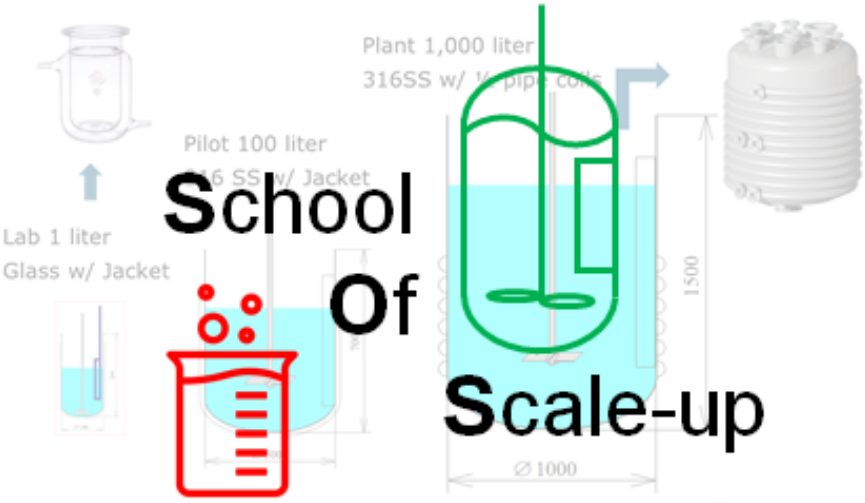
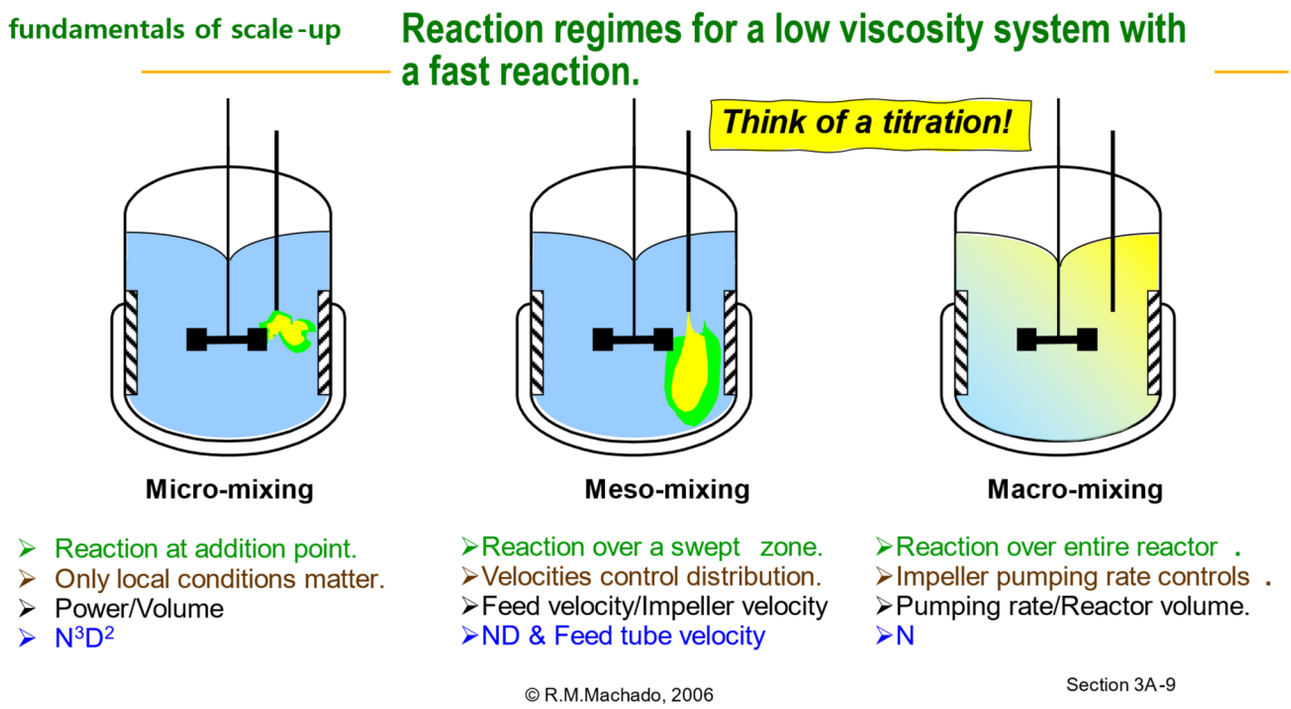
School Of Scale Up



