VisiMix

Simulation of Mixing Processes

VisiMix Ltd,
PO Box 45170,
Jerusalem, 91450,
Israel
Tel: 972 - 2 - 5870123
Fax: 972 - 2 - 5870206
E-mail: info@visimix.com

The influence of Mixing in your Process: Simulation Cycle

Moshe Bentolila

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About Us

VisiMix.Ltd is a unique software enabling chemical engineers, process engineers and R&D personnel to characterize and visualize mixing processes via a simple, user friendly interface.

Our products allow significant savings in time and costs by drastically reducing the need for trial-and-error. They have been successfully adopted by hundreds of companies.

VisiMix Background

Established in 1995

1995-1998 – Developed the VisiMix Turbulent Product

1998-2000 – Developed the VisiMix Laminar Product

2000-2003 – Developed the VisiMix Different Impellers Product

2003-2004 – Developed the VisiXcel Product

2007-2010 – Developed the VisiMix RSD Product

2011-2013 – Developed the VisiMix Emulsification Product

2014-2017 – Developed the VisiMix 3D, Generic Hydrofoils Blades and Alternative impellers

2018-2019 – Developed Off Center Impellers

2020-2022 – VisiMix Scale Up – Scale Down / Process Evaluation

Today VisiMix has More than 250 Customers

Motivation

Common Questions

- ✓ Did we cover the main parameters during the process development?
- ✓ Will our facilities will be appropriate for the developed process?
- ✓ Does the equipment offer is good for the process?
- ✓ What about safety and runaway scenario?
- ✓ Do our process is robust?
- ✓ Does the operational range parameters are large enough for the manufacture facilities?

The Goal

Once the Science of the process (Chemistry, Biology or physics) is known well, a common situation during the process transfer from lab to production or from site to site is the gap between the old and new results.

- **Our first goal is to develop a process that will run properly in the first trial on a new scale or site, similar to our successful results in the lab or in the old facility.**

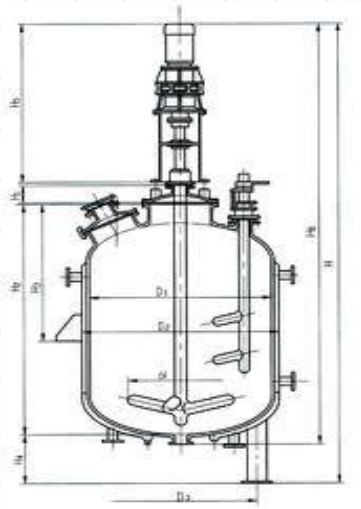
In order to achieve this, we need to evaluate the process with the same conditions we will have in the production phase.

- **The main parameters we change are the hydrodynamics of the system. If we are able to identify and control these parameters we will be able to achieve to the available and optimal solution.**

Data and Results Management

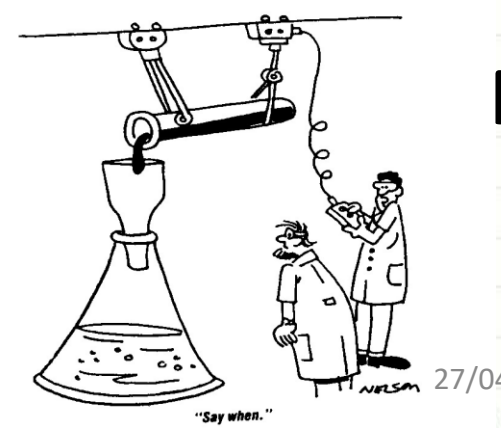
R&D

Design



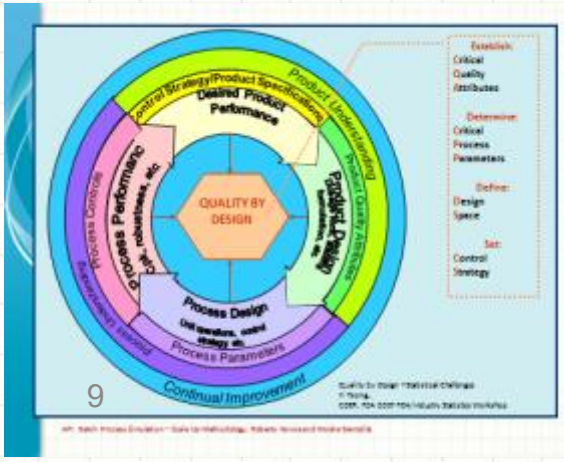
VisiMix

Mixing Simulation Software



Production

QbD



What is Good Mixing?

Troubleshooting in Life Science Industry

Savings of 900,000 Euro!

VISIMIX SOLUTIONS

TURBULENT 2Kx

Low viscosity liquids and multi-phase system

Process: ***Trouble shooting in Life Science Industry after break down of equipment***

Task: ***Understand reason for failed batches and establish new operation conditions with the new equipment.***

The Process

Chemical reaction on porous beads in the life science industry.

The Problem

One product is produced in three slightly different reactors. An intermig impeller was installed in one of the reactors after a breakdown. The flow properties were much higher for batches from the reactor with the new impeller and several batches were out of specification. It was known that oxygen hydrolysis destroys the sugar molecules while the slurry is basic.

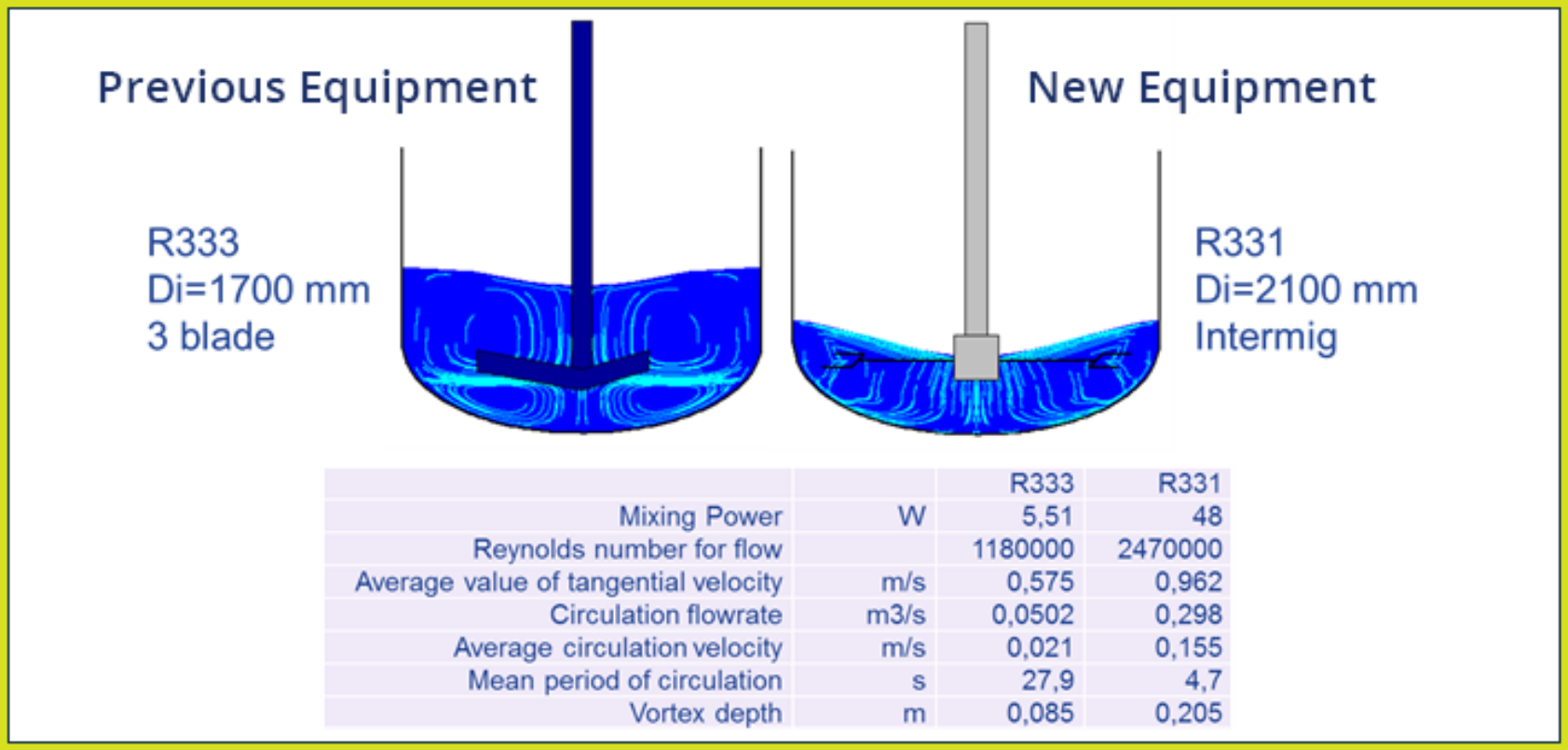
The Traditional Approach	Trial and error in the production facilities in order to do "fine tuning" of the operational parameters in the process. No improvement was observed.
The VisiMix Analysis	VisiMix was used to find out why the process failed and make suggestions to remedy the challenge.
The VisiMix Solution	Due to the design of the old impeller, all beads were found in the lower part of the reactor. VisiMix calculations showed that the improved mixing accelerated hydrolysis. VisiMix also showed that the new impeller was not suited for the process and that the only way to avoid failed batches was to stop using the vessel for this product.
The Results	Oxygen hydrolysis during basic conditions destroys the sugar molecules. Concentration of product much higher below the old impeller. Due to the improved mixing hydrolysis was accelerated.

"From the outcome of this case, we understood that the combination of the company knowledge of the process with VisiMix simulation is more than must – in order to succeed to define new equipment for new processes."

"The Launch was delayed by 6 months and the potential of production during this months is – 1,200,000 Eu and there are some more expenses connected with purchasing equipment"

Technical Description

Process :
Troubleshooting in the life science industry after breakdown and repair of equipment
Task :
Understand the reason for failed batches and establish new operation conditions with the new equipment.



		R333	R331
Mixing Power	W	5,51	48
Reynolds number for flow		1180000	2470000
Average value of tangential velocity	m/s	0,575	0,962
Circulation flowrate	m3/s	0,0502	0,298
Average circulation velocity	m/s	0,021	0,155
Mean period of circulation	s	27,9	4,7
Vortex depth	m	0,085	0,205

Improved mixing accelerated hydrolysis. VisiMix showed that the impeller was not suited for this process, and as a result the production was moved to reactors with appropriate mixing.

Proposed Method

Mixing Calculations in Development

Save with VisiMix (for this example: $1,000,000 per project)!

VISIMIX SOLUTIONS

TURBULENT® 2Kx

Low viscosity liquids and multi-phase system

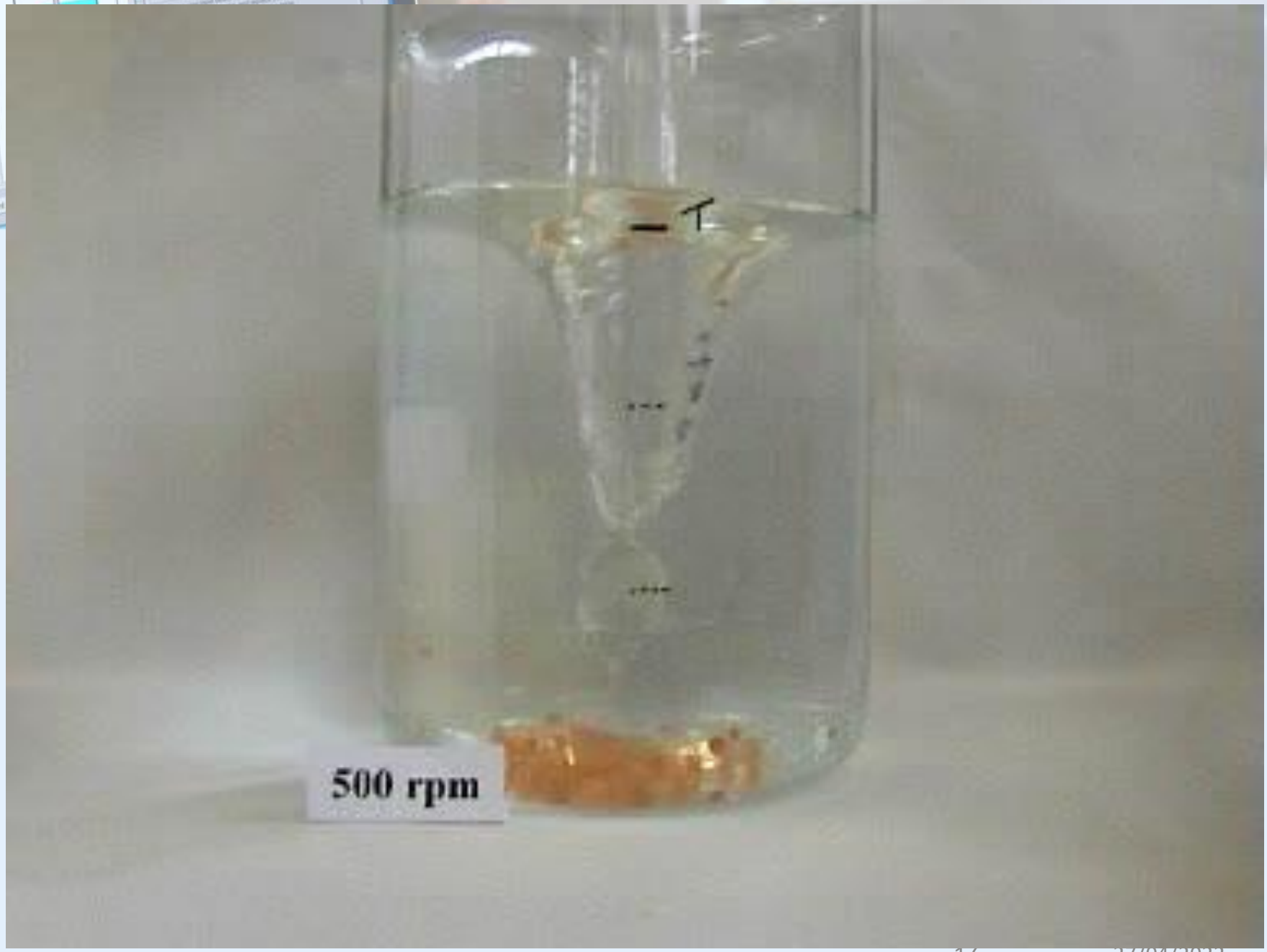
Process:

Typical Fine Chemical Development

Task:

Decreasing the Number of required batches for Validation Process in the production step.

