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CFD-DEM modelling of suffusion in multi-layer soils with different fines contents and impermeable zones

Pei WANG, Ying GE, Tuo WANG,
Qi-wei LIU, Shun-xiang SONG

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CFD-DEM model for multi-layered soils

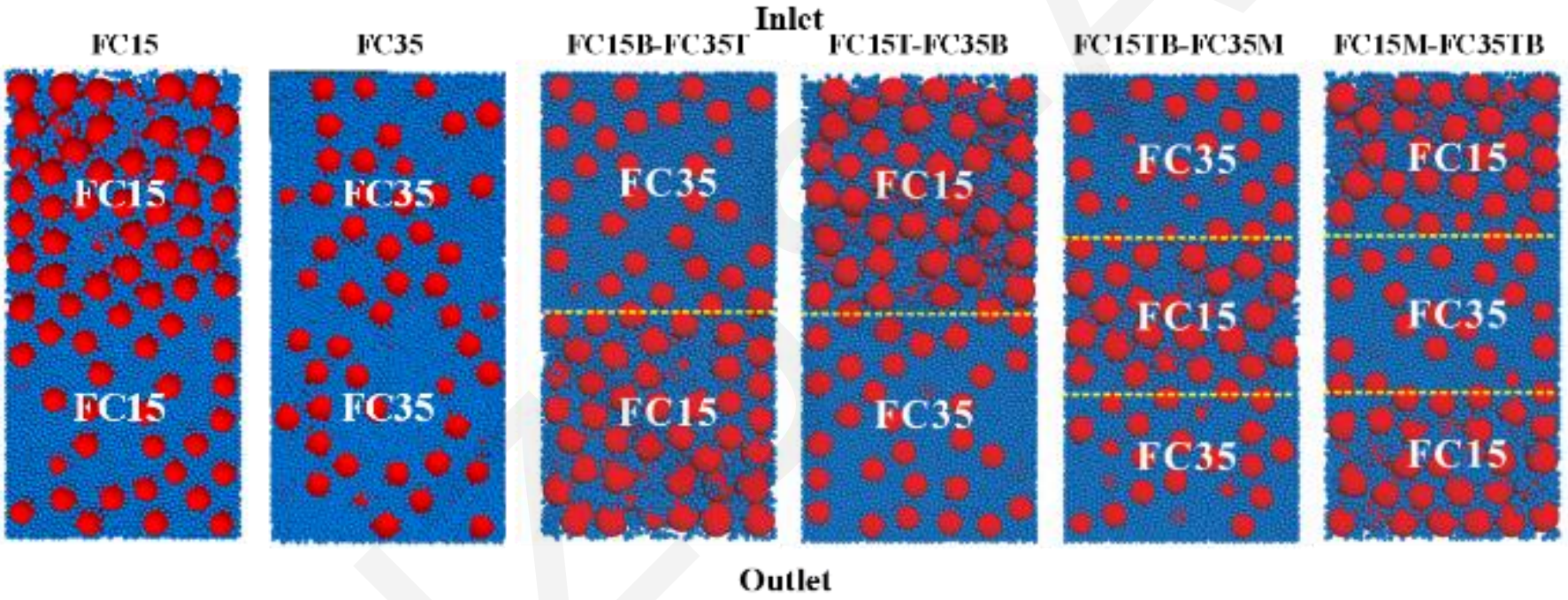

Fig. 1 Multi-layered soil specimens in DEM

CFD-DEM model for multi-layered soils

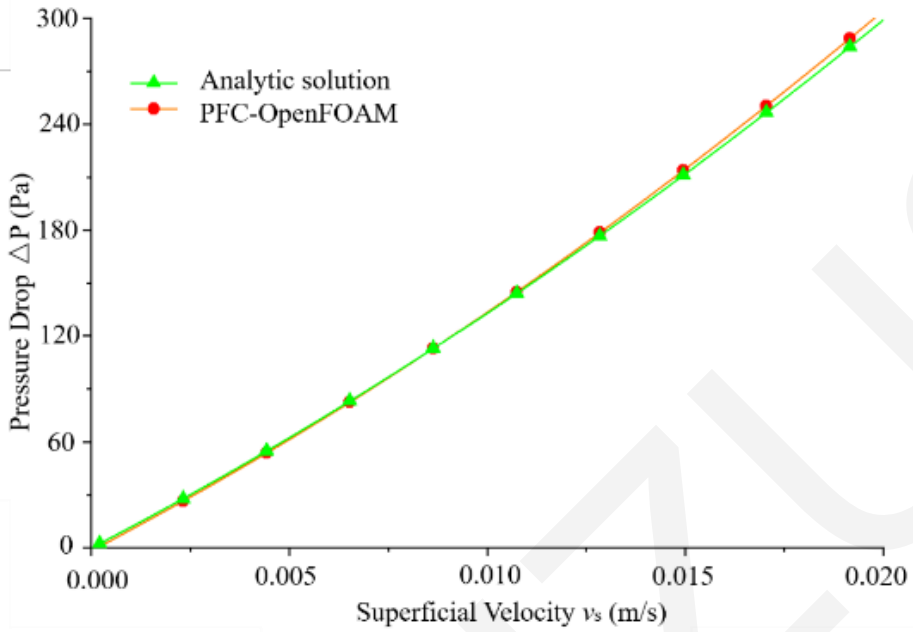

Fig. 3 Model validation：a comparison between the CFD-DEM simulation results and the analytical solution of the Ergun test