.... Surety to Succeed

Increasing productivity in research, scale-up and manufacturing are key goals for all chemical industries as the time to market shortens to meet fast-paced technology needs. This requires technologists to increase their practical knowledge on a foundation of state-of-the-art data acquisition and analysis tools.

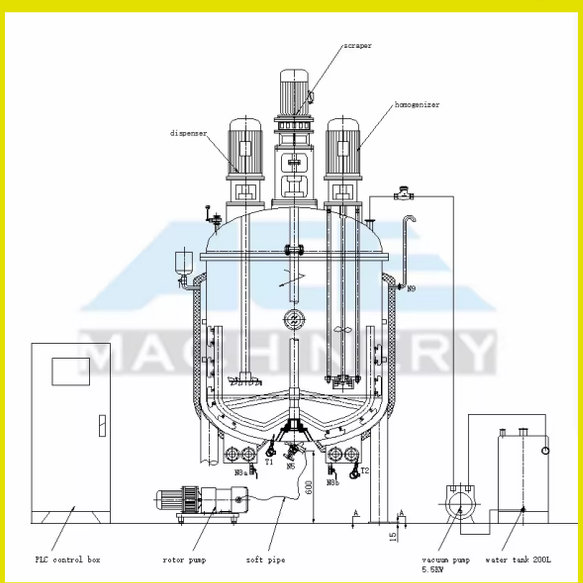
We are putting together a unique hands-on technology course designed to teach and show the practical application of scale-up for "test chemistries" in a customer's equipment and lab, ~1 liter for the lab and upto ~100 liters for the pilot depending on a customer's goals. The course targets the workforce in the Pharmaceutical, Specialty and Electronics manufacturing space including operators, engineers and chemists.



We are proposing to test this the idea with a class of about 10-20 participants from various industries for a one-day experience with this unique training idea. We will use the customers equipment and lab with we will provide the details of the test chemistry and equipment requirements. We will also provide software and deliver the full package to interested companies within the United States. The location for setting up the courses will depend on the resources and infrastructure which are available and local universities sites are one option. Note that the test chemistries are all aqueous based and considered very safe to implement.

for routine training experiences with options for customization

Software Company, SC, (VisiMix, www.VisiMix.com) provides training using their state-of-the-art software to address the technical basis for scale-up and scale-down. It is a fast fundamental momentum-based mathematical methodology



which accounts for variations in hydrodynamics and mixing for all the major situation encountered in industrial processes and equipment using stirred tank reactors. It allows for immediate mixing/scale-up analysis like CFD (Computational Fluid Dynamics) but virtually instantaneous allowing the user the ability to analyze, visualize, various scale-up or scale-down scenarios.

Experimental Company, EC, (rm2technologies LLC, www.rm2technologies.com) will lead the training activity for the "test chemistries" and work with small teams to conduct the reaction chemistry in the lab and pilot reactors. The EC will ensure safety, chemical and waste management, data collection and organization collection. This data will form the basis for developing the scale-up strategy and the software. Note that the chemistries are all aqueous, simple, safe and all waste can be readily put down a normal drain. No special ventilation is necessary.