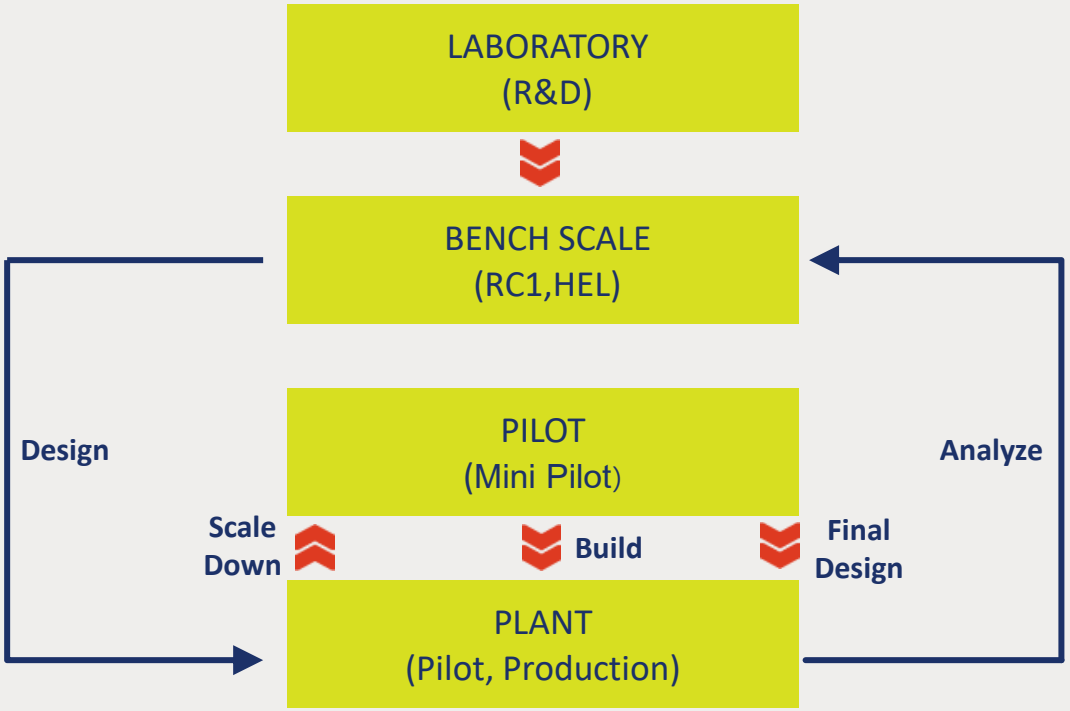
The Process	Batch and Semi batch Process.
The Problem	Gap between R&D and production results.
The Traditional Approach	Running the process at increasing sized reactors and looking for optimal process and operation parameters at every stage.

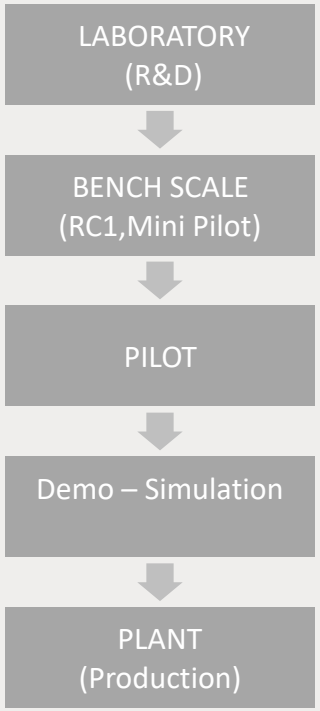

500 rpm

Methodology

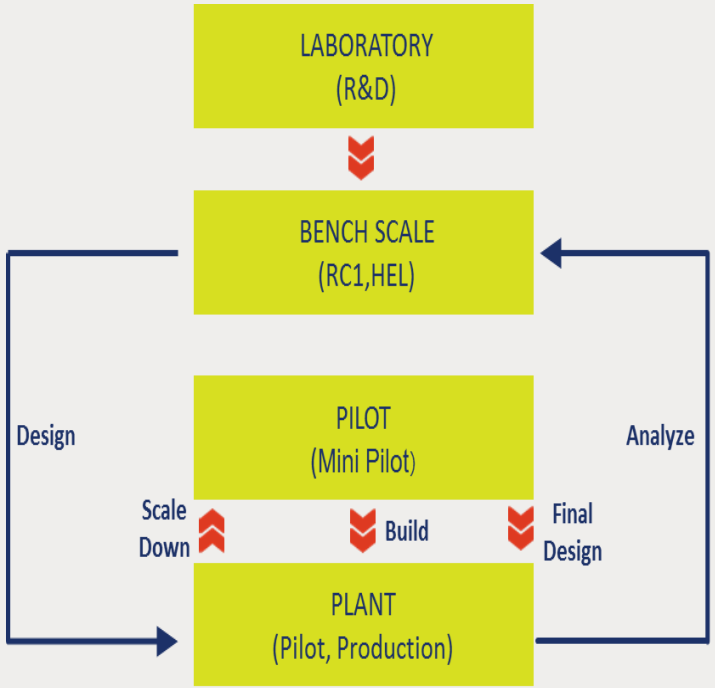
(J.M. Berty, CEP, 1979)

New Process with Mixing





Methodology



- **Step 1**: Know the Mechanism of your Process.
- **Step 2**: Calculate Mixing Parameters will be available to provide in the commercial stage equipment.
- **Step 3**: Set Up Lab or Pilot equipment at the same range of work as calculated in Step 2.
- **Step 4**: Run Statistical Design of Experiments under conditions Set Up in Step 3 and select relevant experiments to proof the mechanism and achieved a good product quality, effective process operation and maximum yield.
- **Step 5**: Model Verification by Scaling down in industrial equipment for sample customer product.
- **Step 6**: Generate a Final Design, Procedure an Operation.

Lab and Prod Calculations

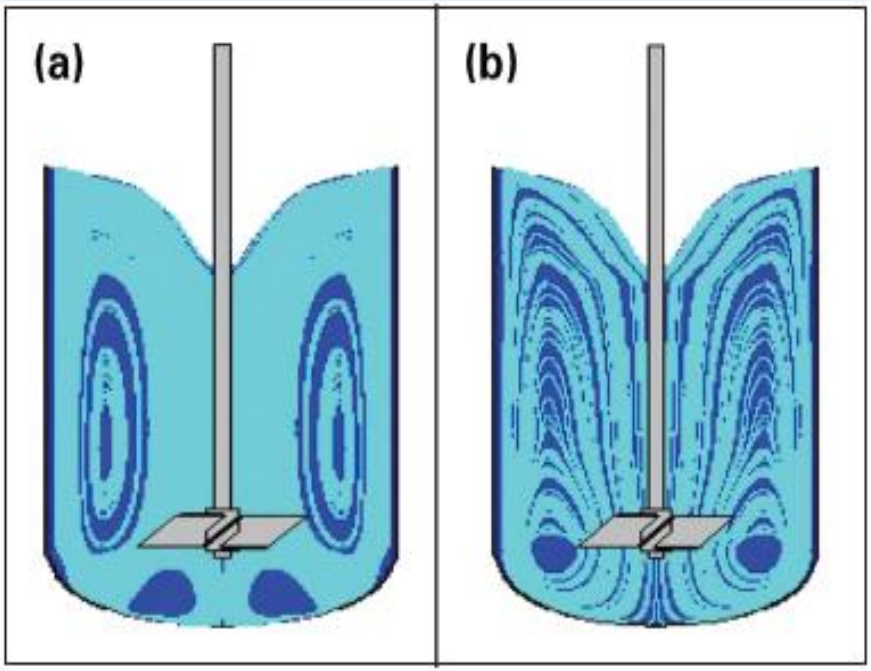


Figure 1. RC–1 General flow – pattern picture, (a) pumping down and (b) pumping up.

Operational Parameter	R 7610	R 7501 Modified
Operation Initial Conditions		
Reactor Volume, L	8	100
Reactor Temperature, °C	70	70
Stirrer Velocity, rpm	450	300
Hydrodynamics		
Mixing Power, W	17	335
Reynolds for Flow	73200	249000
Turbulence Main Characteristics		
Energy Dissipation – Average value, W/kg	2.29	3.61
Energy Dissipation – Maximum Value, W/kg	103	122
Liquid-Solid Mixing Main Characteristics		
Solid Suspended Condition is Expected	OK	OK
Maximum Degree of Non-Uniformity – Axial, %	14	15
Maximum Degree of Non-Uniformity – Radial, %	5	4
Average Concentration of Solid Phase in Continuous Flow, kg/m^3	39	39
Gassing Characterization		
Gas Hold – Up*	0.00024	0.16
Specific Mass Transfer Coefficient Gas – Liquid, 1/s	0.0015	0.655
Gas Mass Transfer Rate*, kg/h	0.0011	6.84
Gas Distribution: Satisfactory, Flooding Not Expected	OK	OK

* Gas Hold-up: represents the average value of volume fraction of gas in the gas-liquid mixture.
* Gas Mass Transfer Rate: rate of gas dissolution corresponding to specific mass transfer coefficient.

Moshe Bentolila, Roberto Novoa, and Wayne Genck, Michal Hasson, Efrat Manoff, "Computer Aided Process Engineering at Chemagis" , PHARMACEUTICAL ENGINEERING July/August 2011. 30-38

