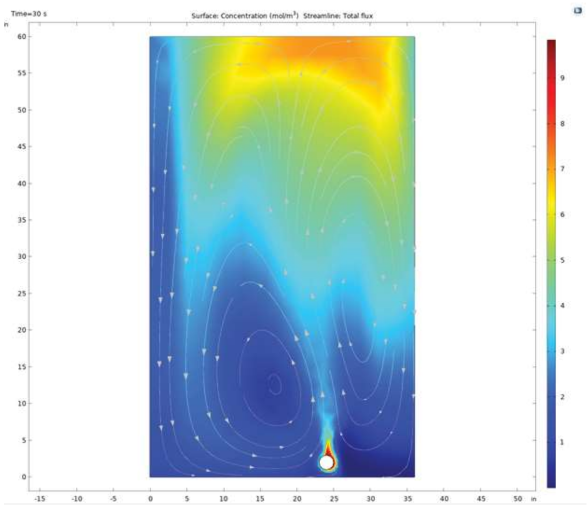
# COMPUTATIONAL FLUID DYNAMICS (CFD) SERVICES

Computational Fluid Dynamics (CFD) modeling is an excellent service to accelerate product development. It allows for cost-effective equipment sizing and identification of optimal operational parameters. In addition, it helps to better understand the physics behind a process. Porous media is often difficult to model due to the complex nature of porosity. Mott Corporation's expertise as the world's largest installed base of porous metal products sets the company apart as a leader in understanding porous material.  By leveraging this unique expertise, Mott CFD services can help reduce design and development costs to create high performance solutions.

## APPLICATIONS

- Bioprocessing / Cell Culture
- Aeration / Carbonation
- Chemical Reator Design
- Piping Network Design
- Hydrogenation
- Fermentation
- Stripping / Adsorption
- Fluid Diffusers
- Static Mixing Efficiency
- Mixing Efficiency / Power Number Analysis
- Process Equipment Design
- Cavitation Pressure Analysis
- Transient Flow and Pressure Analysis
- Heat and Mass Transfer Analysis

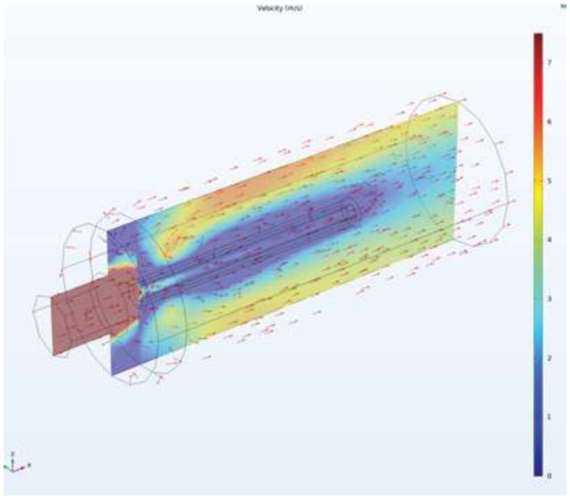



2D Profile of Dissolved Gas Concentration and Dissolved Oxygen Flux Streamlines Evolving off a Ring Sparger in Cylindrical Tank of Water

## APPROACH

CFD services grounded in empirical data can help identify critical features,  operating conditions, and performance metrics of products to reduce risks associated with new product development and projects.  Mott uses the following approach to create value-added CFD analysis:

1. Process review with scientists to understand application and its niches.
2. If needed, laboratory testing at our state-of-the-art facility to generate empirical data
3. Initial CFD modeling and review.
4. Validation testing of initial model.
5. If needed, secondary modeling and validation testing.
6. Recommendations to improve process performance and further collaborative development.



