HERIOT WATT UNIVERSITY

UNIVERSITY OF LEEDS

LEADERS IN IDEAS AND SOLUTIONS

Field Case Study #4

H_2S Scavenging in Iron Bearing Substrates

Mike Singleton

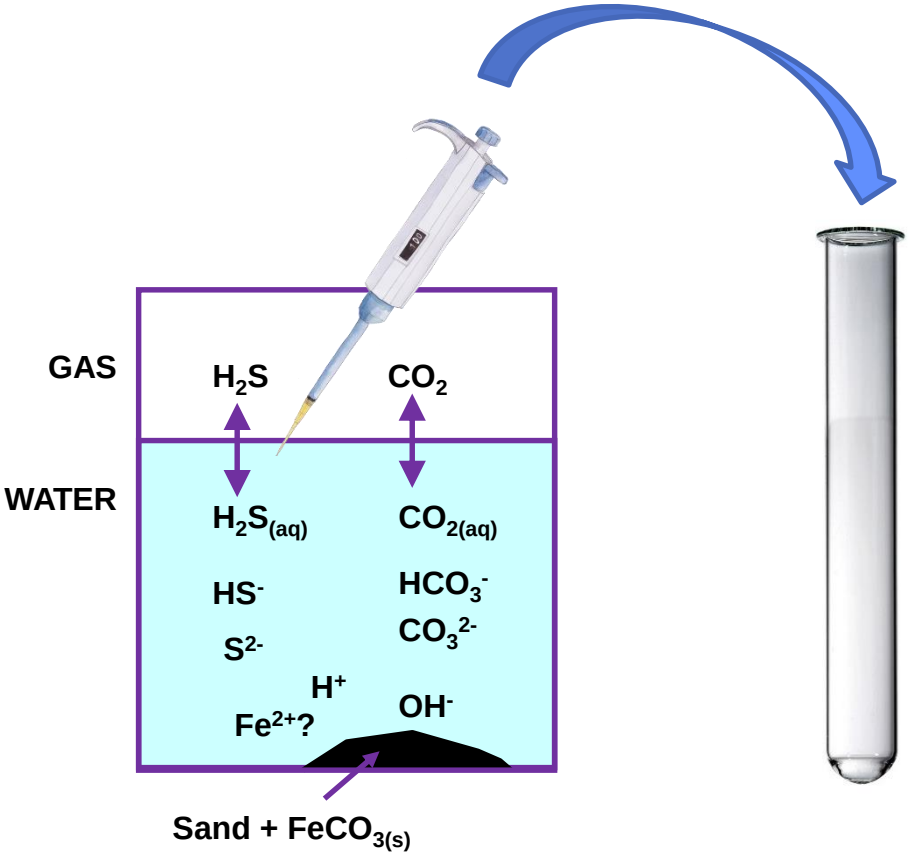
Flow Assurance & Scale Team: Scale Workshop
Treetops Hotel, Aberdeen, 29 January 2019

Background

- **Project with Petronas**
- **Full findings published at First EAGE/IFPEN Conference on Sulphur Risk Management – 2018**

- **Objective:**
  - Understand the mechanism of H_2S scavenging by Fe bearing substrates
  - Generate scavenging capacities (mg/g) for inclusion into reservoir models