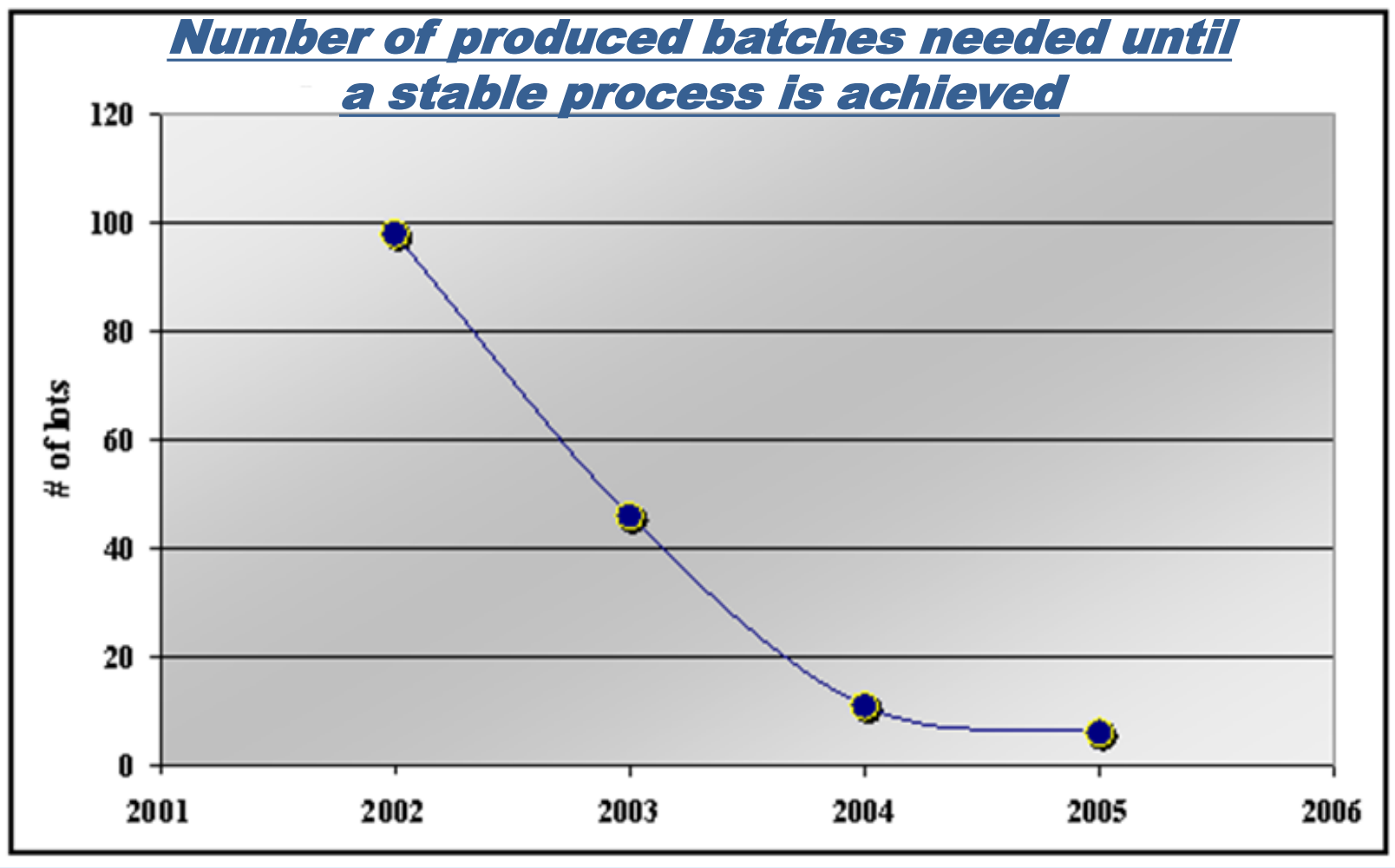
Non Ideal Stirring – Non homogeneity

Before performance of scale up experiments **VisiMix** simulation was used to check suspension at different Mini Pilot Reactors:

Reactor	**7603**	**7605**	**7605**	**7607**
Volume, L	**10**	**25**	**25**	**50**
RPM	**500 (Max)**	**400**	**500 (Max)**	**150 (Max)**
Liquid – Solid Mixing				
Solid suspension quality	Complete suspension is questionable. Partial settling of solid phase may occur.	Complete suspension is expected.	Complete suspension is expected.	Complete suspension is questionable. Partial settling of solid phase may occur.
Max. degree of non uniformity of solid distribution				
AXIAL, %	22.3	10.3	29.1	132
RADIAL, %	65.7	34.3	76.3	90.8

Not all Mini Pilot reactor are capable of full suspension of Reagent

Methodology



Brief Description of Mixing Phenomena

Macromixing Time

- This parameter characterizes the time required for the distribution of solute (admixture, tracer, paint, etc.) throughout the entire volume of the tank.
- It is calculated as the time required to reduce the maximum difference of local concentrations of the admixture to about 1% of its final average value (in batch mixing conditions).

Brief Description of Mixing Phenomena

Mean period of circulation

- The average time of a single cycle of media circulation is calculated on the basis of the circulation flow rate.
- In many cases, it is recommended to reduce this parameter, for instance, to avoid significant change of concentration near the inlet pipe.
- To reduce circulation time without increasing the mixing power, try an impeller with a larger tip diameter and lower pitch angle of blades

Brief Description of Mixing Phenomena

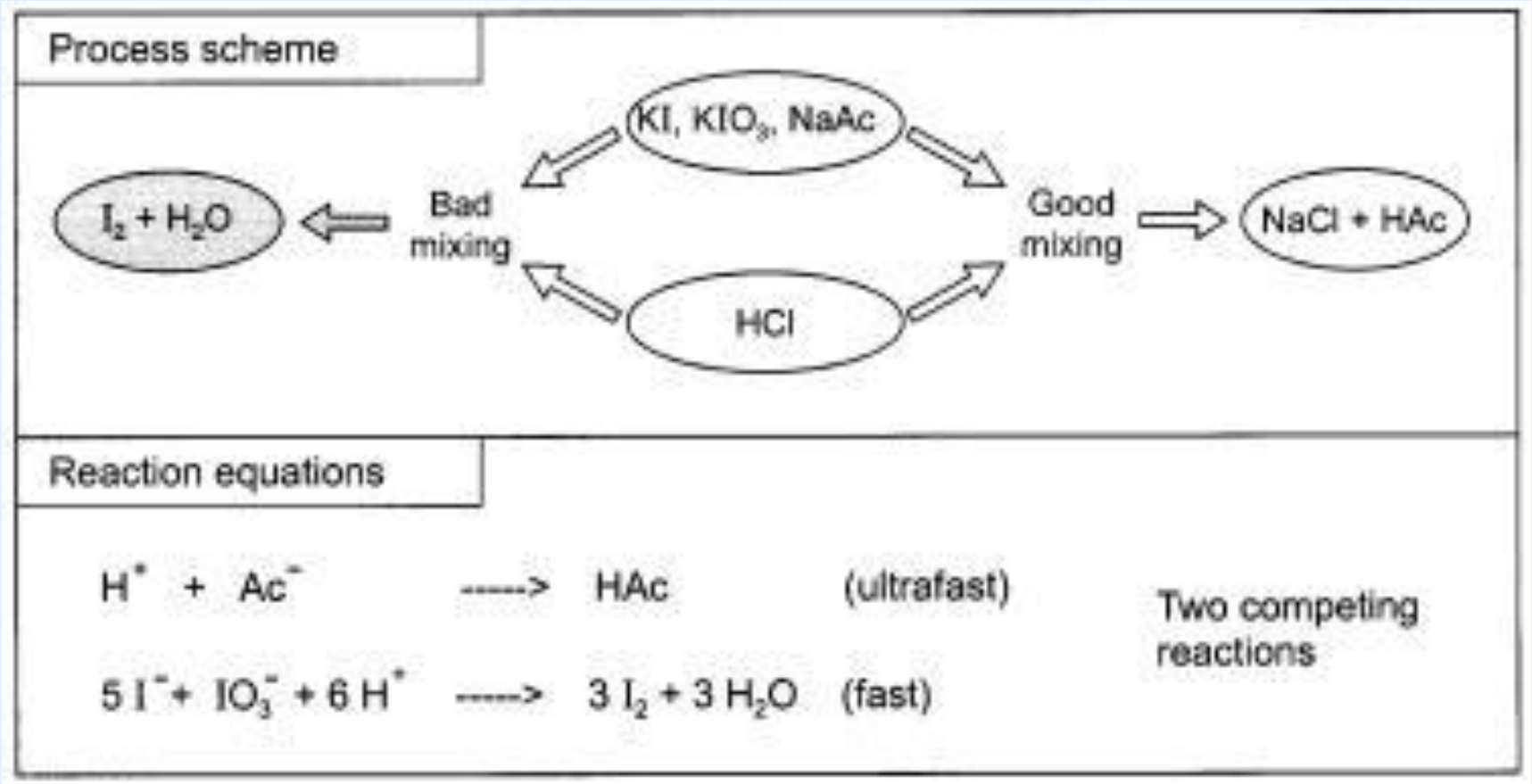
Characteristic time of micromixing

- This parameter represents an estimate of the time required to achieve uniform distribution of the dissolved substances down to the molecular level.
- It is assumed to depend on the molecular diffusion of solute, while the scale of mixing due to molecular diffusion only is supposed to correspond to the microscale of turbulence.
- Micromixing time is estimated both as the diffusion time, and as the maximum lifetime of a volume element, which has elapsed before the element enters the zone of the maximum dissipation rate

VisiMix Application

Homogeneous Reaction

Chemical Reaction



Lab experiment

Feeding HCl without stirring

Lab experiment

Feeding the HCl upper from the top

Lab experiment

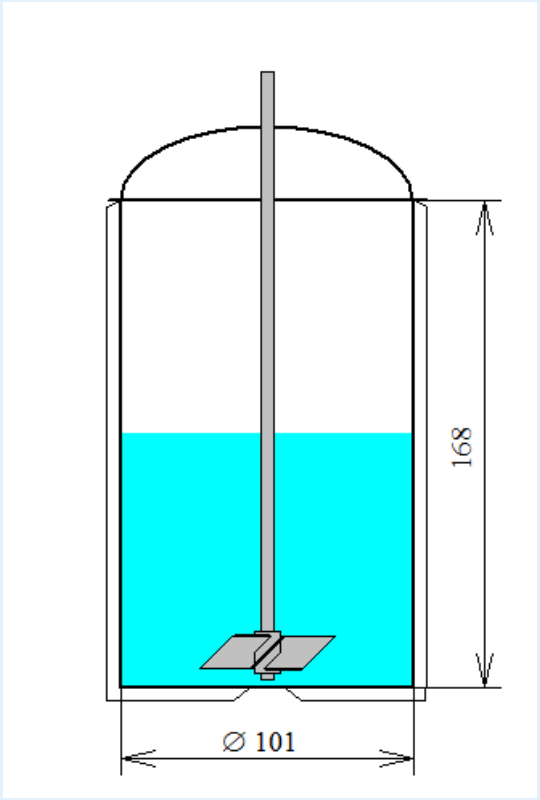
Feeding the HCl close to the impeller low rpm