Note: rm2technologies LLC will prepare the handouts for lab experiments, safety documentation

Syllabus

Introduction of the companies

- rm2technologies LLC
- VisiMix

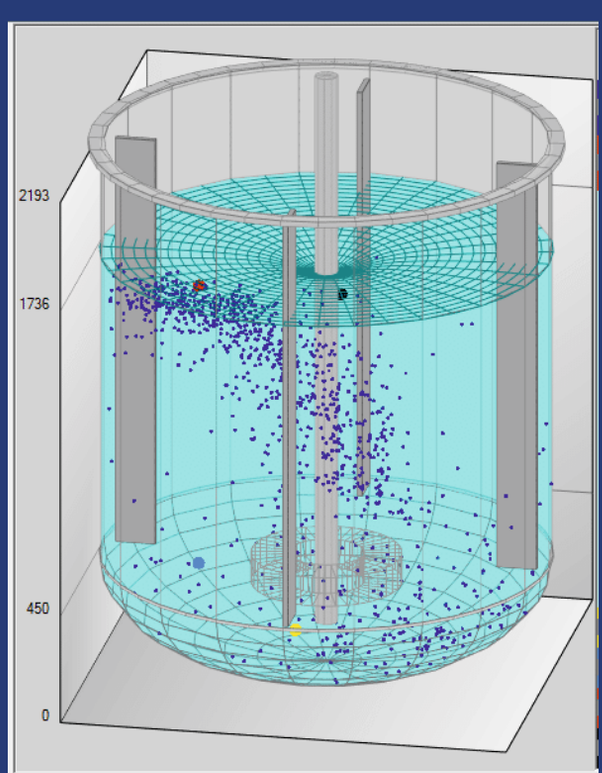
Visual Scaleup Concepts (Instruction with pictures, graphs and videos for various mixing processes)Instructor; rm2technologies.

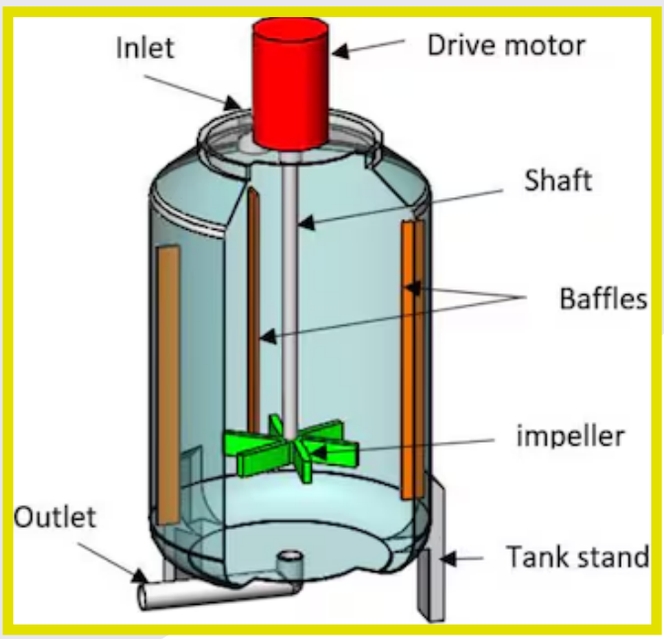
Blending with a feed; Videos = semi-batch reaction chemistry

- Slow reactions
- Fast reactions

Solid Liquid Video (ion exchange, crystallization, dissolution, catalysis)

- Gas Liquid Video (purging, hydrogenation, gas evolution, oxidation)
- Liquid-Liquid Video (phase transfer catalysis, extraction, neutralization)
- Heat Transfer Pictures (heating and cooling)



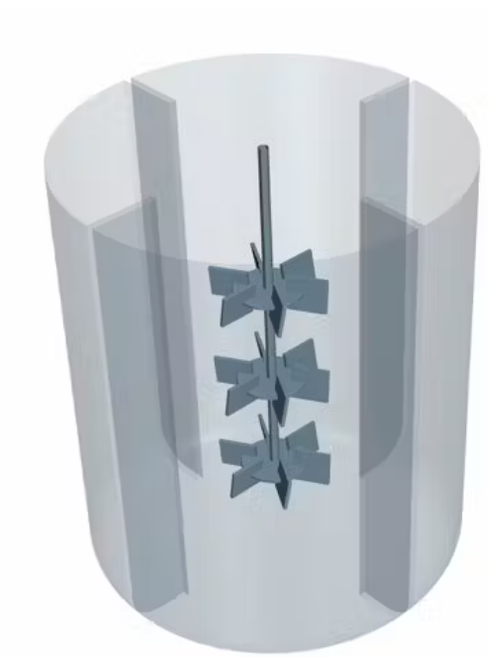


Basic Hydraulic Concepts

(Video of experiments to measure key parameters)