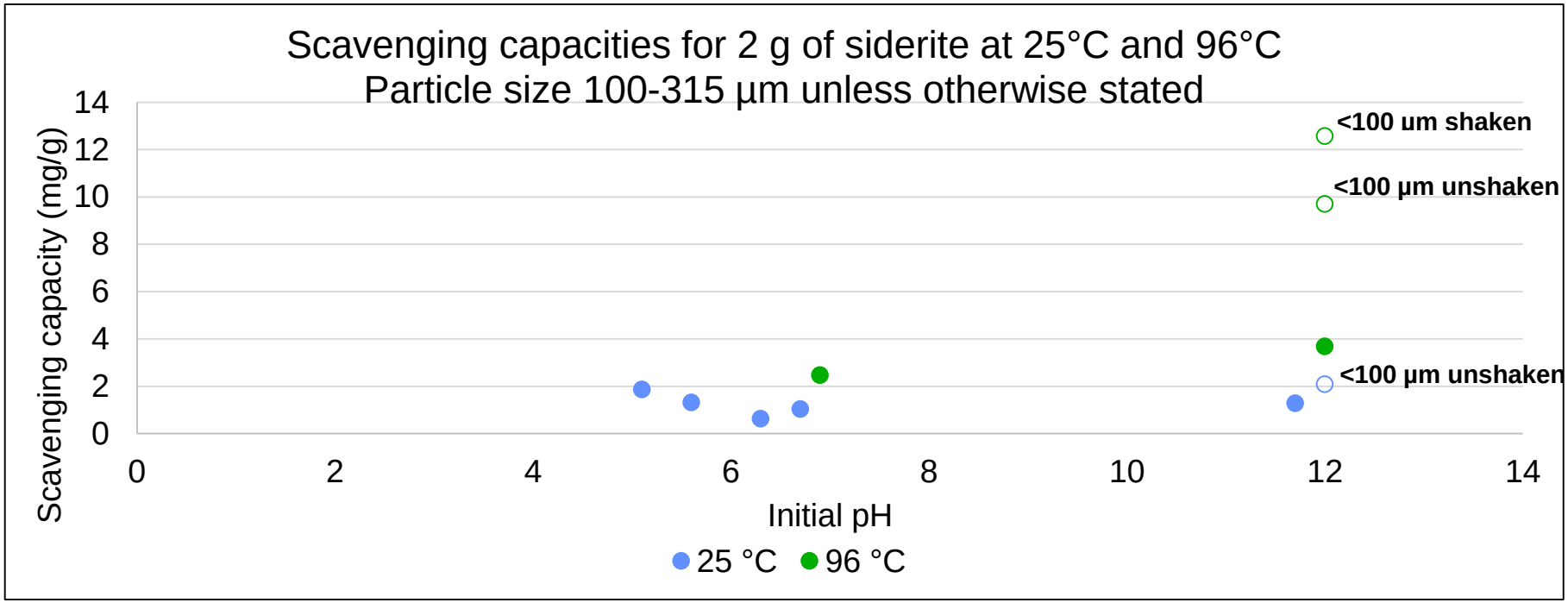
Scavenging Capacity – Static Tests



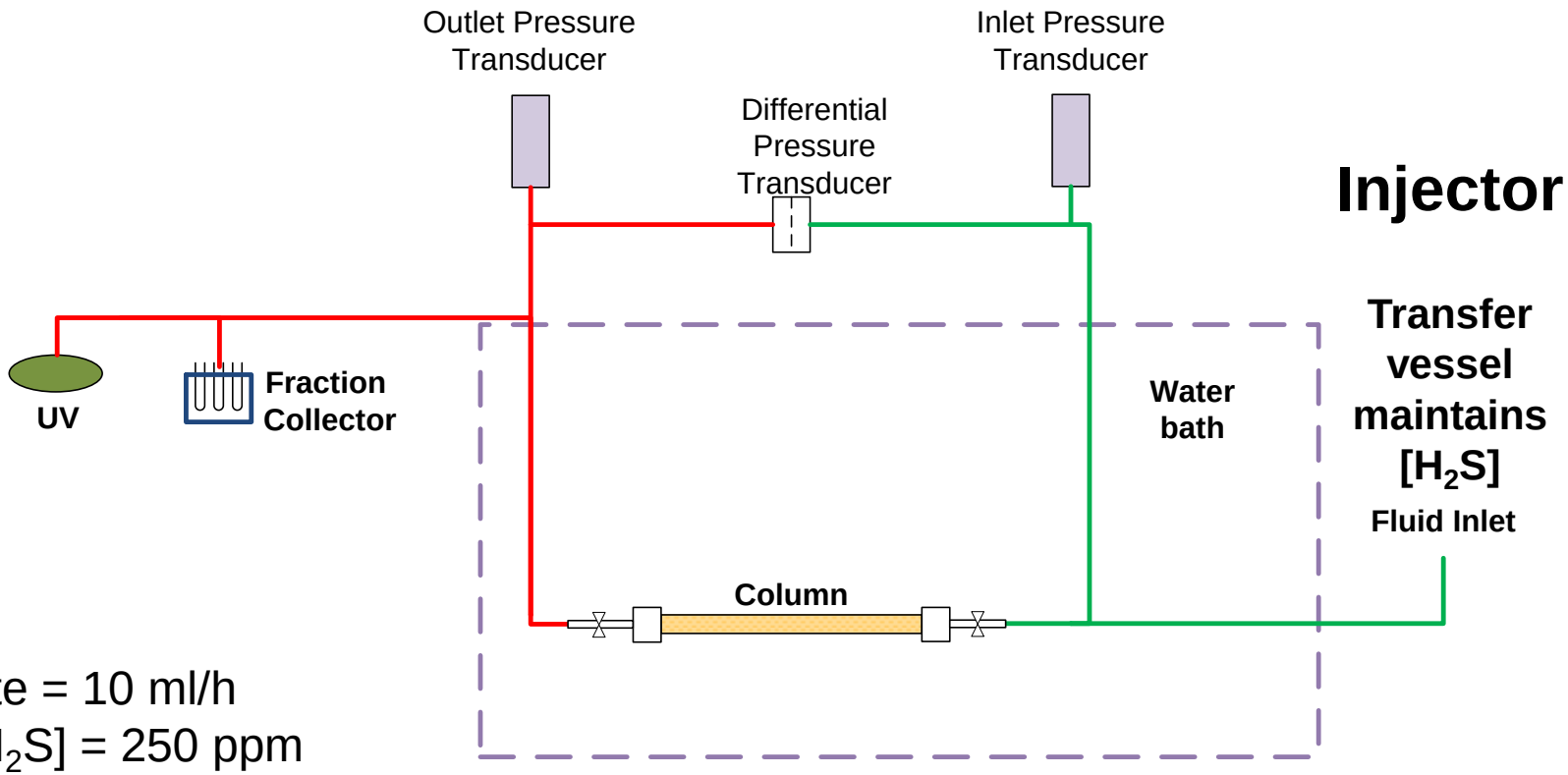
- Brine of known [H_2S] (aq)
- T = 25ºC or 96ºC
- Substrate – mix of sand and Siderite ($FeCO_3$)