Lab experiment

Feeding the HCl close to the impeller high rpm

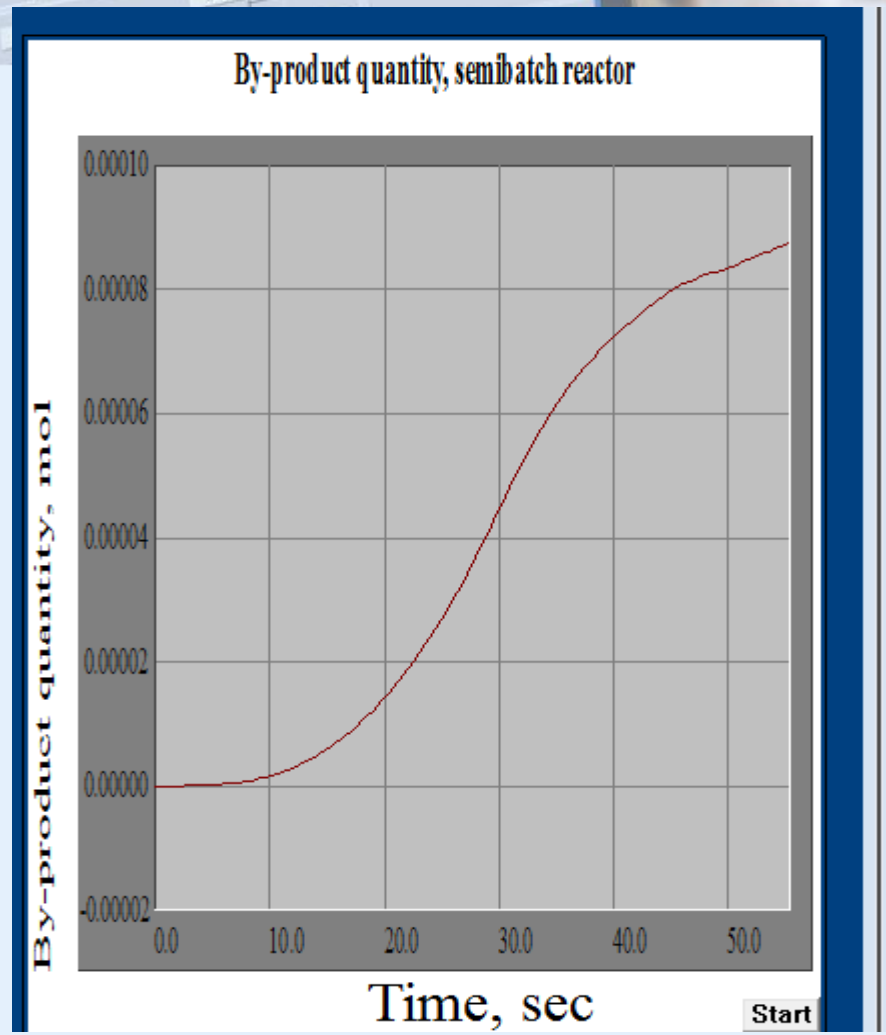
VisiMix Results

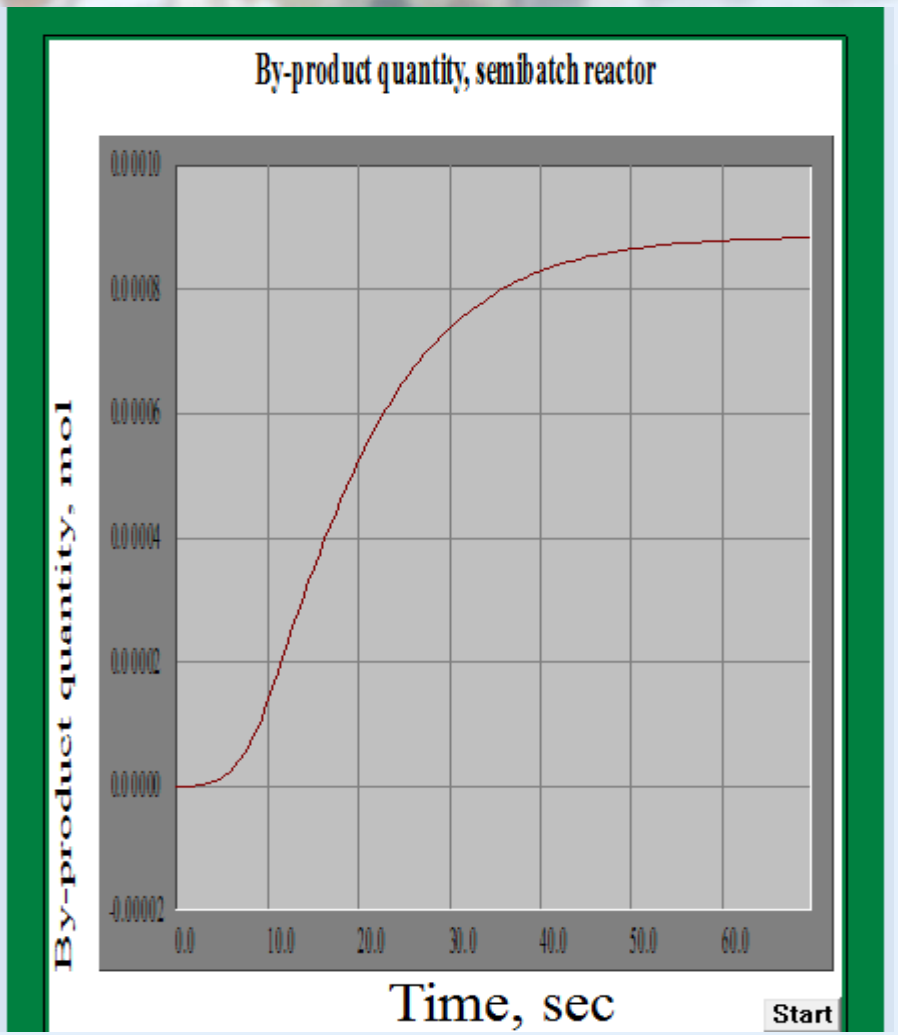
Optimax



VisiMix Optimax Model

VisiMix Results





Liquid-Liquid Mixing

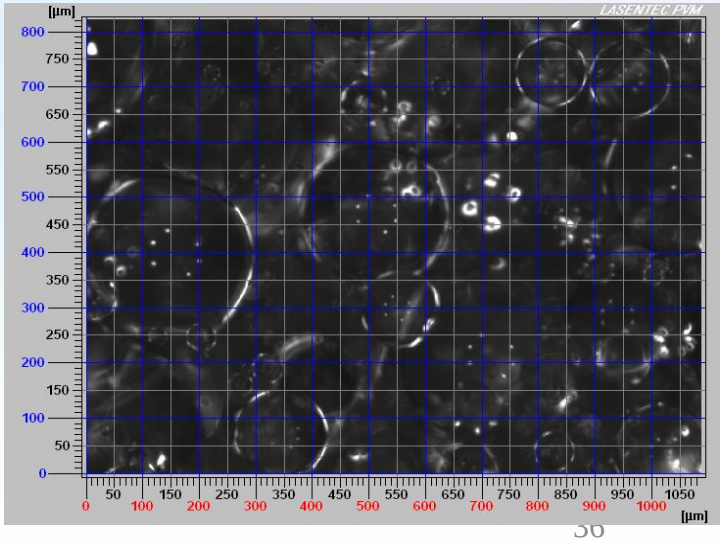
Impeller Design for Liquid-Liquid Dispersion Using VisiMix RSD/Turbulent

Matthew Jörgensen
matt.jorgensen@nalasengineering.com
860-460-9611

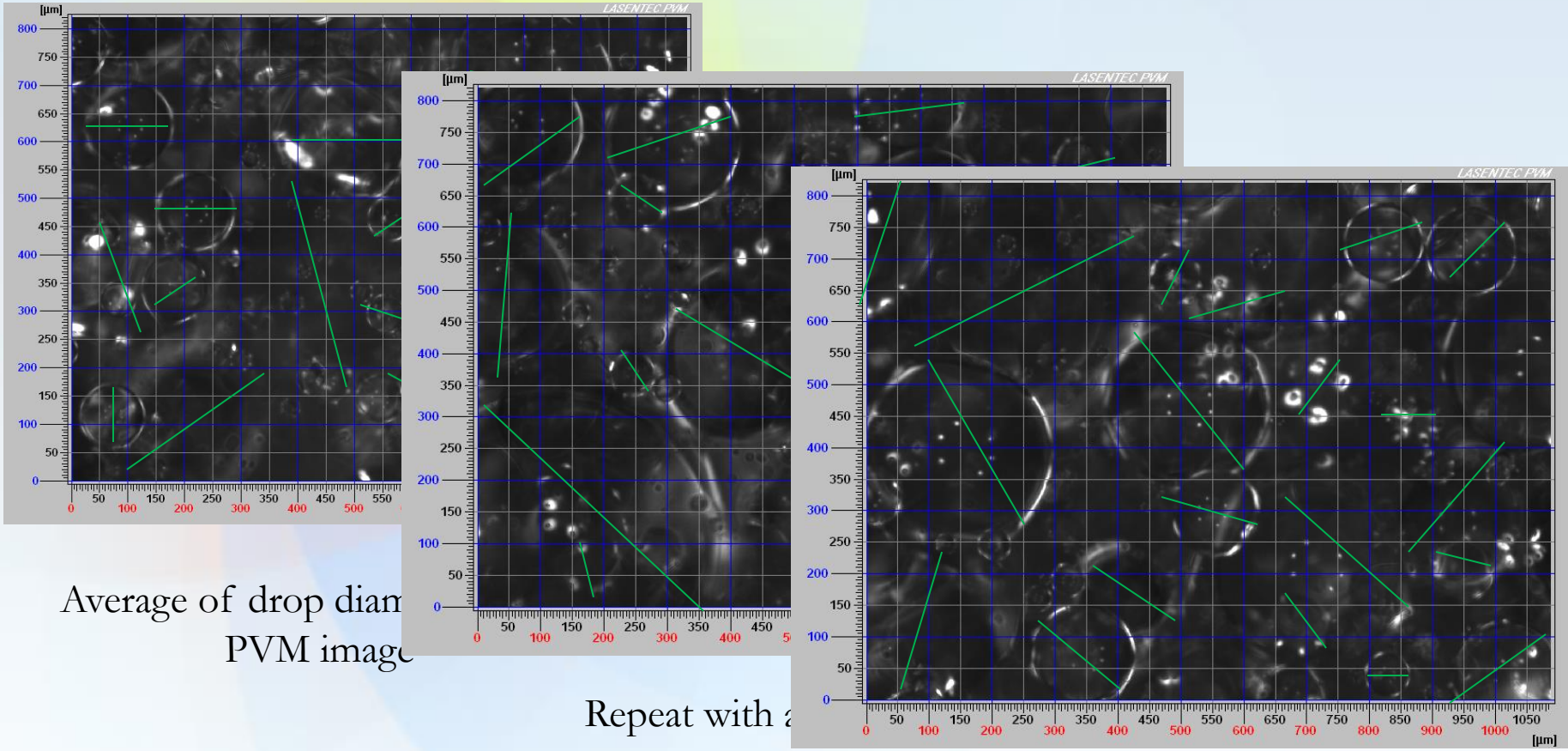
Jerry Salan
jerry.salan@nalasengineering.com

Validate Model Using PVM

- Taking the PVM data at one setup to test the model for the admixture value.
- Comparing drop size distribution to the VisiMix values
- By matching the shear between systems we hope to match drop size, surface area, and mixing.
  - Mean drop size



Calculating Drop Diameter from PVM



Average of drop dian
PVM image

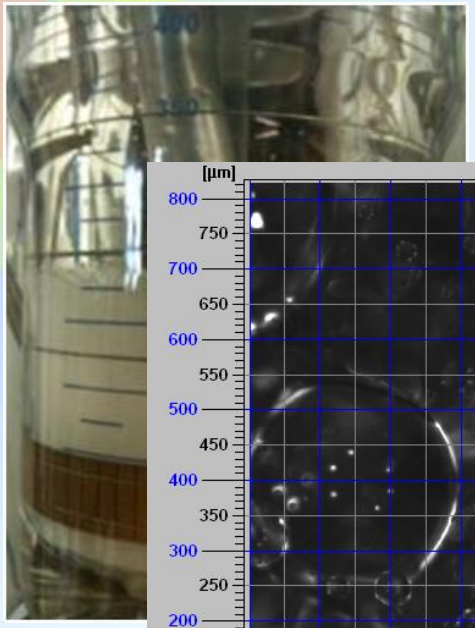
Repeat with a

Repeat a third time

The average diameter for all three images is then averaged again and that value is the drop diameter for that RPM

RC-1 Experiments

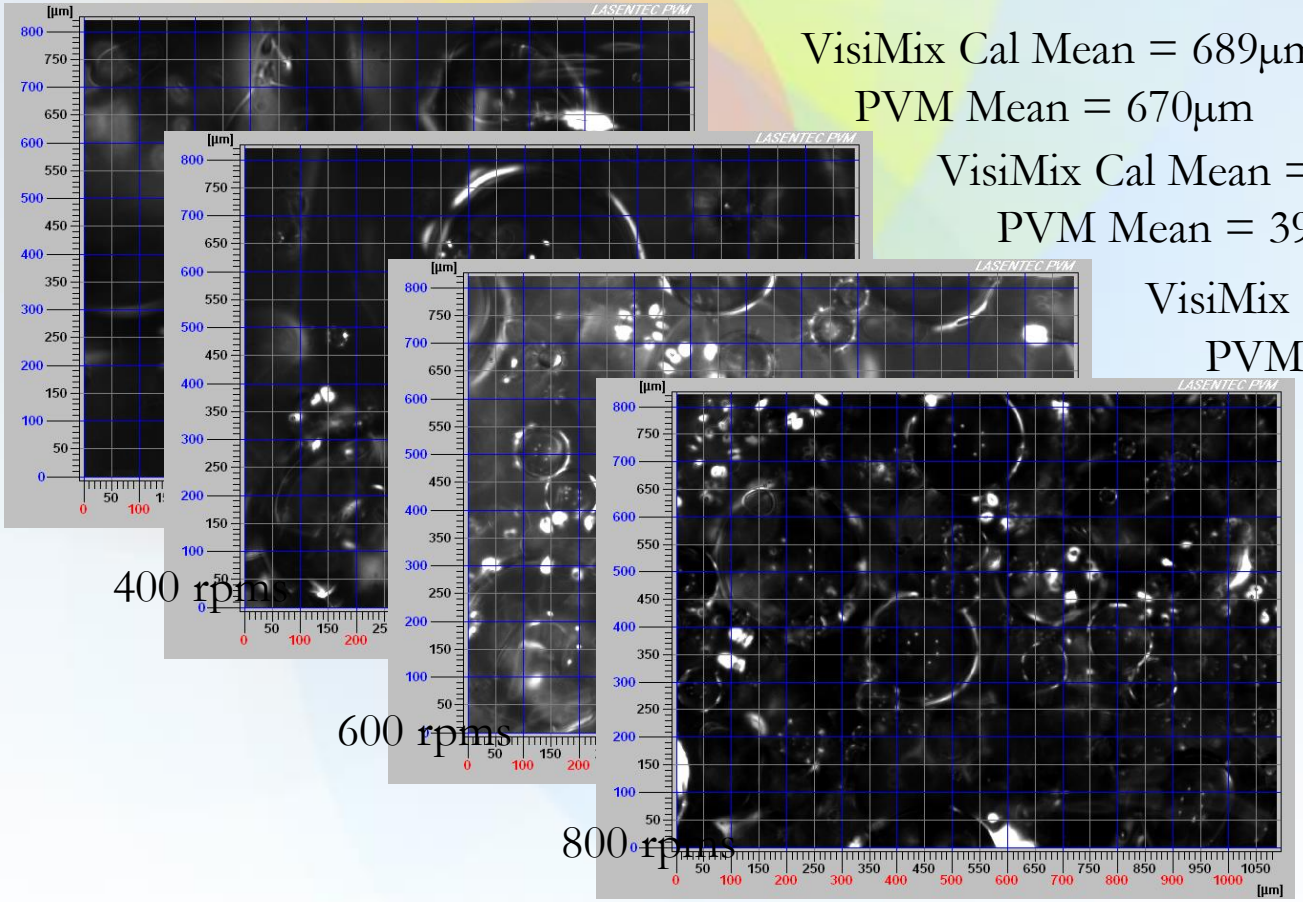
Pitch blade impeller with PVM and Tr as baffles.



