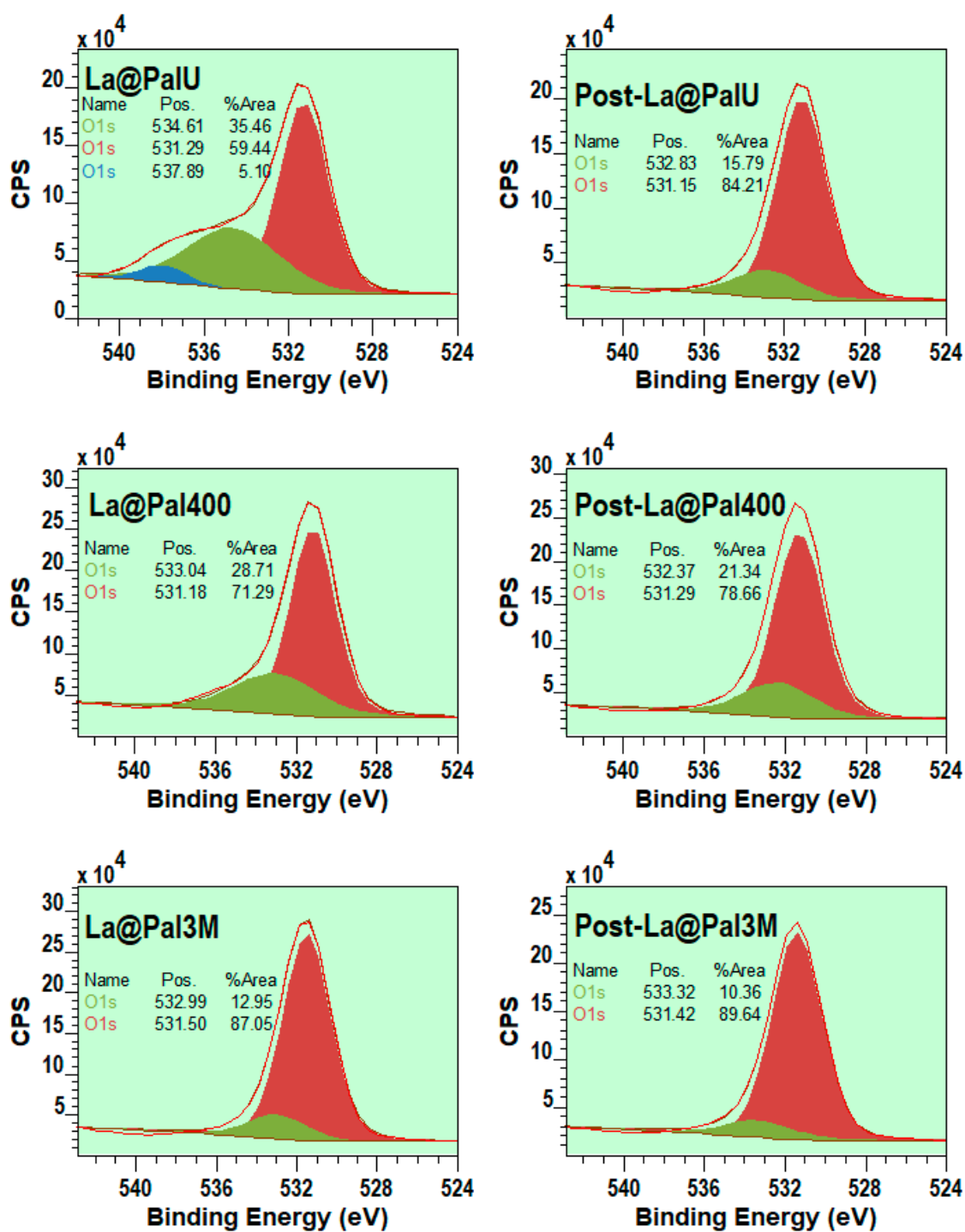


Figure S5. High-resolution XPS and model fitting of O1s signature spectra. The inset table provides the position and area derived as a result of model fitting using C1s calibration of 284.8 eV using CasaXPS Kratos library.