- Samples taken over time
- Assay for H_2S(aq)
- Correlate H_2S removal to
- Scavenging Capacity (mg/g)

Scavenging Capacity – Static Tests



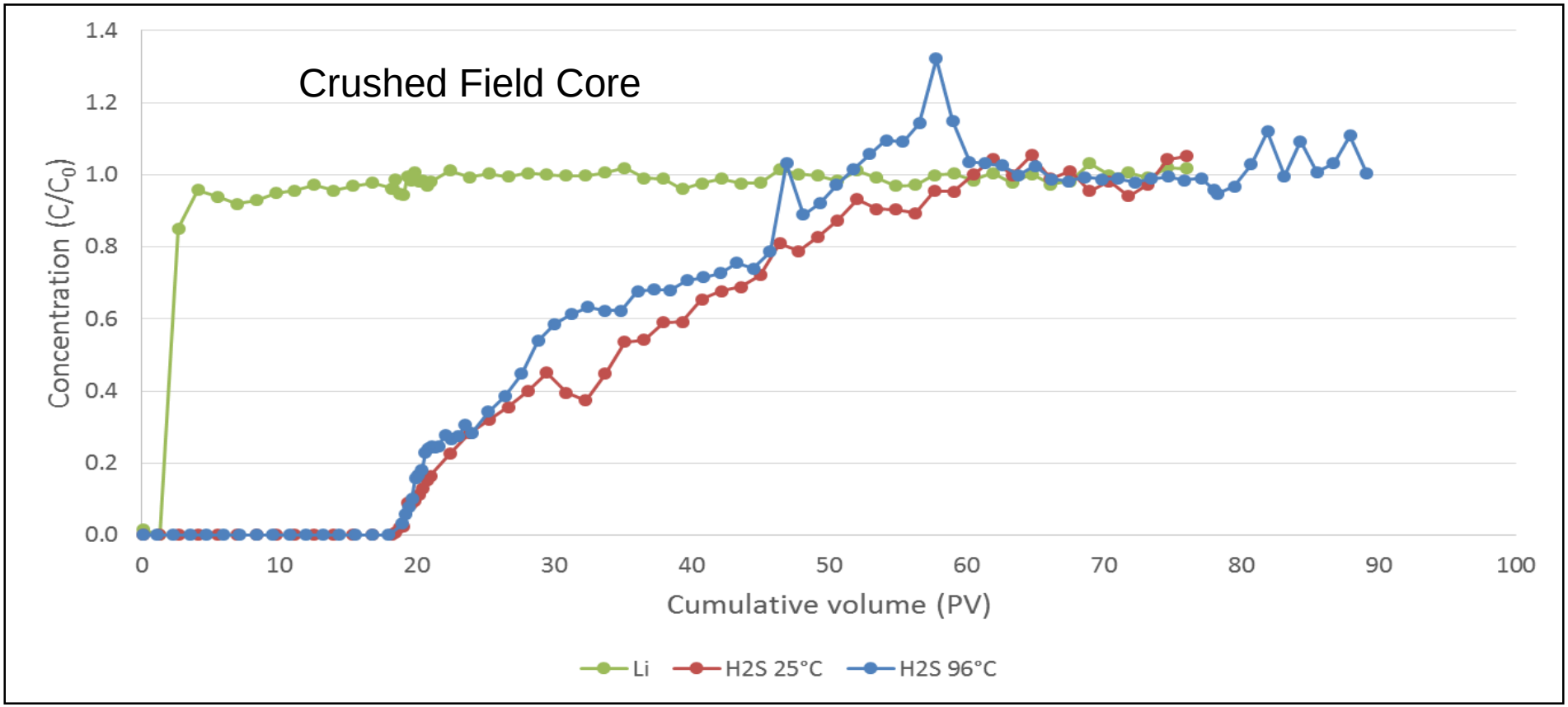
Scavenging Capacity – Dynamic Tests