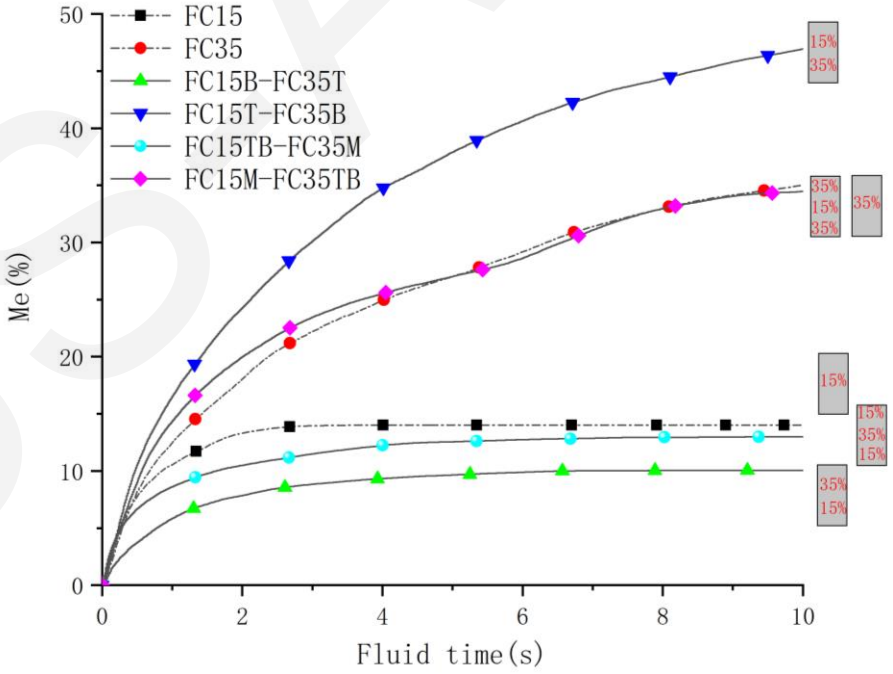

Fig. 2 Cumulative eroded mass over fluid time

CFD-DEM model for soil specimens with impermeable zones

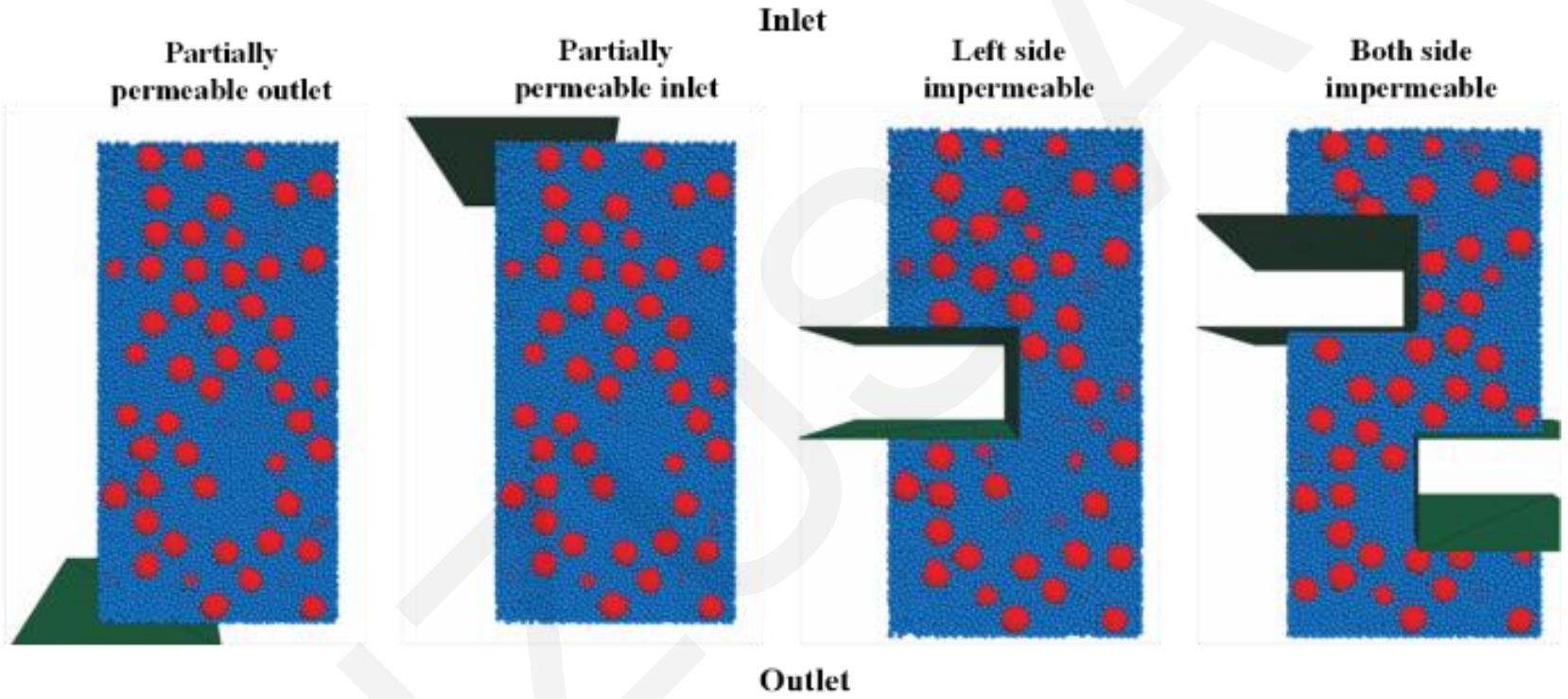

Fig. 4 Specimens with impermeable zones

CFD-DEM model for soil specimens with impermeable zones

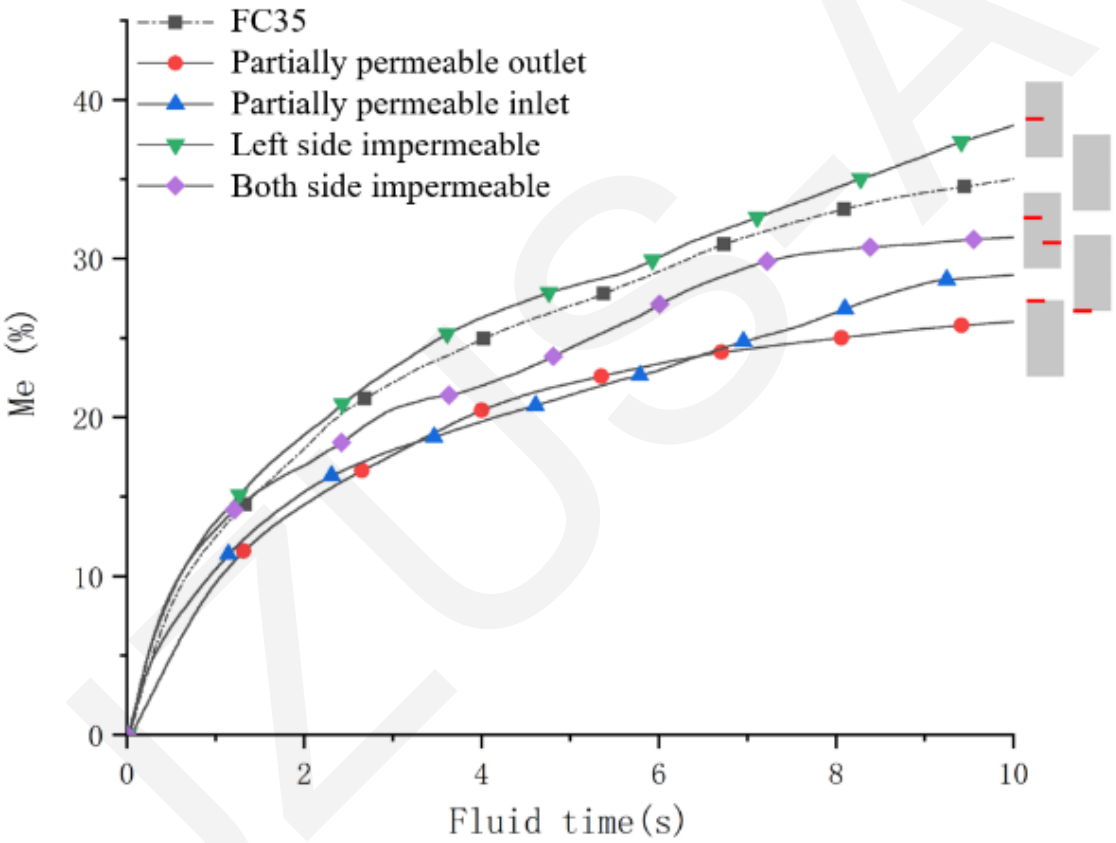

Fig. 5 Cumulative eroded mass over fluid time

Conclusions

- For soils with multiple layers, the cumulative eroded mass is mainly determined by the layer at the bottom. In general, the higher the fines contact of the bottom soil layer, the higher the cumulative eroded mass. In addition, when soils above the bottom layer have higher fines content, suffusion is alleviated. On the other hand, when soils above have lower fines content, suffusion is more severe.

- In the tests with specimens with various impermeable regions, the volume of flow plays a major role in determining the cumulative mass. The impermeable zones inside soil specimens can increase the flow velocity around these zones, facilitating the migration of fines particles and intensifying suffusion. Suffusion can also be alleviated by increasing the number of impermeable zones, which can increase the length of flow path and settle the fines particles.