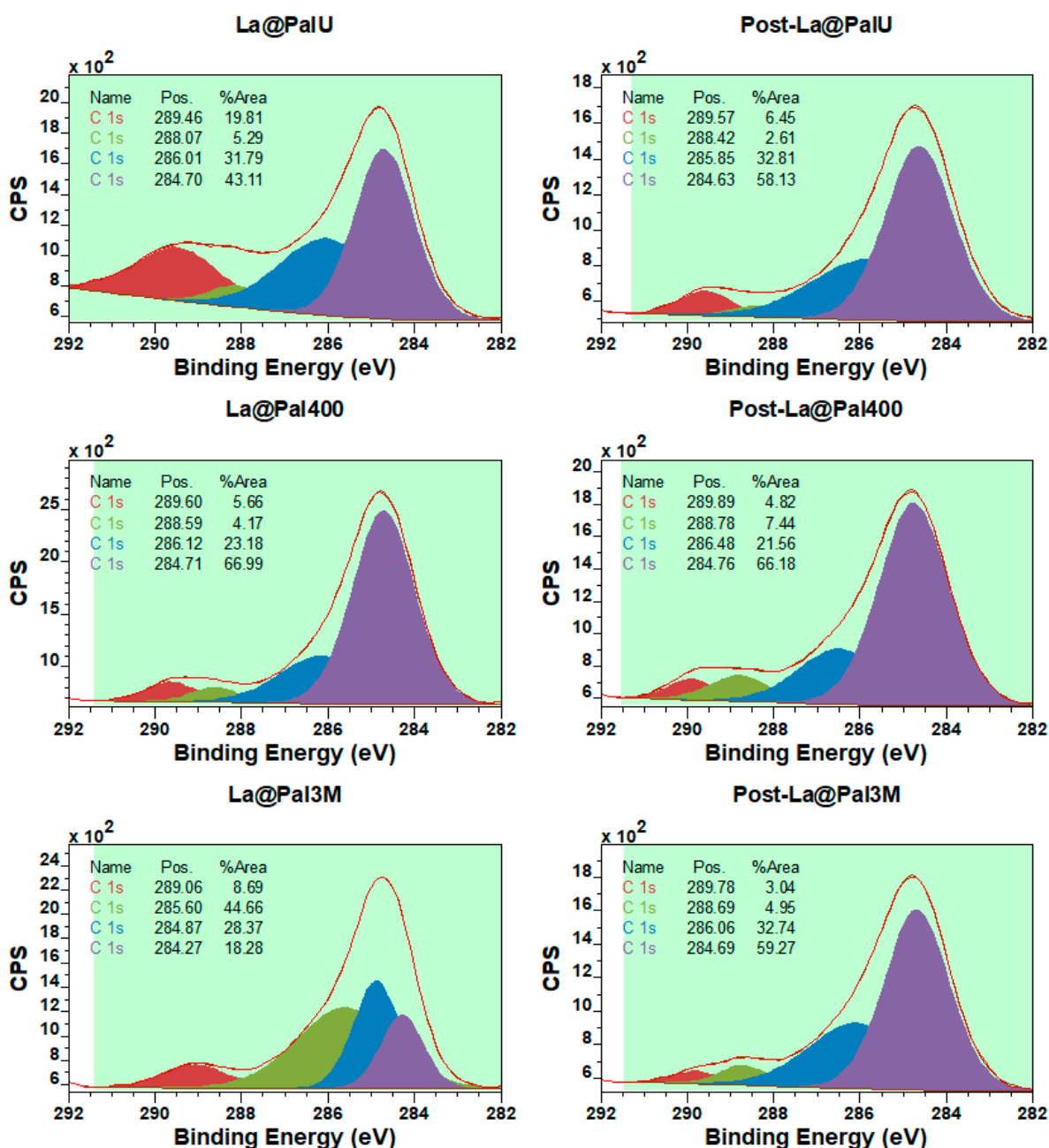


Figure S6. High-resolution XPS and model fitting of C 1s signature spectra. The inset table provides the position and area derived as a result of model fitting using C1s calibration of 284.8 eV using CasaXPS Kratos library. **Reduction of %area of ~290 eV position in the post-adsorption material:** La@PalU = 67.44%, La@Pal400 = 14.80% and La@Pal3M = 65.02%.