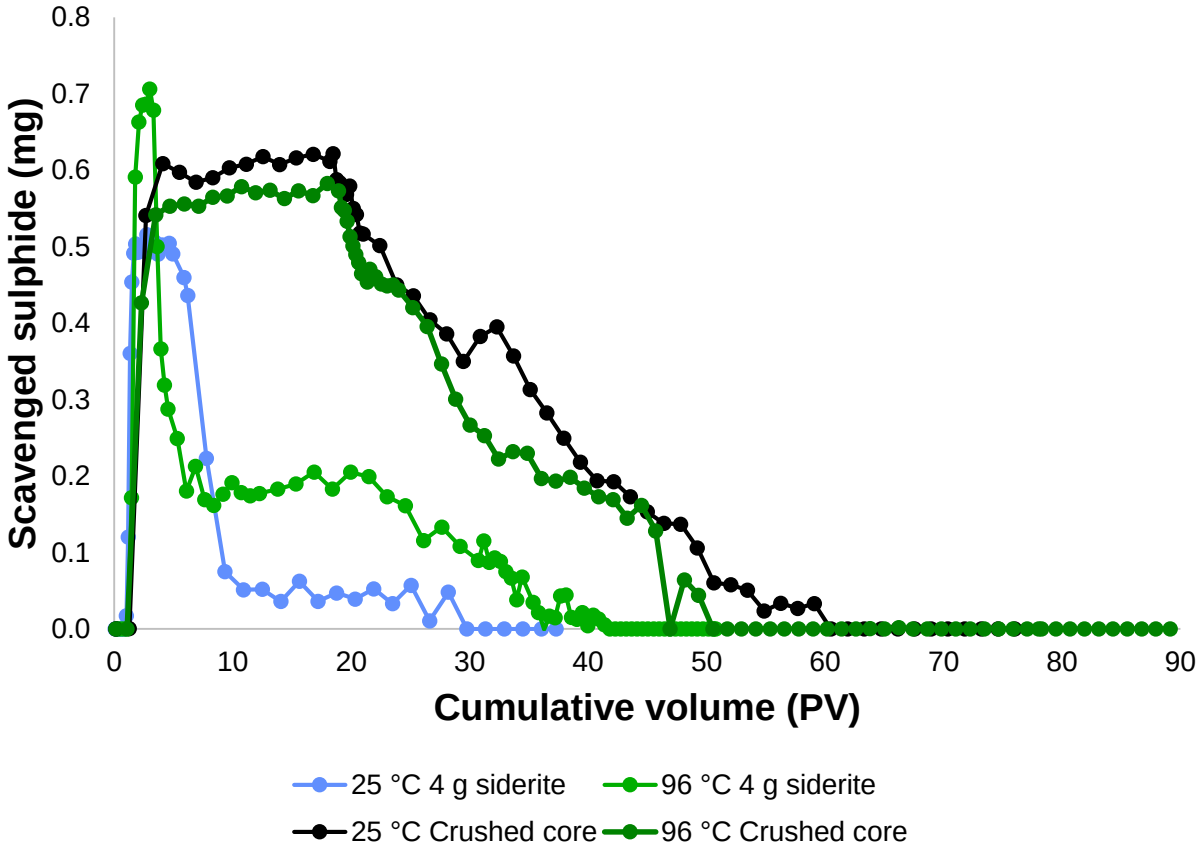
Flow rate = 10 ml/h
Initial [H_2S] = 250 ppm

Porosity of columns ≈ 40%
Mass of siderite = 4 g in 50 g (8 wt%)
Mass of crushed field core = 25 g

