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Binary transport of PS and PET microplastics in saturated quartz sand: Effect of sand particle size and PET shape

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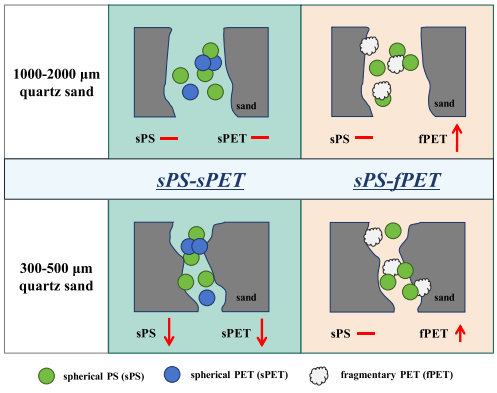
HIGHLIGHTS

- Co-transport of different types and shape-specific MPs were investigated.
- Both sPS-sPET and sPS-fPET aggregates formed.
- Aggregation drove decreased sPS and sPET transport in fine sand.
- Carrier-effect of sPS induced the increased transport of fPET.
- Quartz sand particle size greatly affected the co-transport behavior of MPs.

GRAPHICAL ABSTRACT



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ABSTRACT

Understanding the transport behavior of microplastics (MPs) with diverse polymer types and shapes in subsurface environments is crucial for assessing their environmental risks. This study systematically investigates the individual and binary transport of spherical polystyrene (sPS), spherical polyethylene terephthalate (sPET), and fragmentary PET (fPET) with ~1 μm sizes in saturated quartz sand with two particle sizes (8–16 mesh and 26–40 mesh), under varying ionic strengths (0.1–50 mM NaCl). In coarse quartz sand, both single sPS and sPET exhibited high mobility, and their transport was not affected by co-occurrence. In contrast, in fine quartz sand, the transport of both single sPS and sPET was significantly reduced. Additionally, the transport of single fPET was markedly reduced compared to both single sPS and sPET in two-sized quartz sand. For binary transport of sPS and fPET, sPS mobility remained unaffected, whereas the presence of sPS slightly enhanced the transport of fPET in both coarse and fine quartz sand, with the enhancement more pronounced in the coarse sand due to larger pore spaces. Further mechanistic investigations, including columns preconditioning experiments, scanning

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