5. Visual inspection of the settling of the modified palygorskite

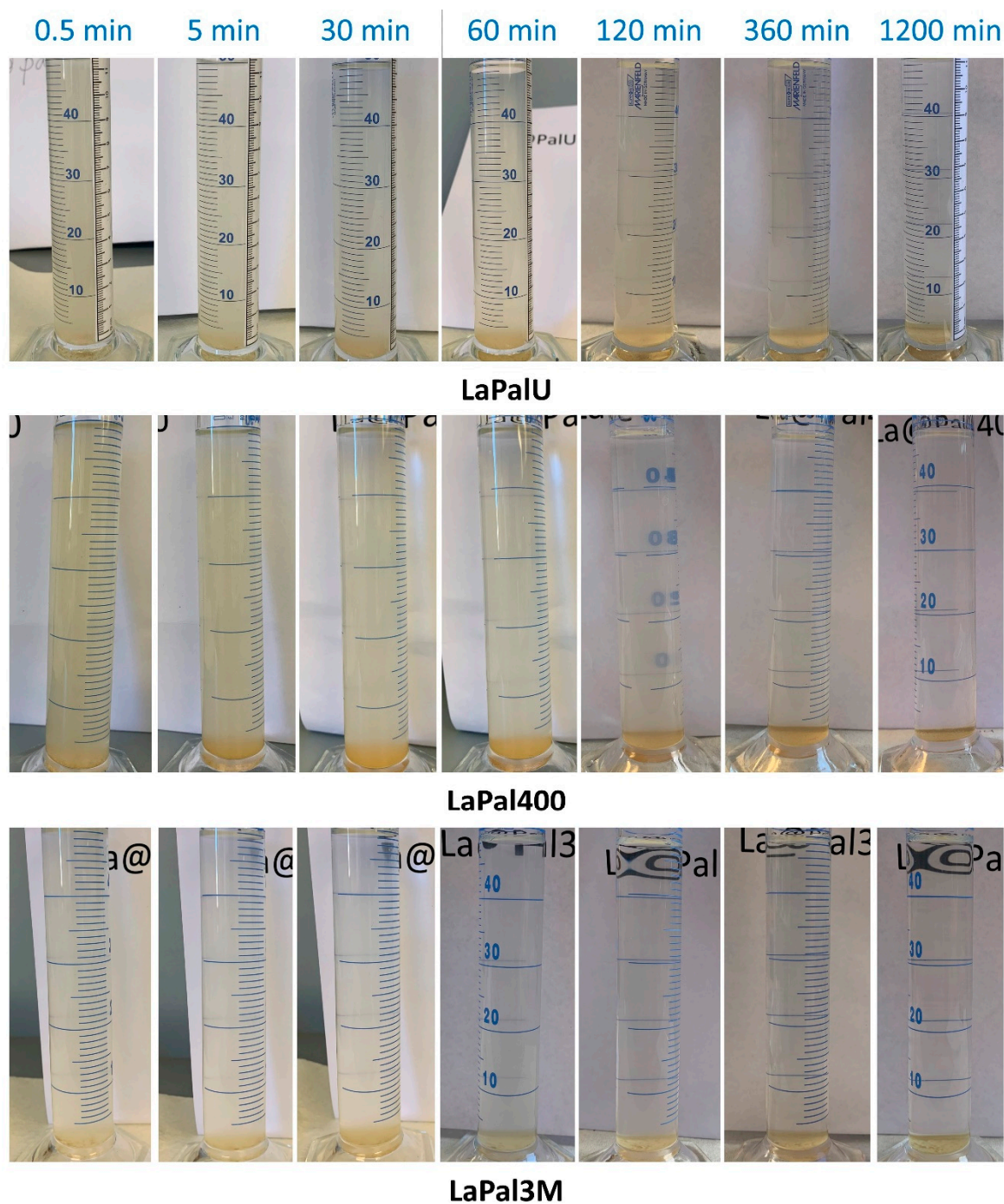


Figure S7. The visual inspection of settling and turbidity of materials in a 50 mL cylindrical lake water column.

6. Microbial toxicity test using growth curve – only early phase

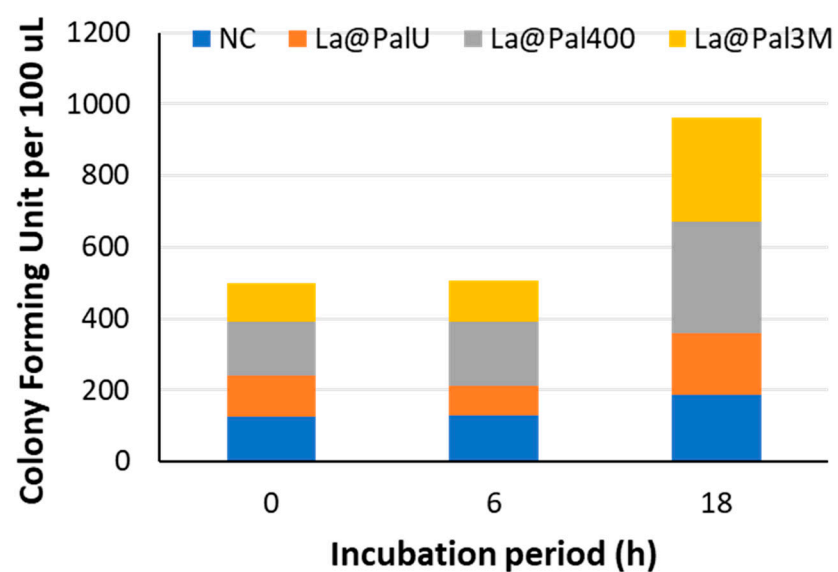


Figure S8. Colony-forming unit from the raw (NC = no clay) and material-spiked lake water in the relatively early stage of material-bacterial interaction.