Scavenging Capacity – Dynamic Tests



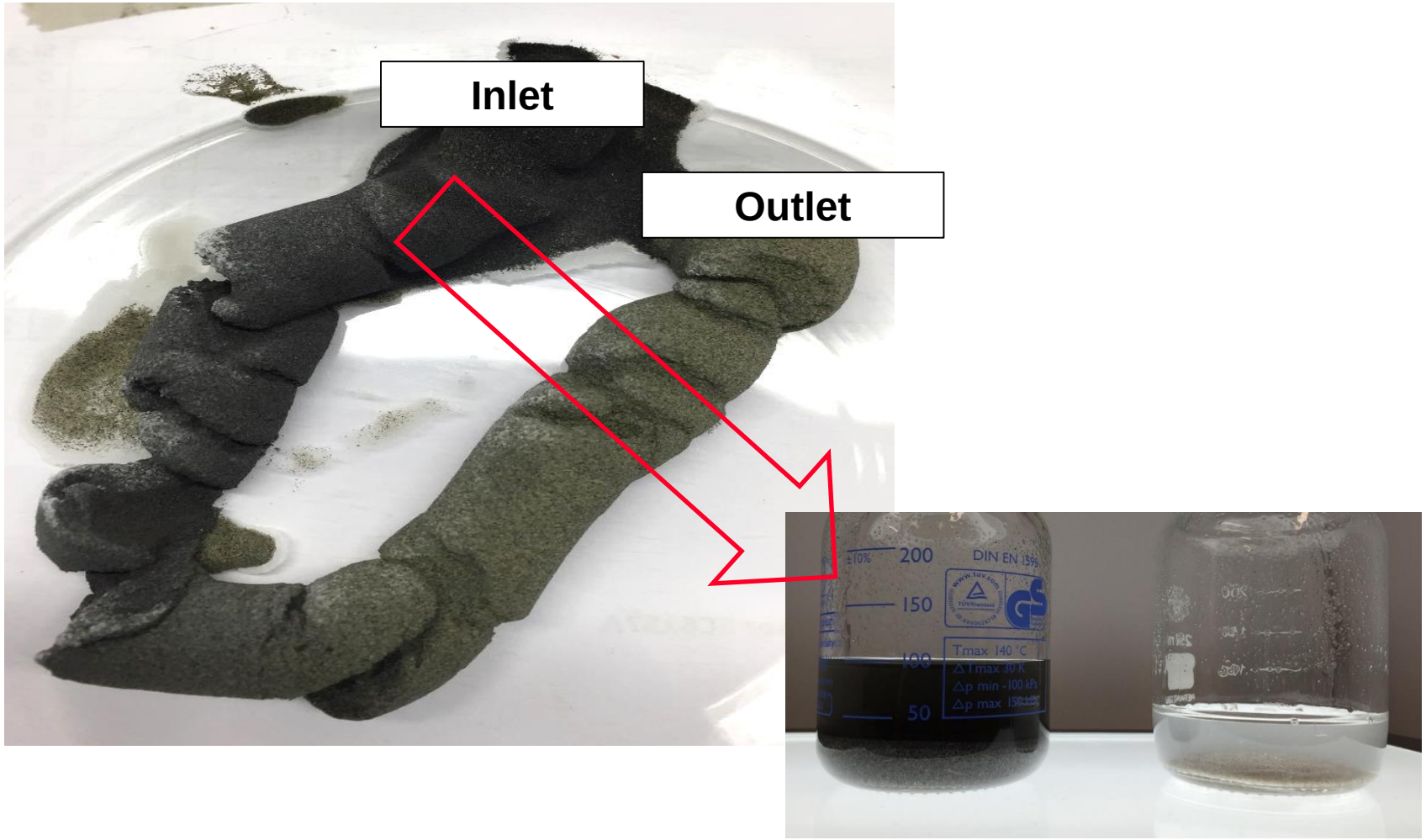
Scavenging Capacity – Dynamic Tests



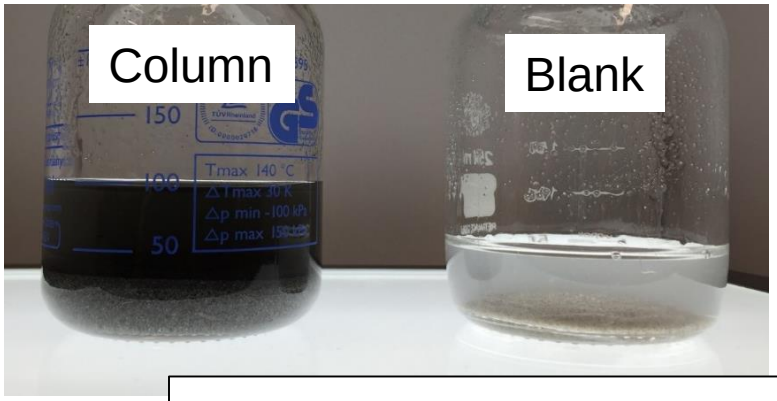
25°C
Crushed core = 144 mg total (**5.76 mg/g**)
Siderite pack = 51.72 mg total (**1.03 mg/g**)

