Diagram 3 shows how the process allows greater control over final product achieved

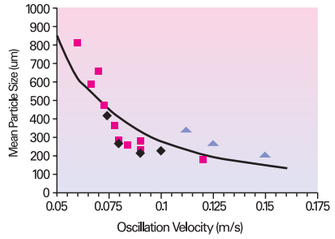


Diagram 4 Control over particle size can be determined by reactor configuration

### Crystallisation

- Precise control over the conditions for crystal formation and growth
- Reduction in process variation
- Increased product consistency and quality
- Greater selectivity of outcomes
- Improved scale up
- Less waste

### Size Distribution

- Decrease in process variation allows narrower size distributions to be consistently achieved
- Mean diameter of the size distributions can be controlled
- Ability to select multiple size distributions

The Diagram 3 shows how operational parameters within the OBR control size with a great deal of consistency.

### Solids Suspension

- High degrees of solid suspension at up to 50% concentration
- Minimal sedimentation.
- Faster reaction times
- Low shear
- Avoid scale-up issues



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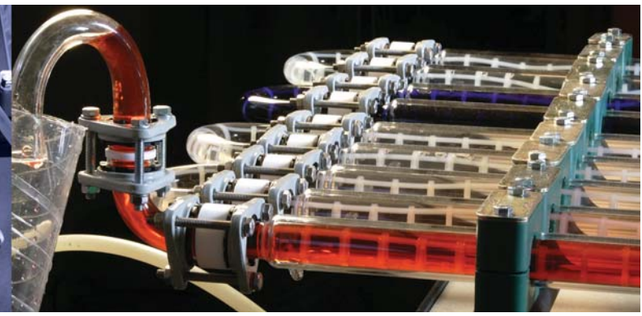


# Application AREAS

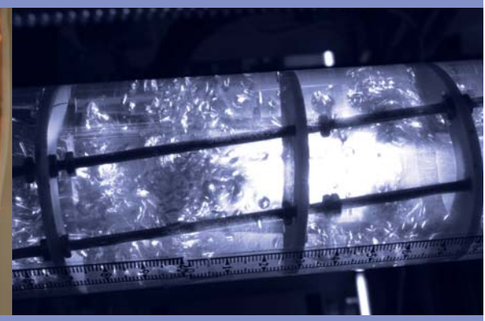
**Creating competitive advantages through Process Intensification**

**NiTech Solutions have revolutionary mixing technology that assists companies within the Process Industry to be more competitive by enabling the adopting of smaller scale continuous manufacturing methods.**

NiTech are the world's leading authority on delivering Process Intensification benefits through the use of **continuous oscillatory baffled reactors (COBR™s).** This technology is particularly effective in enhancing mixing and dispersion, and controlling the formation of solid particles.

NiTech assist companies within the pharmaceutical and chemical industry to apply this technology to deliver the fundamental changes in process performance that are necessary in today's competitive marketplace.

A range of business benefits from; lower costs to improved product quality and reduction in waste contribute to increasing business competitiveness.



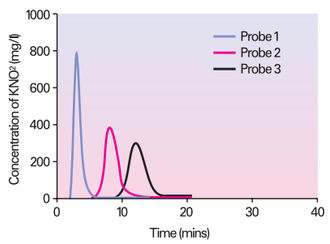
## Exceptional Heat Transfer Characteristics

- Increased effectiveness in heat transfer compared with traditional processes
- Fluid renewal over the surfaces of a COBR™ is much more frequent than traditional batch stirred tank reactor as a result of improved radial mixing
- Removal of thermal gradients ensures more uniform heat transfer rates.
- The vessel diameter is considerably smaller - rather than having a large tank with a diameter measured in meters, a COBR™ will rarely exceed 250mm in diameter,
- The ratio of reactor diameter to length virtually eradicate the issues associated with heat transfer in scale-up

## Plug Flow

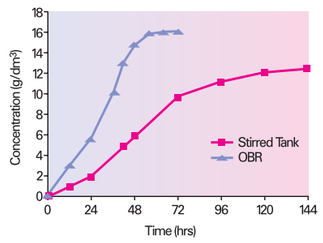
- Conditions very near to plug flow are attained at low flow rates; from 0.3l/minute
- Mixing is controlled by oscillation rather than net flow
- Resulting in consistent product quality and less waste
- Significantly more compact reactor footprint
- When net flow is applied the plug moves with minimal axial spread

**Diagram 2 residence time distribution measured in a COBR™**




Probe 1 --- 3.7 meters away from injection
Probe 2 --- 7.9 meters away from injection
Probe 3 --- 10.1 meters away from injection

**Diagram 1 shows significant improvement in mass transfer rate in the manufacture of a biopolymer.**




## Improved Mass Transfer and Dispersion

- Gas-liquid mass transfer coefficient can be enhanced by up to six times as much as would be possible using conventional mixing.
- Increased residence time of the gas phase in the liquid
- Enhanced gas hold up
- Reduced bubbles sizes and greater uniformity
- Increased interfacial area between phases
- Improved dispersion in Liquid-Liquid systems
- Controlled droplet sizes delivering increased interfacial area
- Effective with large density and viscosity differences
- Excellent for multi-phase systems with combinations of liquid, gas and solids
- Diagram 1 shows the effectiveness of the OBR at mass transfer
- Benefits from this could be higher concentration or a reduction in process time required.