PVM mean ≈ 280 μm

VisiMix calculated mean = 282 μm
with admixture value set to 0.75

RC-1 Experiments Using PB-Impeller



VisiMix Cal Mean = 689µm
PVM Mean = 670µm

VisiMix Cal Mean = 403µm
PVM Mean = 397µm

VisiMix Cal Mean = 314µm
PVM Mean = 301µm

VisiMix Cal Mean = 281µm
PVM Mean = 275µm

Stable Emulsion

VisiMix Application

Crystallization

Mixing Parameters for Crystallization Processes

IMPORTANT PARAMETERS	ANSWERED QUESTIONS AND NOTES
Axial and radial solids uniformity (distribution)	What is the uniformity throughout the vessel? Ensure that solids do not accumulate on the bottom.
Micromixing time	How long is the micro scale degradation of non-homogenized concentration? This is important for precipitations.
Energy of collisions in bulk	What is the collision energy of particles? A high number of collisions in the bulk can affect breakage and secondary nucleation.
Collisions of maximum energy	How often do the slurry particles see the maximum collision energy? What is the frequency near the zone of maximum turbulence near the impeller blades? Frequent collisions lead to more breakage and secondary nucleation.
Local values of energy dissipation	What is the average energy dissipation in the agitator zone? What is in the bulk slurry? What is it at the baffles? Dissipation controls breakage, nucleation and micromixing in these zones.
Maximum energy dissipation	Manipulating energy dissipation in the area behind the agitator blades controls breakage, nucleation and micromixing in this zone.
Time between strong collisions	What is the average period of uninterrupted crystal growth?
Shear rates	What is the likelihood of rupturing the crystal or agglomerates? What is the impact on growth and desolution for the agitation conditions?

Mixing Parameters for Crystallization Processes

Cooling crystallization of API in 6000 liter reactor.

Campaign	X (v,90)< 250 µm
First	195
Second	325

After investigation it was found that the tip diameter of the Agitator was damaged and the real diameter is a 80 % of the reported one.

ENERGY DISSIPATION - MAXIMUM VALUE

Parameter name	Units	Value
Energy dissipation - maximum value	W/kg	191

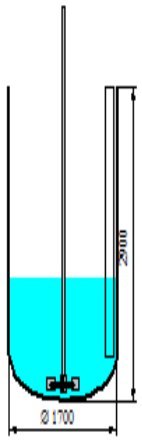
For HELP press F1

ENERGY DISSIPATION - MAXIMUM VALUE

Parameter name	Units	Value
Energy dissipation - maximum value	W/kg	115

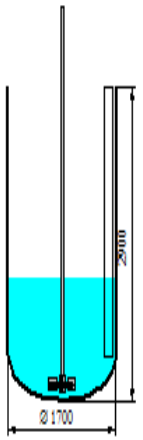
For HELP press F1

[VisiMix_R3107] - Drawing of apparatus



For HELP press F1

[VisiMix_R3107-new] - Drawing of apparatus



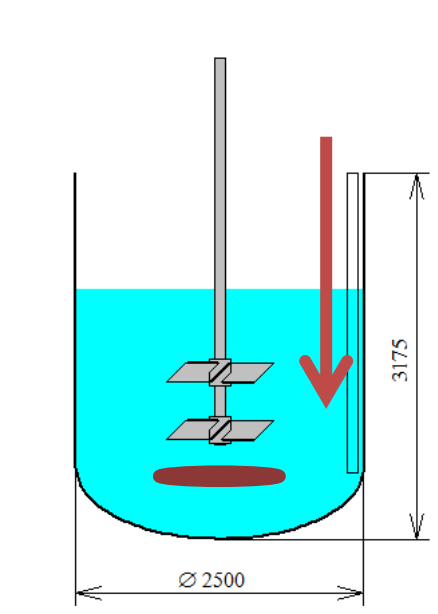
Volume

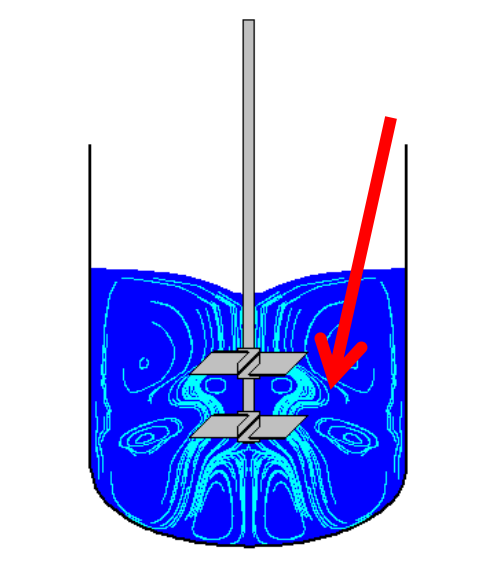
VisiMix Application

Gas Liquid Reaction

Description

- Gas – Liquid reaction in pilot scale ~ 1000 liter is finished after 4 Hour
- Same in Production 4 Days.





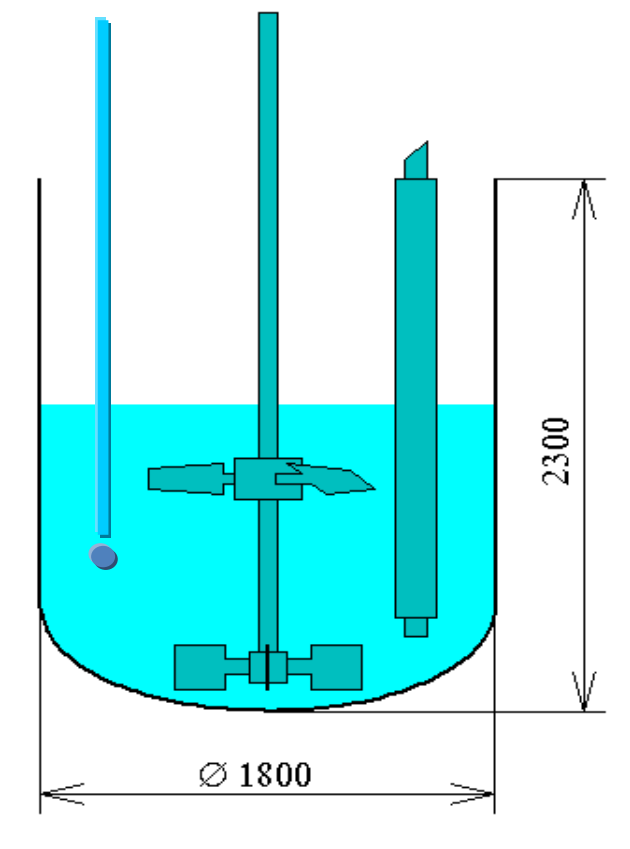
After Change Position the process take around 14 hours

VisiMix Application

High Shear Rate in Semi Batch Homogeneous Reaction

Process and Quality Problem

Feed R-Cl



R-6826

Process

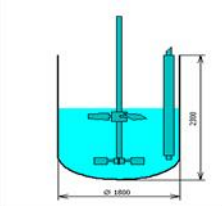
$R\text{-}NH_2 + R'\text{-}Cl \longrightarrow t\text{-}D\text{-}R\text{-}R'$

Impurity

t-L-R-R’

Impurity Results at Laboratory and Production

[%]impurity	RPM	Impeller type	system
0%	15,000 rpm	rotor stator	Laboratory reactor
0.3%	1,500 rpm	3-blade	
0.6%	800 rpm		
1.5%	100 rpm		
0.3% - 0.6%	140 rpm	bottom – flat blade up - turbofoil	R-6826



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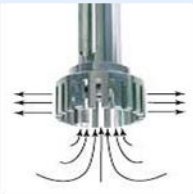


Rotor stator

Lab impeller

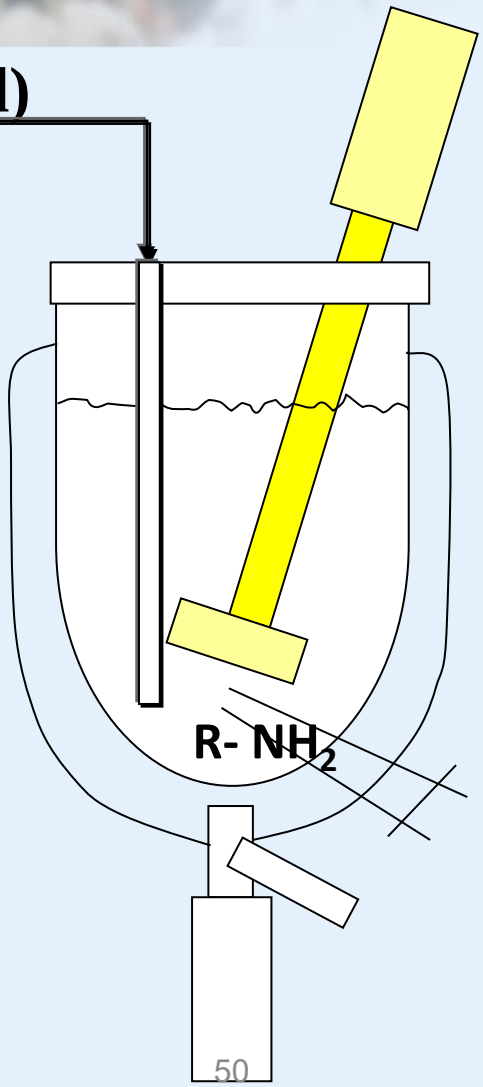
Working with Rotor Stator at Laboratory Scale

Problem

How to scale up ?

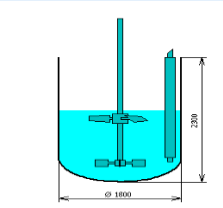
Potential Saving :

MORE than 250 K$



Calculating Shear Forces with VisiMix

Turbulent shear rate [1/s]	[%]impurity	RPM	Impeller type	system
780,000	0%	15,000 rpm	rotor stator	Laboratory reactor
32,900	0.3%	1,500 rpm	3-blade	
12,900	0.6%	800 rpm		
580	1.5%	100 rpm		
15,200	0.3% - 0.6%	140 rpm	bottom – flat blade up - turbofoil	R-6826



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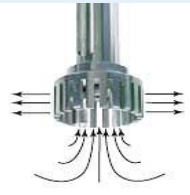
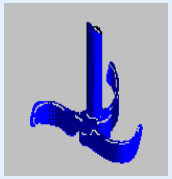


