Supplementary Materials

Part A

Particle size analysis of the feed slurry

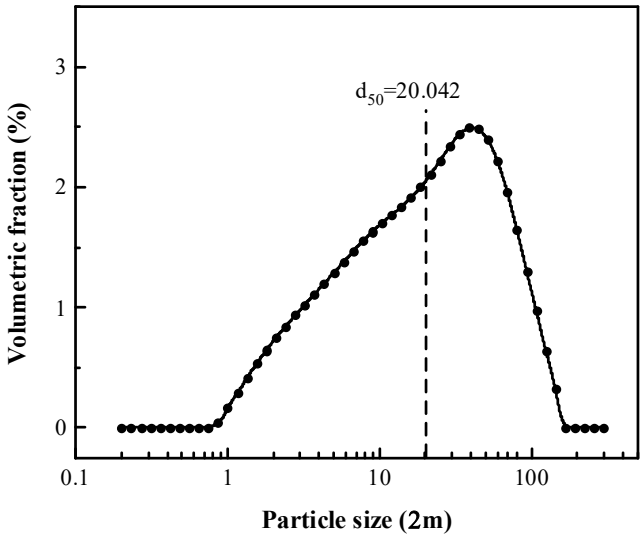

Figure S1. Particle size distribution of the slurry fed to the flotation column.

Installation of the medium in the flotation column

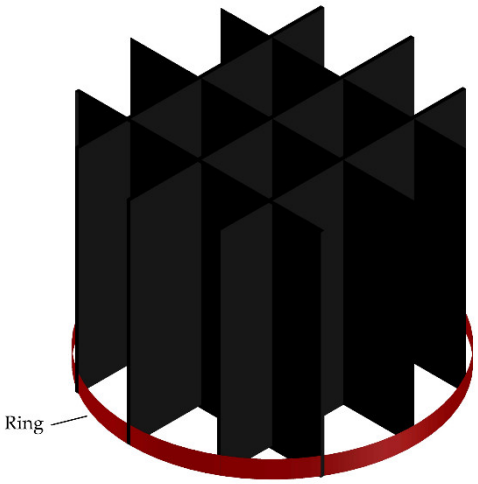

Figure S2. Schematic of the media packed in the flotation column.

The packing medium was manufactured by polyethylene plate. We glued a ring with a height of 5mm on the outside of the media (shown in Figure S2), and fixed it at a specific height by bonding the ring with the inner wall of the flotation column.

Part B

Mesh independence verification

In this research, five types of grids were meshed for the calculation domain of the flotation column, which were 95,000, 186,000, 270,000, 380,000 and 500,000, respectively. Taking the volume average Turbulence Kinetic Energy as a reference physical quantity, the simulation results obtained using different grid numbers are shown in Figure S3. It can be seen from the figure that TKE is barely changed when the number of grids increases to 380,000. Considering the calculation accuracy and computation amount, this study uses 380,000 unstructured meshing models. Moreover, a finer meshing was adopted for the calculation space where physical quantities changed drastically, such as filling media, in order to achieve higher accuracy.

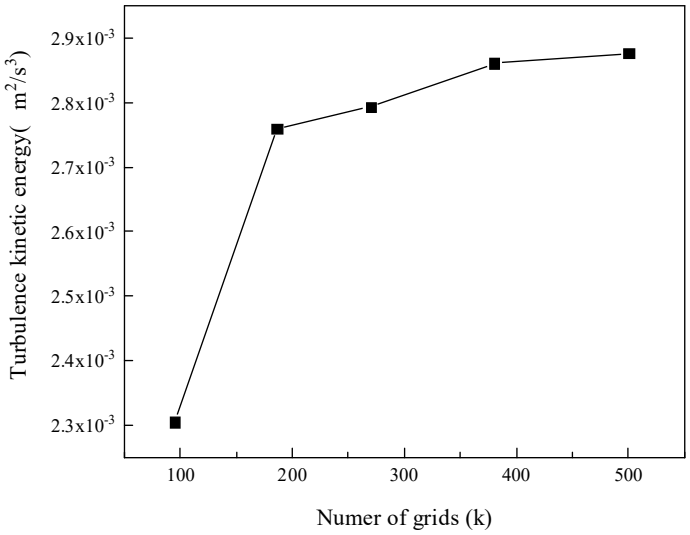

Figure S3. Simulation results obtained using different mesh numbers.

Part C

Additional boundary conditions:

1) Calculated fluid is incompressible;
2) Continuous phase is water, the density ρ_l = 998.2 kg/m^3, viscosity ν_l = 1.003 × 10^{-3} Pa·s;
3) Discrete phase is air, the density ρ_g = 1.225 kg/m^3, viscosity ν_g = 1.7894 × 10^{-5} Pa·s;
4) Surface tension σ = 0.072 N/m, acceleration of gravity g = 9.81 m/s^2;
5) Isothermal flow in the simulation process, without considering heat transfer;
6) The packing medium is regarded as wall surface with no thickness, velocity on all walls equals zero.

Simulation model and calculated parameters:

1) Multiphase model: Eulerian- Eulerian;
2) Viscous model: Standard k-epsilon, near wall treatment: Standard Wall Functions;
3) Pressure-velocity coupling scheme: Phase Coupled SIMPLE, discrete solution of volume fraction, momentum and turbulence equations using first-order upwind;
4) Time step size 0.001s, number of time steps 15,000;
5) Monitor the residual curve, inlet and outlet flow rate, and internal feature points as criteria for determining whether the calculation has converged.