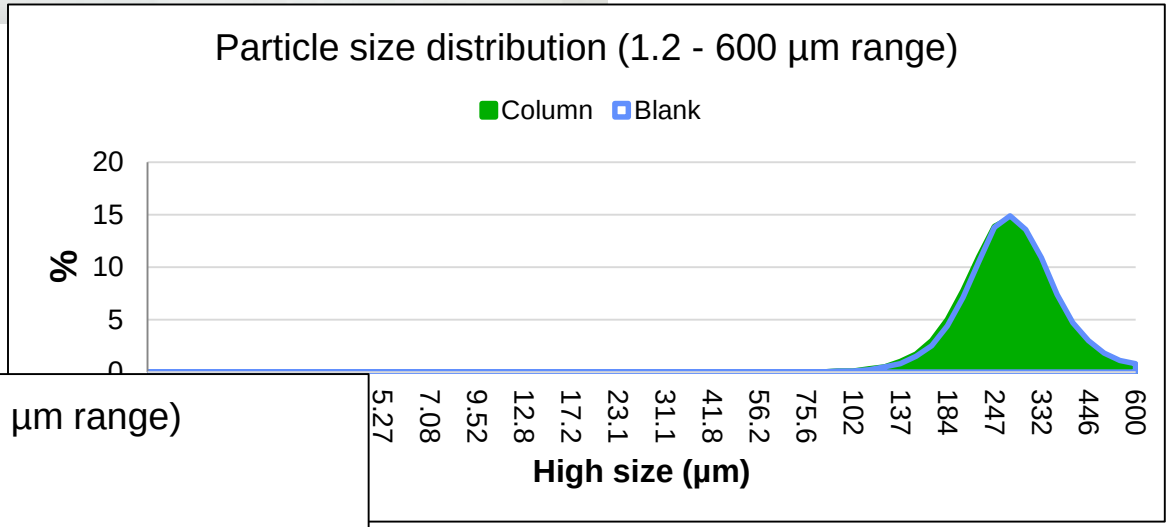
96°C
Crushed core = 145 mg total (**5.80 mg/g**)
Siderite pack = 87 mg total (**1.74 mg/g**)