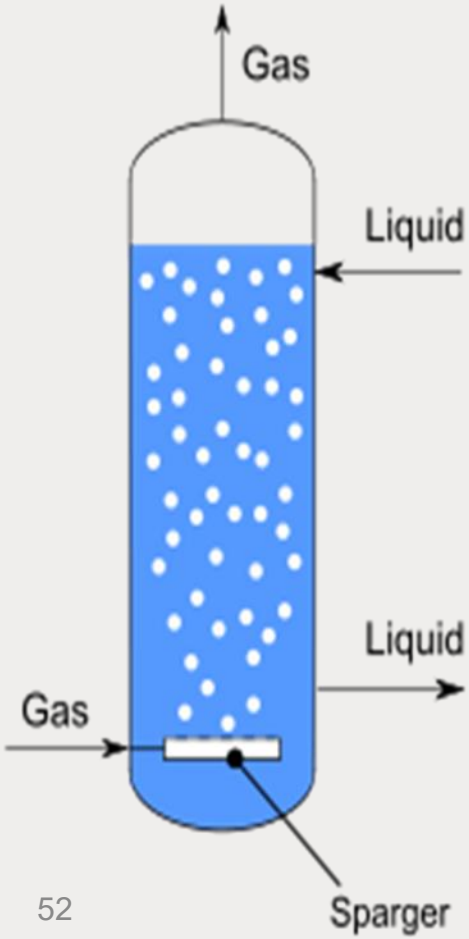
Rotor stator



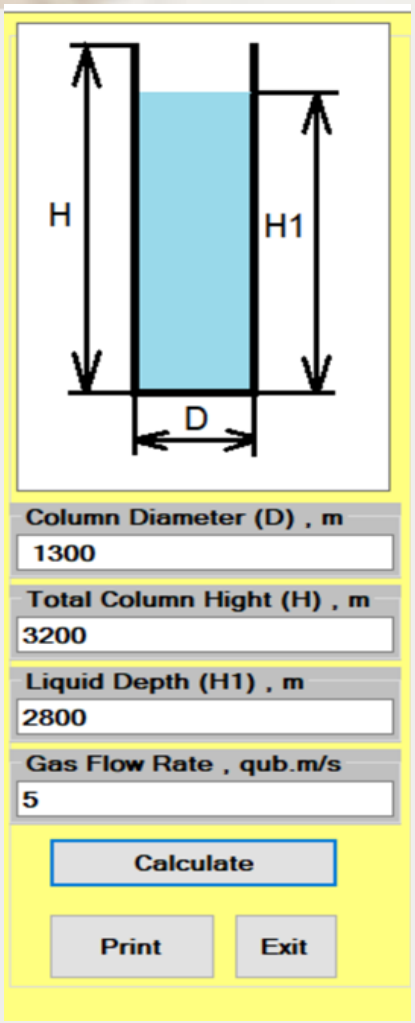
Lab impeller

2020 - VisiMix Bubble Columns

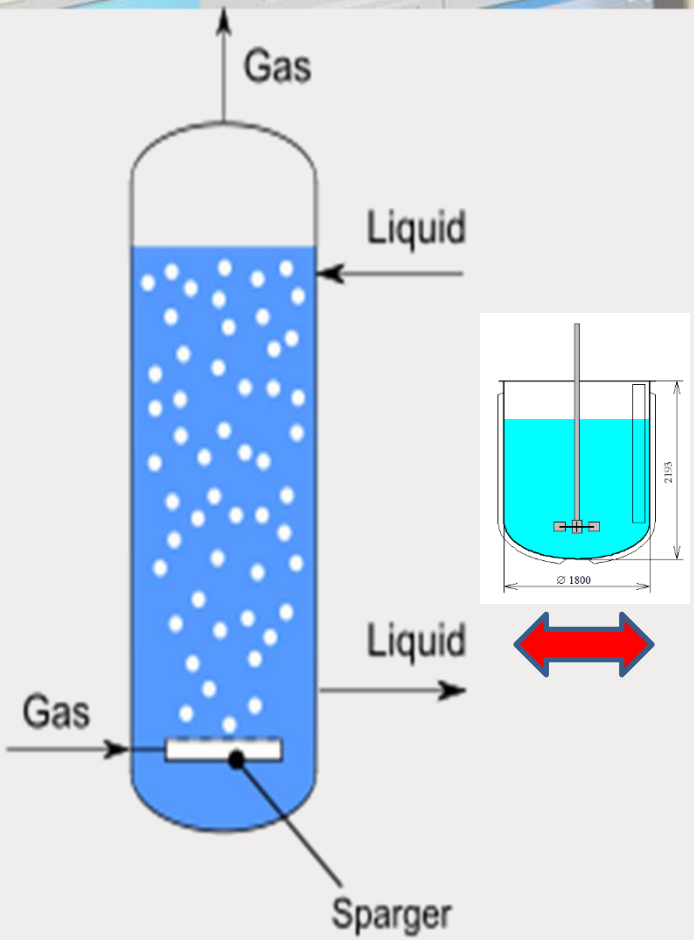
End of April 2020! Follow our Future Announcement!



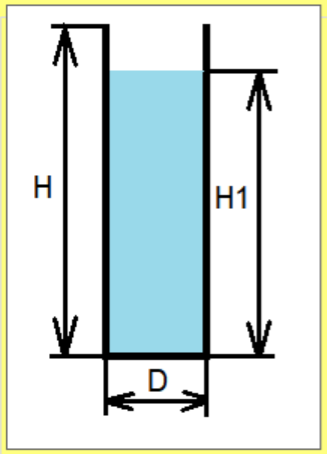
New Release!!



Bubble Columns Interphase



Prepare Visimix Input Data for Heat Transfer Calculations in Bubble Columns



Column Diameter (D) , m: 1300

Total Column Hight (H) , m: 3200

Liquid Depth (H1) , m: 2800

Gas Flow Rate , qub.m/s: 5

Calculate

Print | Exit

Jacketed Tank with Flat Bottom

Inside diameter, m	1300
Total tank hight, m	3200
Level of media, m	2800

FLAT BAFFLE-1

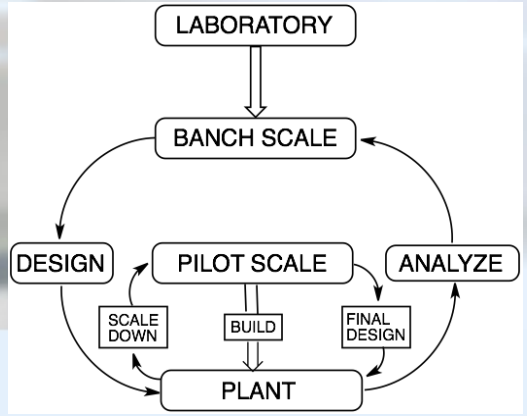
Number	4
Width, m	130
Length, m	2800
Dist. from bottom	0
Angle to radius (fi)	0

Impeller PITCH PADDLE. MULTISTAGE

Tip diameter(D), m	650
Impellers number	3
Dist. between stages, m	560
Number of blades	3
Pitch angle, deg	30
Width of blade, m	65
Dist. from bottom, m	560
Rotation speed, rpm	0.06284
Motor power, kw	3.998E+05

Circulation Flow, qub.m/s	2.652E+05
Near Wall Velocity, m/s	0.3996

Summary



- Step 1: Know the Mechanism of your Process.
- Step 2: Calculate Mixing Parameters will be available to provide in the commercial stage equipment.
- Step 3: Set Up Lab or Pilot equipment at the same range of work as calculated in Step 2.
- Step 4: Run Statistical Design of Experiments under conditions Set Up in Step 3 and select relevant experiments to proof the mechanism and achieved a good product quality, effective process operation and maximum yield.
- Step 5: Model Verification by Scaling down in industrial equipment for sample customer product.
- Step 6: Generate a Final Design, Procedure an Operation.

VisiMix Products

VisiMix software:

- Based on advanced scientific knowledge and practical expertise
- User-friendly and easy to operate
- Requires easily accessible initial data

The VisiMix products are:

- **VisiMix 2K8 Turbulent**
- **VisiMix 2K8 Laminar**
- **VisiMix 2K8 Different-Impellers**
- **VisiXcel- Data Base**
- **Pipe Line**
- **Rotor Stator Disperser Emulsification – RSDE**
- **3D VisiMix Visualization**
- **VisiMix Off Center**
- **VisiMix Bubble Columns**
- **Scale Up/down**
- **Process Evaluation**

VisiMix Products

VisiMix *2K8 Turbulent* – for **low-viscosity** liquids and multiphase systems.

The program provides process parameters necessary for analysis, scaling-up and optimization of mixing tanks and reactors with all types of impellers

Calculations of:

- ✓ Blending
- ✓ Suspension
- ✓ Dissolution
- ✓ Emulsification
- ✓ Gas dispersion
- ✓ Heat transfer
- ✓ Chemical reactions
- ✓ Mechanical stability of shafts

VisiMix Products

VisiMix *2K8 Laminar* - for **highly viscous** media

- ✓ Newtonian and non-Newtonian
- ✓ Macro-scale blending
- ✓ Micromixing in high-shear areas
- ✓ Heat transfer

- pastes
- creams
- shampoos
- liquid soaps
- gels
- ointments
- paints:
- coatings
- slurries
- polymer solutions

VisiMix Products

VisiMix *2K8 Different Impellers – for combined mixing devices*

- The program handles mixing devices consisting of any 2 – 5 impellers.
- Different distances between impellers
- Used in combination with VisiMix Turbulent.
- Provides parameters of hydrodynamics, turbulence and heat transfer.

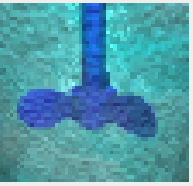
VisiMix Products

VisiMix *VisiXcel* – *Data Base (DB)* – automatic conversion tool: Visimix Output to Excel Spreadsheet

- ✓ Integrates VisiMix report parameters in standard Excel worksheets
- ✓ Analysis VisiMix results in Excel
- ✓ Builds a Database of mixing tanks and reactors.
- ✓ Builds a Database of projects - for processes
- ✓ Makes correlation between plant equipment nomenclature to VisiMix database of mixing tanks and reactors in VisiMix Project Database.
- ✓ Easy access to design data of the mixing tanks, to process parameters and to corresponding results of VisiMix modelling.
- ✓ Results of VisiMix mathematical modelling in the **VisiMix VisiXcel-DB** and arrange the data according to the reactor nomenclature.
- ✓ Easy access to recalculation of the VisiMix modelling from the Database of the reactors & the projects

VisiMix Products

VisiMix Pipe-Line



- ✓ Calculates hydraulic resistance of simple pipelines for liquid viscosity and non-Newtonian products.
- ✓ *Chemical engineers benefit from a quick and user friendly method for **charging times** and the **bottle-necks** in the line.*
- ✓ **Includes : -** *Pipes* **-** *Riffled hoses – Elbows – Valves* **-** *And more*
- ✓ Also comes with a **database containing rheological constants** for the typical commercial non-Newtonian products **-** pastes, creams, shampoos, paints, etc. (**see Help Section for details**)
- ✓ *The **first and only tool** calculating flow resistance for liquids that correspond to **Carreau rheological model**. (See Help Section for details)*

VisiMix Products

VisiMix RSDE (Rotor Stator Disperser Emulsification)

- ✓ **The <u>revolutionary</u> new VisiMix RSDE - Rotor Stator Disperser Emulsification software is the first product of its kind that provides support for mixing devices for media subjected to high sheer stress:**
  Based on <u>3 years</u> dedicated research in a lab with dedicated equipment
  Works with all types of media - both high and low viscosity liquids, Newtonian and Non-Newtonian.
- ✓ **Input geometrical data and process parameters and obtain fast and reliable results with one click**

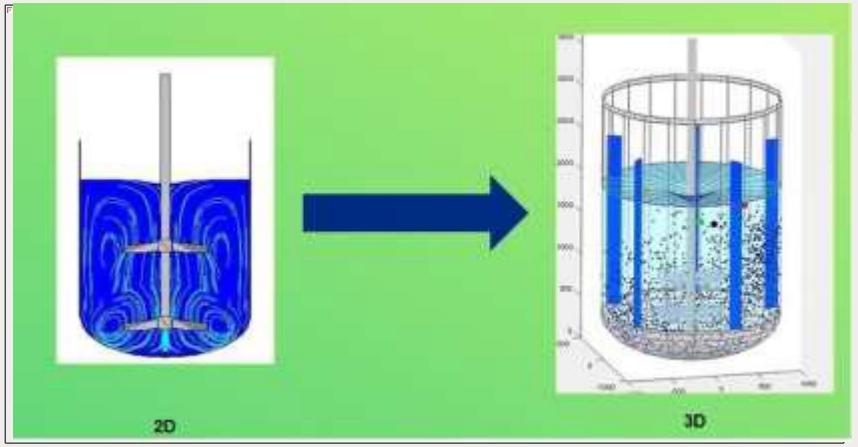
- ✓ **VisiMix RSDE enables you to quickly calculate**
  Shear rates and stresses in internal spaces
  Pumping capacities
  Power consumption and torque

NEW!

VisiMix New Version

3D Visualization of Mixing, Based on the Hydrodynamic Model of the Flow Pattern.

- ✓ This is an exciting 3D visualization based on the VisiMix calculations
- ✓ Grasp the VisiMix results much better.
- ✓ The VisiMix process now looks alive.
- ✓ It is much easier to understand and explain VisiMix results to others and to management.



NEW!

VisiMix New Version

Alternative Impellers

- ✓ Now anyone from your professional can use VisiMix for the entire range of impeller geometries and can now be studied for **known power and flow numbers**.

ALTERNATIVE IMPELLER. SCHEME IS SYMBOLIC.

Tip diameter (D) 900 mm

Number of blades 3

INPUT OPTIONS

Np - Power Number &
Nq - Circulation Flow Number

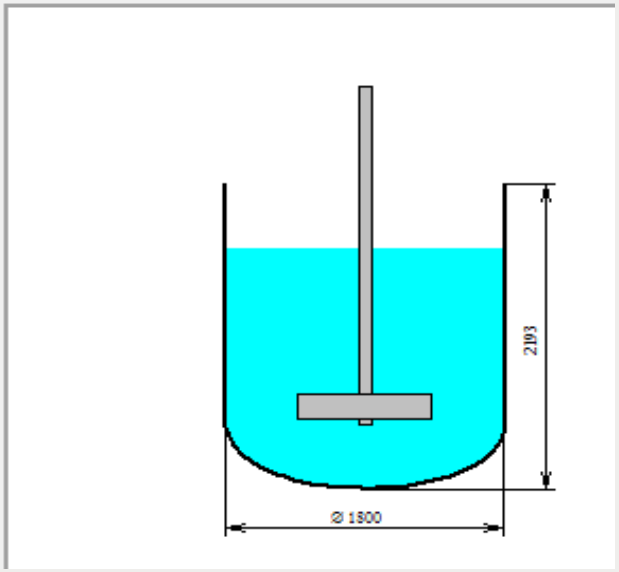
Np - Power Number &
Tip Pitch Angle of Blades

Power number Np 0.182

Circulation flow number Nq 0.584

Tip pitch angle of blades deg

Np and Nq - values based on experimental measurements in water in a fully baffled tank with H / T = 1 and T/D = 3.
Here T - tank diameter, H - level of liquid, D - tip diameter of impeller.