Velocity (m/s) Profile of Gas Through a Porous Metal Filter

## SEE OUR CASE STUDIES ON PAGE 2

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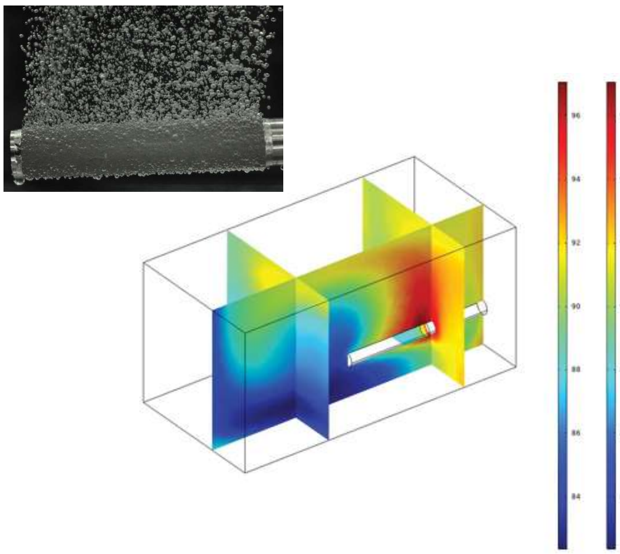
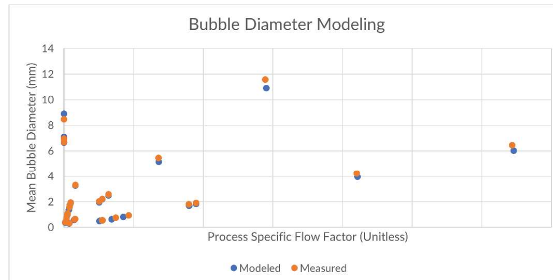
## CASE STUDY 1: OXYGENATION OF TAP WATER

<u>Goal:</u> Design a sparger system that hits a specific oxygen transfer rate and turbulence while minimizing the operational costs associated with gas feeds.

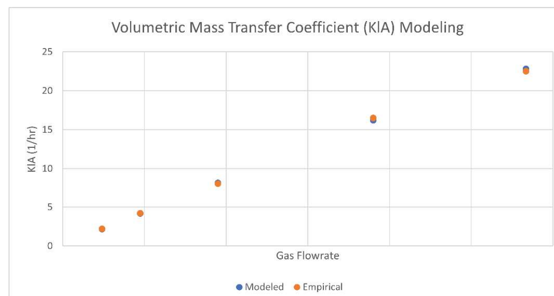
<u>Results:</u> Proprietary knowledge employed to predict bubble size dynamics and resulting mass transfer coefficient ($K_LA$) of the system. Bubble size as a function of gas flow rate to the sparger modeled within ± 10% of empirically measured results while $K_LA$ is within ± 5%. Analysis determined mass transfer rate as a function of gas flow rate and located stagnant areas of low mass transfer. Information used to optimize equipment sizing to minimize the gas flow rate to the sparger, keeping operational costs down.



Oxygen Saturation (%) for Sparging of a Rectangular Tank




Prediction of Bubble Diameter Based on Sparging Hydrodynamics

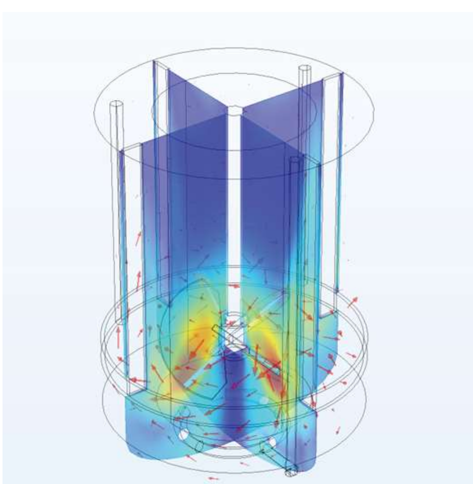



Prediction of Volumetric Mass Transfer Coefficient Based on Sparging Hydrodynamics

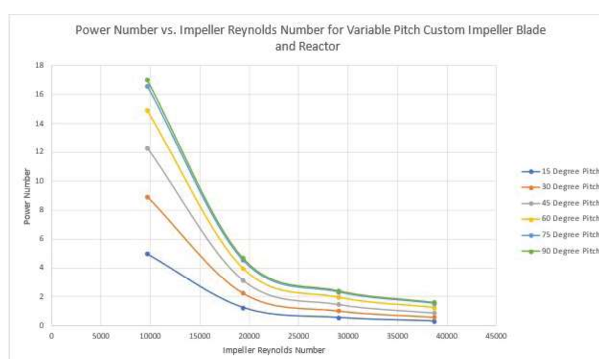
## CASE STUDY 2: IMPELLER OPTIMIZATION FOR MIXING

**<u>Goal:</u>** Given a certain target for mixing efficiency or maximum induced shear stress, use CFD to design an impeller blade to optimize its geometry to meet targets.

**<u>Results:</u>** CFD simulation performed to identify optimal geometry to minimize shear stress while retaining adequate mixing performance. Effect of baffles and instrumentation on power number and shear force evaluated. Model scaled to larger system to predict power consumption and performance.



Velocity Profile Generated by Rotating Impeller




Power Number Analysis on Impeller Blade Pitch for a Specific System