



Contribution ID: 256

Type: Oral Presentation

Structure induced vortices control anomalous dispersion in porous media

Wednesday, 1 June 2022 16:45 (15 minutes)

Natural porous systems, such as soil, membranes, and biological tissues comprise disordered structures characterized by dead-end pores connected to a network of percolating channels. The release and dispersion of particles, solutes, and microorganisms from such features is key for a broad range of environmental and medical applications including soil remediation, drug delivery and filtration. Yet, the role of microscopic structure and flow for the dispersion of particles and solutes in such disordered systems has been only poorly understood, in part due to the stagnant and opaque nature of these microscopic systems. Here, we use a microfluidic model system that features a pore structure characterized by dead-ends to determine how particles are transported, retained and dispersed. We observe strong tailing of arrival time distributions at the outlet of the medium characterized by power-law decay with an exponent of $2/3$. Using numerical simulations and an analytical model, we link this behavior to particles initially located within dead-end pores, and explain the tailing exponent with a hopping and rolling mechanism along the streamlines inside vortices within dead-end pores. These dynamics are quantified by a stochastic model that predicts the full evolution of arrival times. Our results demonstrate how microscopic flow structures can impact macroscopic particle transport.

Acceptance of the Terms & Conditions

[Click here to agree](#)

MDPI Energies Student Poster Award

No, do not submit my presentation for the student posters award.

Country

Switzerland

References

Time Block Preference

Time Block A (09:00-12:00 CET)

Participation

Online

Primary authors: Dr BORDOLOI, Ankur (UNIL - ISTE); Dr SCHEIDWEILER, David (UNIL - ISTE); Dr DENTZ, Marco (CSIS - IDAEA); Prof. ABBARCHI, Marco (Aix Marseille University); Dr BOUABDELLAOUI, Mohammed (Aix Marseille University); Prof. DE ANNA, Pietro (UNIL - ISTE)

Presenter: Prof. DE ANNA, Pietro (UNIL - ISTE)

Session Classification: MS23

Track Classification: (MS23) Special Session in honor of Brian Berkowitz