A mathematical model for the transport of multi-component PFAS in unsaturated porous media

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**MOTIVATION**
PFAS retained in the vadose zone there for long periods of time. Moreover, the presence of multiple PFAS components introduces additional complexities to the flow and transport system.

**RESEARCH QUESTIONS**
- How does competitive adsorption affect PFAS retention and leaching in the vadose zone?
- What are the conditions under which competitive adsorption will significantly accelerate PFAS leaching?
- Our goal: develop a mathematical model that accounts for multi-component transport and competitive adsorption among PFAS in the vadose zone.

**METHODS**
Solving the unsaturated flow and advection diffusion equations for PFAS numerically in mixed and single components.

- **Richards equation**
- **Flow equation**
- **Advection Diffusion equation**
- **Langmuir isotherm equation**

**Impact of competitive adsorption on PFAS leaching**
Release of PFAS mixtures. Three scenarios:
1. PFOS + PFOA
2. PFOA + PFPeA
3. PFOS + PFPeA

**Take-home message**
PFAS competitive adsorption in multi-components

**Key factors**
- PFAS chain length
- PFAS concentration
- The number of PFAS species
- The amount of AWI
- The flow regime condition

**Conclusion:**
1. Longer-chain PFAS dominantly occupy the AWI when multiple PFAS are present.
2. Competitive adsorption is only significant at relatively higher concentrations (> 1 mg/L).
3. The difference in the mobilities of PFAS can lead to spatial separation that further reduces the significance of competitive adsorption.

**Future work:**
1. Conduct more comprehensive numerical simulations considering a wide range of PFAS components to fully evaluate the impact of potential competitive adsorption among PFAS on their long-term retention and leaching to groundwater.
2. Apply the model to field contaminated sites to quantify the risks of PFAS leaching to groundwater in the presence of multi-components.

Acknowledgement:
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**Cognitive Predictors of Student Success:**
Non-traditional factors among them inadsorption

**Future research:**
- A Predictive Validity Comparison Between Domestic and International Students