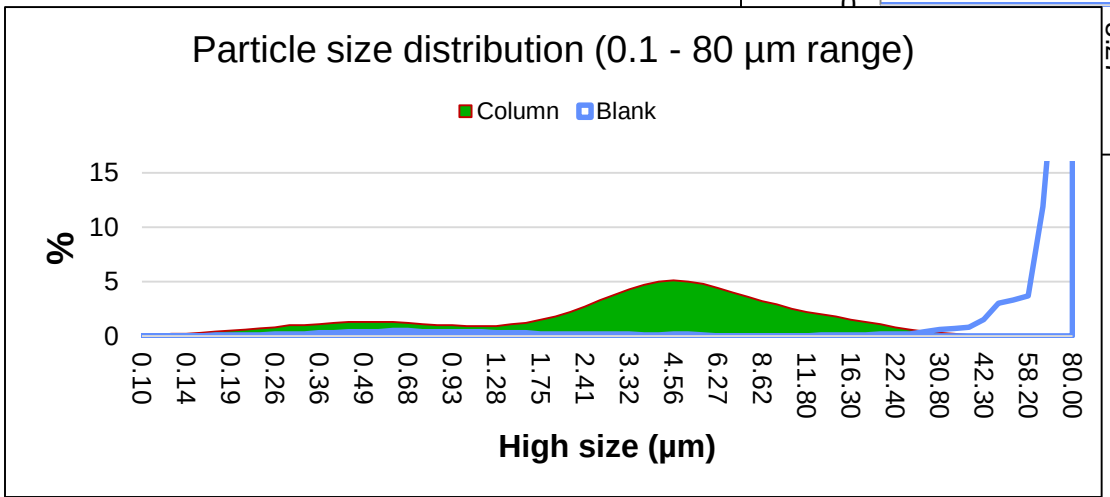
Scavenging Capacity – Dynamic Tests



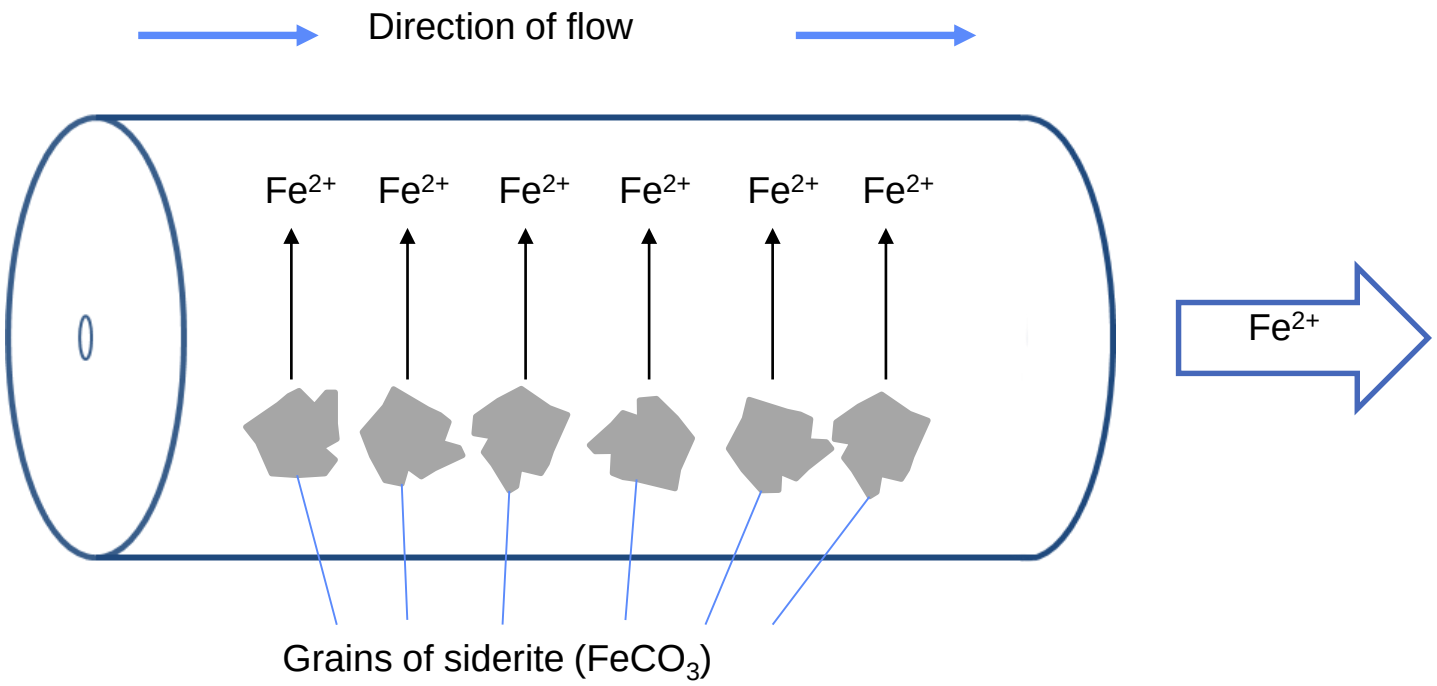
Scavenging Capacity – Dynamic Tests



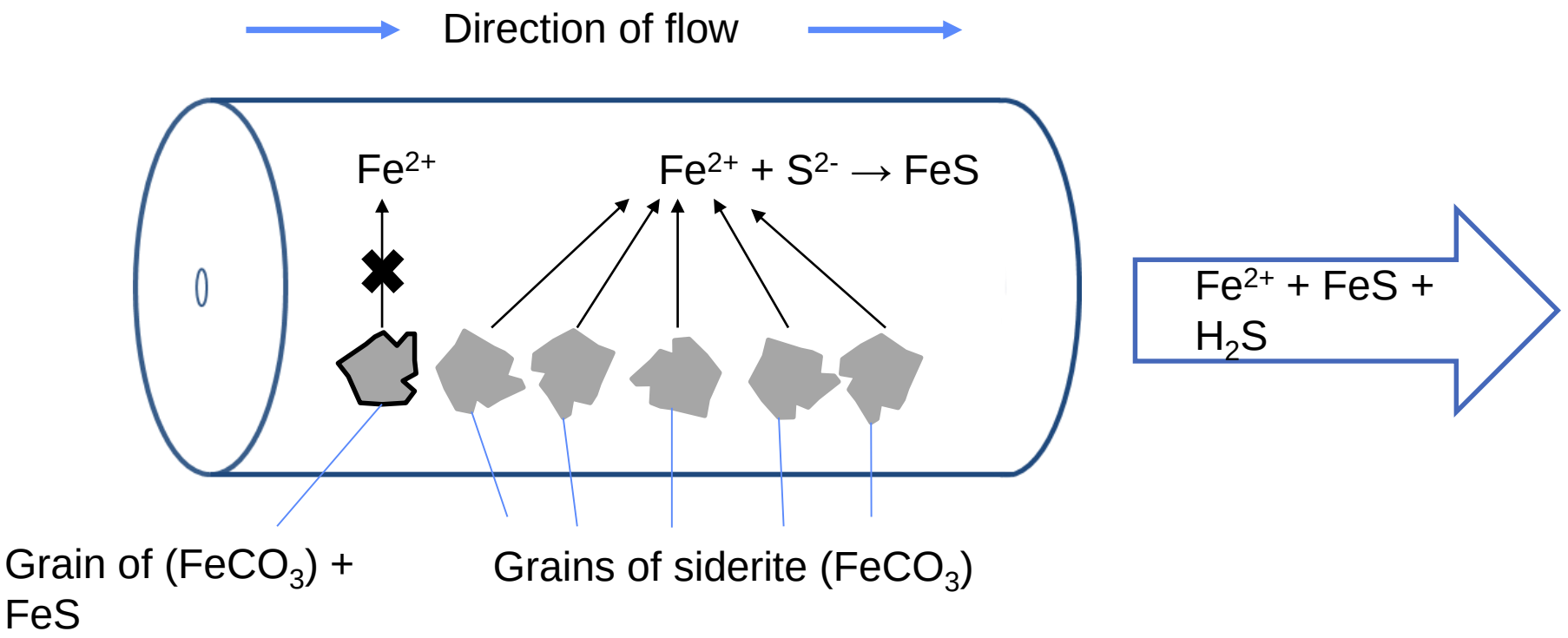




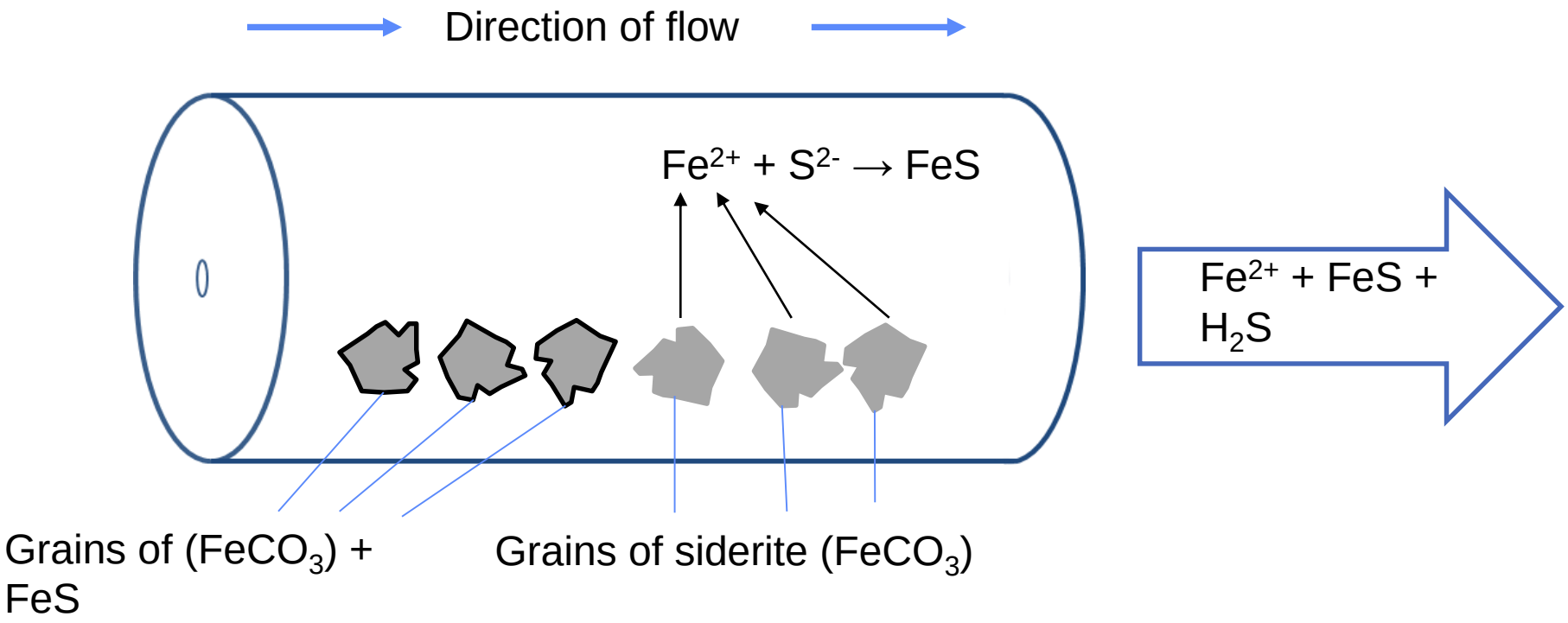
Mechanistic Interpretation



Mechanistic Interpretation



Mechanistic Interpretation



Other Factors to be Investigated

- **Capacities for Consolidated Core**
- **Presence of Oil**
  - H_2S partitioning to oil phase
  - Impact of Oil films
- **Impact of Kinetics**
- **Other Fe bearing Substrates**