Instructor: rm2technologies

- **Force and Torque**
- **Momentum**
- **Energy**
- **Power**
- **Flow**
- **Axial**
- **Radial**
- **Shear**
- **Viscosity**



Geometry and introduction to VisiMix

Instructor: VisiMix

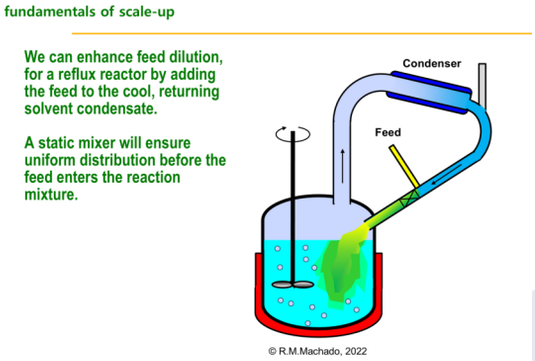
- Reactors and vessels
- Baffles
- Impeller
- Axial
- Radial
- High Viscosity

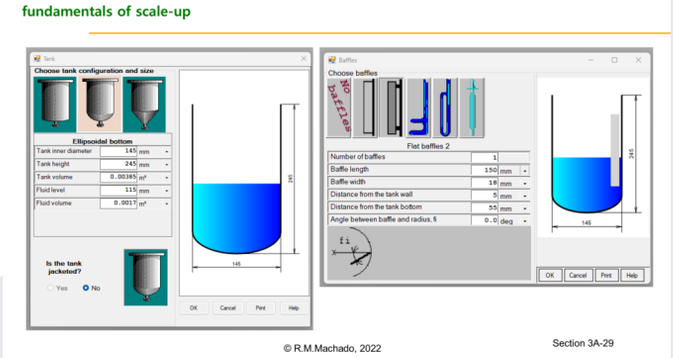
Heat Exchange surfaces

- Inside a vessel Outside surface
- External Condensers

VisiMix Software

Instructor: VisiMix





REINALDO MACHADO

Reinaldo (Ray) Machado is a seasoned chemical process consultant with rm2technologies LLC and an adjunct faculty member at Arizona State University. Recently retired from EMD Electronics, a subsidiary of Merck KGaA, Darmstadt, Germany, Ray brings 38 years of applied scale-up experience from Air Products and Chemicals, Inc., and Versum Materials LLC.

With 40 years of industrial and academic expertise, Ray is dedicated to advancing lab training and scale-up techniques. He consults on scale-up projects within the Pharmaceutical, Specialty, and Electronics chemical industries and teaches onsite courses.

Reinaldo Machado, President

Ray's technical expertise spans applied reactor engineering, scale-up of chemical reaction processes, crystallization, applied reaction calorimetry, catalysis, and electrochemical engineering. He holds a Ph.D. in chemical engineering from the University of Wisconsin, Madison, and a B.A. in chemistry and mathematics from Frostburg State College. Currently, he teaches "Fundamentals of Scale-Up" at Arizona State University, holds 24 patents, and has co-authored 19 publications.

Dr. Moshe Bentolila
Customer Support Manager VisiMix , Israel

MSc in Reactor Design from the Technion (Israel institute of technology) Haifa and BSc in Chemical Engineering from the Technion (Israel institute of technology), Haifa

More than 20 years of experience in process development and scaling-up in the API industry as pilot engineer (IMI Institute for R&D Ltd. ICI Israel Chemicals) and pilot department manager (Chemagis Ltd., Agis Group, Israel) used most of the Automated reactors , Mixing Simulation & DoE tools as part of QbD methodology and its implementation