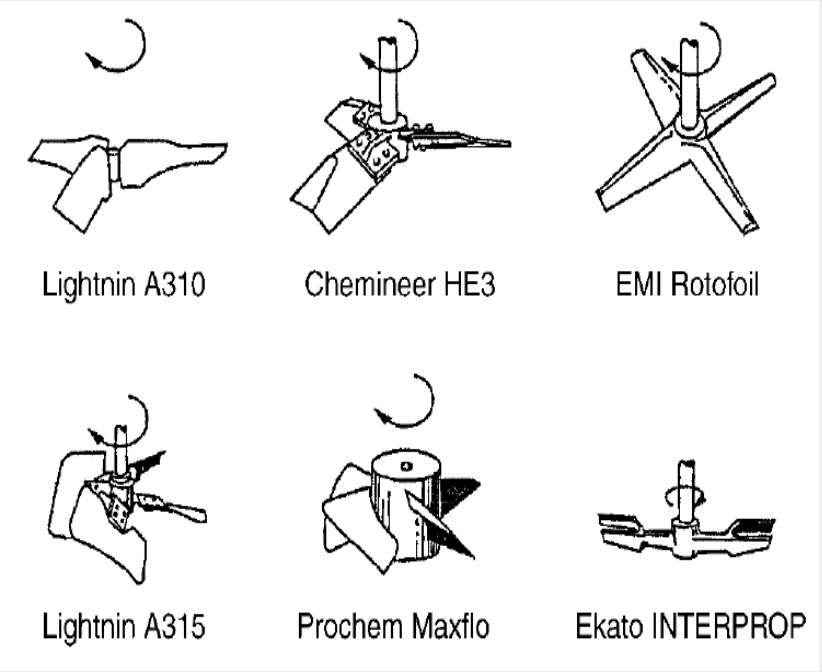


VisiMix New Version

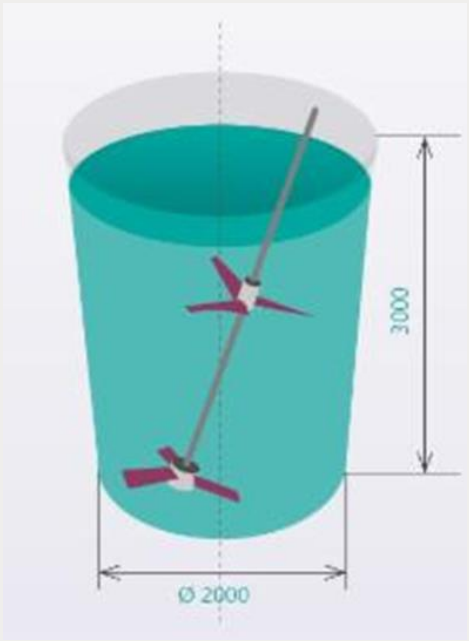
Hydrofoil Impellers

A New Option of Selecting Hydrofoil Impellers from Different Manufacturers

- ✓ Provide streamlined flow as compared to axial imp's
- ✓ Give low shear but more uniform velocity
- ✓ Results in lower power consumption
- ✓ Used mainly for blending of miscible liquids, suspensions of solids and gas-liquid, liquid-liquid mixing



2019 - VisiMix Off Center Impellers

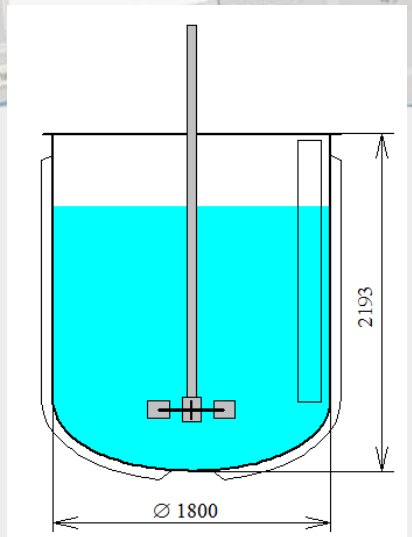


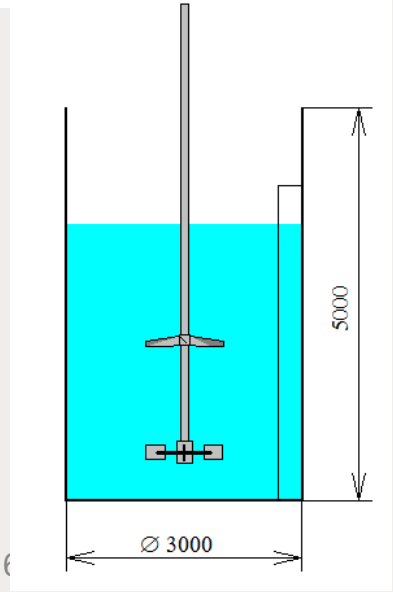
New Release!!

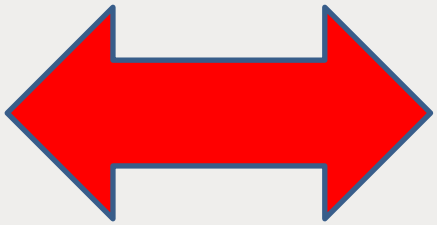
Special price for participants

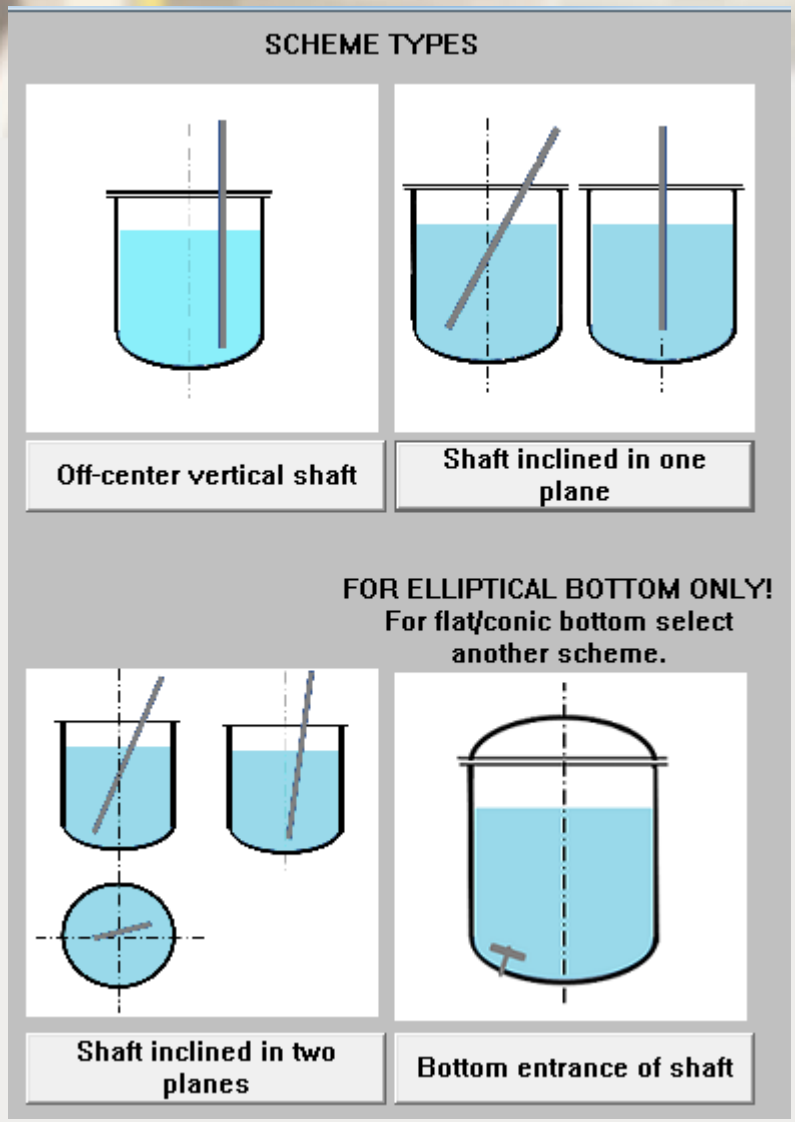
VisiMix

Off Center Impeller Options









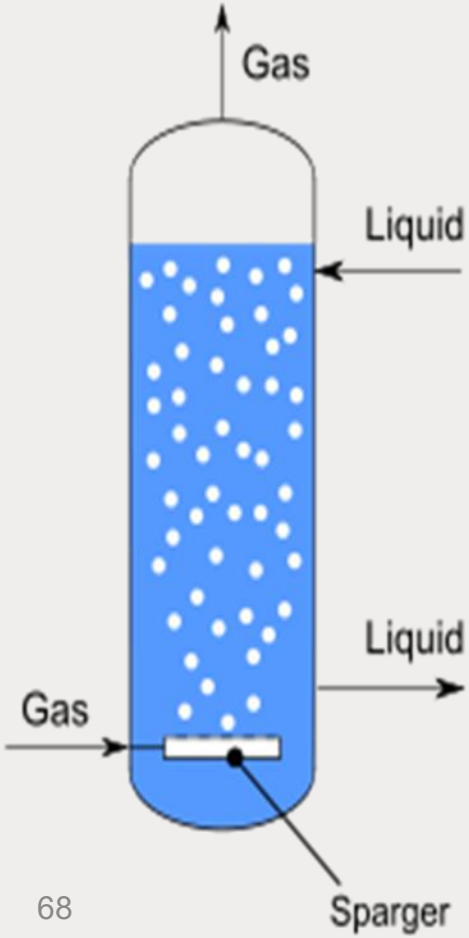
VisiMix Off Center Impellers

- The first release of the program allows for entering of mixing devices with :
  - one or two impellers (identical or different)
  - vertical and inclined head-entering shafts
  - bottom-entering mixing devices with single impeller.

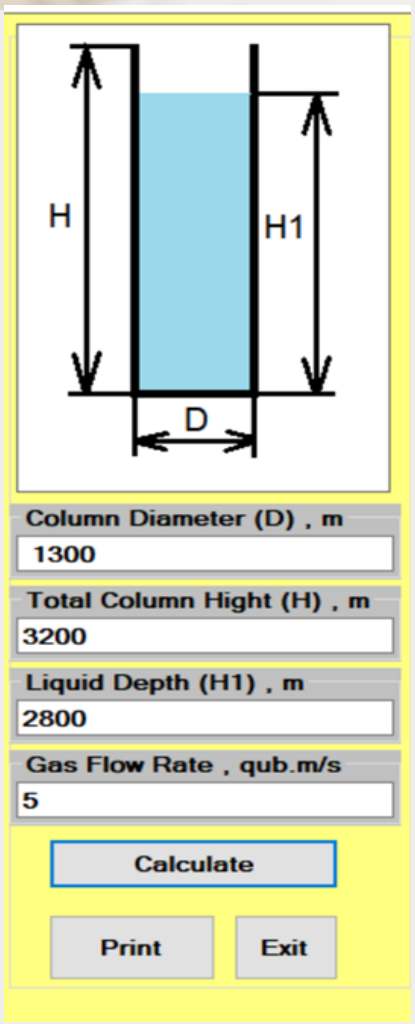
- The program outputs include
  - main parameters of hydrodynamics (power, flow velocities, etc.)
  - turbulence (maximum and other local values, etc.)
  - heat transfer corresponding

2020 - VisiMix Bubble Columns

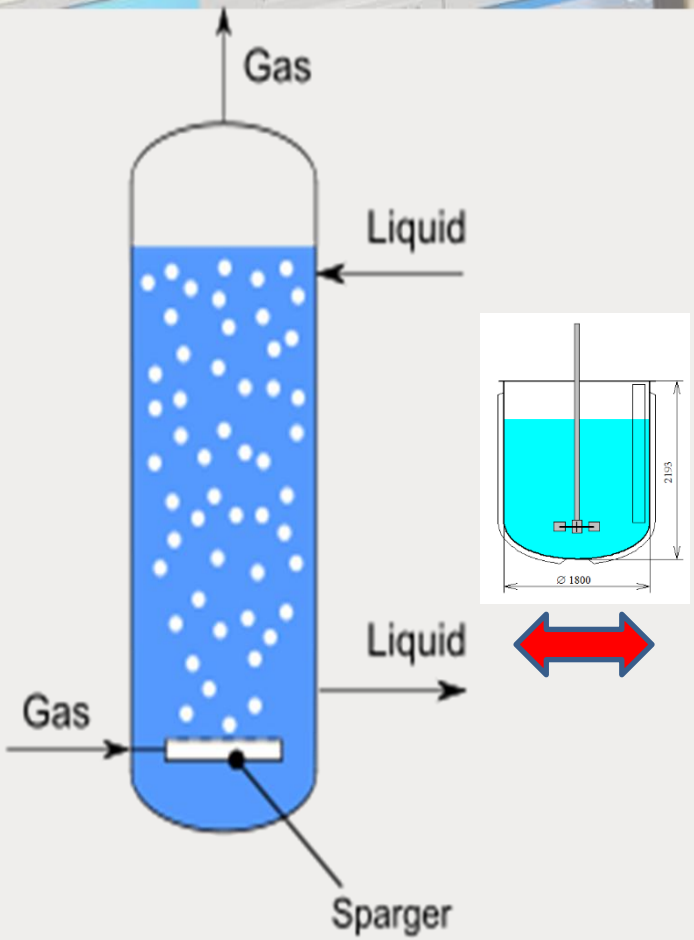
End of April 2020! Follow our Future Announcement!



