Hydrogen Sulfide (H2S) is a harmful gas produced during petroleum extraction that leads to corrosion of drilling tools and pipelines. However, a H2S-scavenging liquid compound, when added to pipelines, interacts with liquids that absorbed H2S to create a non-corrosive bi-product. The interaction is associated with the mixing of gases and liquids. This thesis is a study on the effect of superficial gas and liquid velocities on the scavenger’s efficiency. This study employs two experimental setups designed to simulate this mixing of gases and liquids within pipelines.

A high pressure closed loop was designed and fabricated to determine the influence of gas and liquid velocities and liquid volume on the scavenger efficiency. All experiments were conducted in this high pressure loop with a thousand feet of coiled tubing to simulate the horizontal section of the pipeline that runs along the ocean floor from the reservoir. This allowed for a practical understanding for petroleum companies to make a better forecast on how the scavenger used in eliminating the H2S is affected by transporting the liquids and gases from the reservoir to the surface. For an adequate analysis, experiments on four liquid and four gas velocities ranging from 0.2m/s to 0.5m/s and 0.4m/s to 1.1m/s respectively were conducted. Results in this study indicated that increases in superficial gas velocity at low superficial liquid velocity decreases the scavenger efficiency while the opposite is seen at high superficial liquid velocity.

In addition, the H2S mass absorption was not a function of liquid volume as would be seen in static reservoirs but more of a function of superficial liquid and gas velocities. With the scavenger interacting with the liquid absorbed H2S, it was expected that the efficiency would increase with the increase in volume but in this study this was not the case.

The second experiment is a flow visualization loop which was designed to understand the flow regimes at high pressures. This was done by constructing four 25ft section hoses together with four foot long breaks for visualization. This provided a more fundamental study of the fluid behavior inside the pipelines allowing for the creation of appropriate flow regime maps in air-water flow. A hundred experiments for two different pressures were conducted at the 25ft location. At high pressures, the flow regime map appeared to shift the transition zones.

Major: Mechanical Engineering: Thermofluids Track

Educational Career:
Bachelor's of Mechanical Engineering, BS, 2008, University of Central Florida

Committee in Charge:
Dr. Ranganathan Kumar, Chair, MME
Dr. Louis Chow, MME
Dr. Saptarshi Basu, IISC

Approved for distribution by Dr. Ranganathan Kumar, Committee Chair, on June 5, 2010.

The public is welcome to attend.