New Release!!



Bubble Columns Interphase



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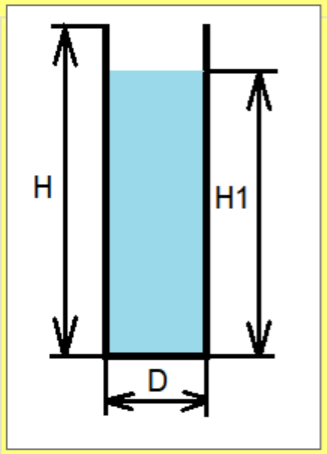

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Inside diameter, m	1300
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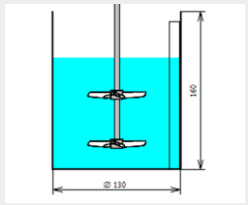
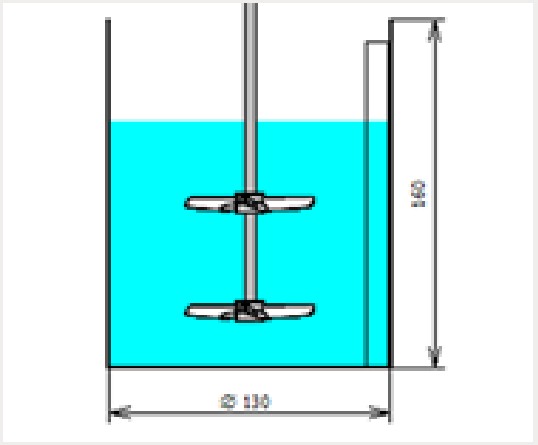
Motor power, kw	3.998E+05

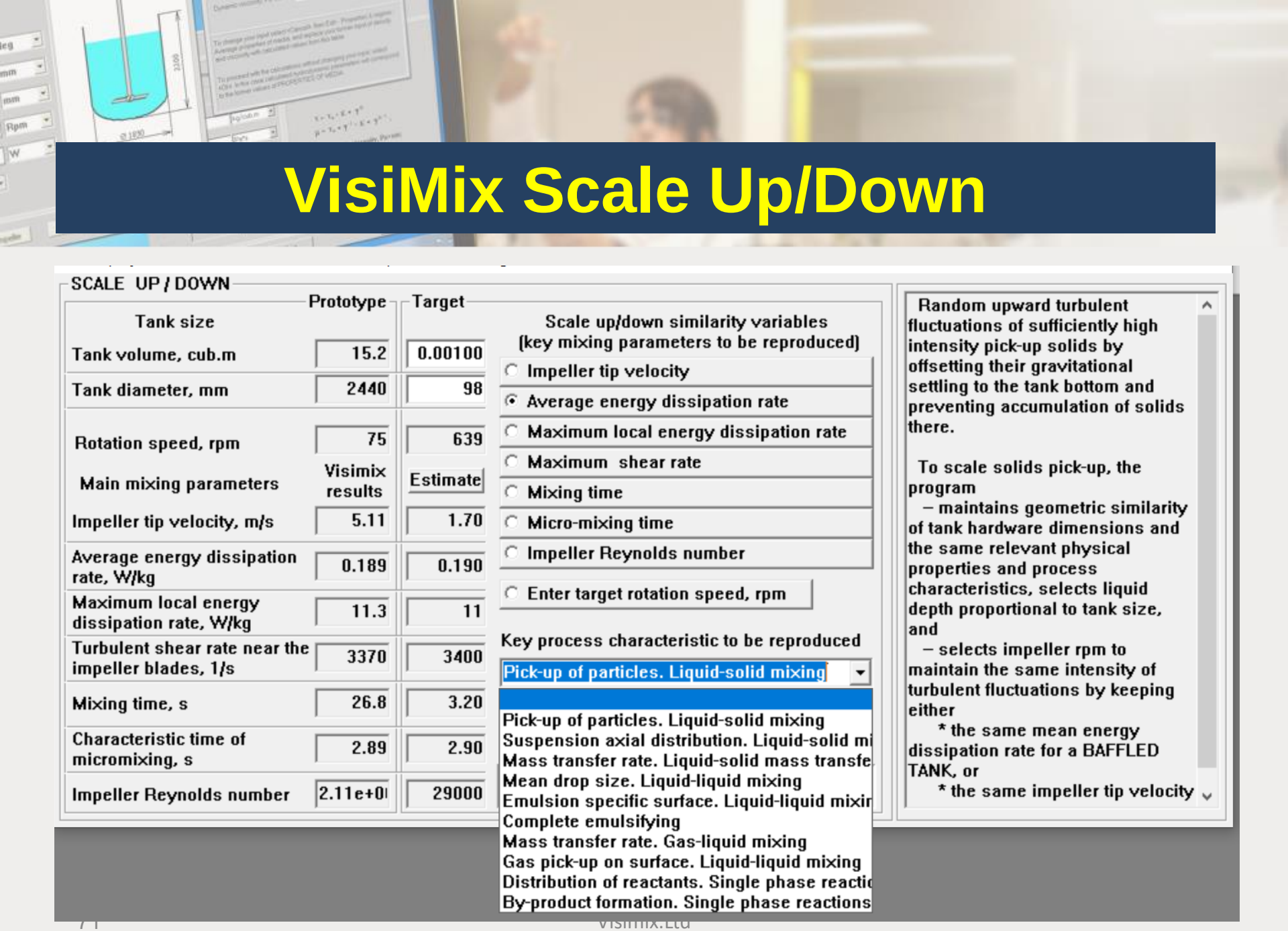
Circulation Flow, qub.m/s	2.652E+05
Near Wall Velocity, m/s	0.3996

VisiMix Scale Up/Down

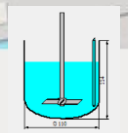


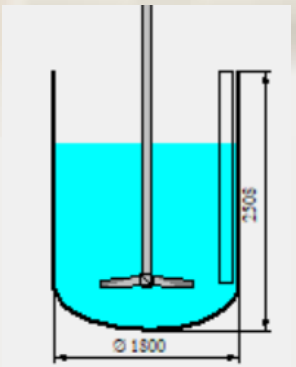


VisiMix Scale Up/Down



VisiMix Process Evaluation





Unit operation:

Suspension of Solid Particles

Open | Save As | Export to Excel | Close | Exit

1 C:\Users\Moshe Bentolila\Desktop\lab.VSM
2 C:\Users\Moshe Bentolila\Desktop\Production 1.vsm
3 C:\Users\Moshe Bentolila\Desktop\Production 2.vsm
4 C:\Users\Moshe Bentolila\Desktop\Production 3.VSM

Target parameters

Parameter	1	2	3	4	5	6
Project Name	lab	Production 1	Production 2	Productio...		
=== TARGET PARAMETERS						
Complete/incomplete suspension	complete	incomplete	complete	incomplete		
Maximum degree of non-uniformity, axial, %	24.1	24.2	23.4	21.9		
Maximum degree of non-uniformity, radial, %	42.5	13.3	12.7	0.34		
Maximum loccal concentration of solid phase, kg/cub.m	138	130	129	124		
Minimum loccal concentration of solid phase, kg/cub.m	44.7	67.3	68.4	79.2		
Average concentration of solid phasein continuous flow, ...	138	130	129	124		
Frequency of collisions of maximum energy, 1/s	0.0698	0.0272	0.0271	0.00233		
=== BASIC DEVICE CHARACTERISTICS						
Tank diameter , mm	110	1800	2000	1800		
Type of impeller	pitched paddle	pitched paddle	pitched paddle	Lightnin A310		
Impeller tip diameter , mm	60	982	1090	900		
Impellers number	1	1	1	1		
Maximum energy of collisions, J	2.89e-12	4.38e-13	4.36e-13	1.37e-12		
Presence of baffles	YES	YES	YES	YES		

Target parameters >> | Mixing tank data >> | Bacground parameters >>

Basic Mixing Characteristics >> | Radial Distribution of solids >> | Axial Distribution of solids >> | All in One >>

Brief description of the application

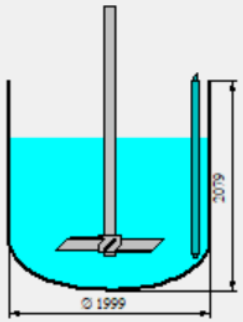
1. General

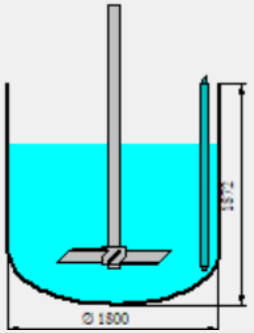
This application presents results of VisiMix simulations of selected unit operation for a number of VisiMix projects that differ from each other by equipment design, scale or process regime.

This comparison is performed with respect to unit operation (technical target of the mixing operation defined by user).

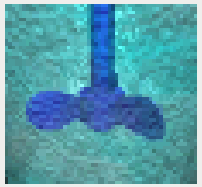
Results of different VisiMix projects comparison organized in form of set of tables and graphs containing values of

User Notes :





VisiMix Orientation



The VisiMix Demonstration Tools:

- ✓ VisiMix Turbulent – Examples & User Guide
- ✓ VisiMix Laminar - Examples & User Guide
- ✓ VisiMix Different Impellers – Examples & User Guide
- ✓ VisiMix RSDE– Examples & User Guide
- ✓ VisiMix Turbulent SV – Trial & Education
- ✓ VisiMix Review of Mathematical Models
- ✓ Selected Verification Examples

The Comparison between Published Experimental Data and VisiMix Calculations

http://www.visimix.com

Millions Saved By Using VisiMix!
Benefit Examples Reported by Customers.

VisiMix LTD, is pleased to provide you with some very important new information on VisiMix Savings, which we have compiled for publication. These documents, show **savings of millions of dollars per year**. Please click the links directly below to view the following savings examples:

Mixing Calculations in Development (Saved - $1,000,000)
Productivity Improvement In API Company (Saved - $1,600,000)
RSD Application in a Chemical Reaction Process (Saved - $250,000)
Control Morphology and P.S. in Energetic Material Processes (Saved - $900,000)
Troubleshooting for Crystallization Processes (Saved $2,000,000)
Troubleshooting in Life Science Industry (Saved €900,000)
Three Phase System – Solid-Liquid-Liquid (Saved €1,200,000)
Improve Dissolution of Organic Solid (Saved €1,200,000)
Physical Properties of the Final Product (Solid) – Ensuring Regulatory Compliance of $20,000,000 Sales

We also invite you to view some highlights from our very successful **International Conference in Boston** and Atlanta that took place in 2011 and 2014 which united users and future users of the VisiMix Software to share some insights into the various uses and benefits of the software.

Conclusion

- Using VisiMix Products support you can
  - understand better your processes
  - Reduce dramatically your Scaling up processes and Scaling down
  - Save a huge amount of Time & Money ($1,000,000 +)
- The VisiMix Products are friendly and easy to use with very quick results.
- The VisiMix results are based on a systematic and seriously experimental checking – and found very reliable.
- VisiMix Projects Parameters and Data Base allows you to share and transfer the data with colleagues in the company.

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Thank you for your attention

VisiMix

VisiMix

Thank You

For your attention

VisiMix Ltd.

PO Box 45170, Jerusalem, 91450, Israel
Tel: 972 - 2 - 5870123 | Fax: 972 - 2 - 5870206
E-mail: info@visimix.com