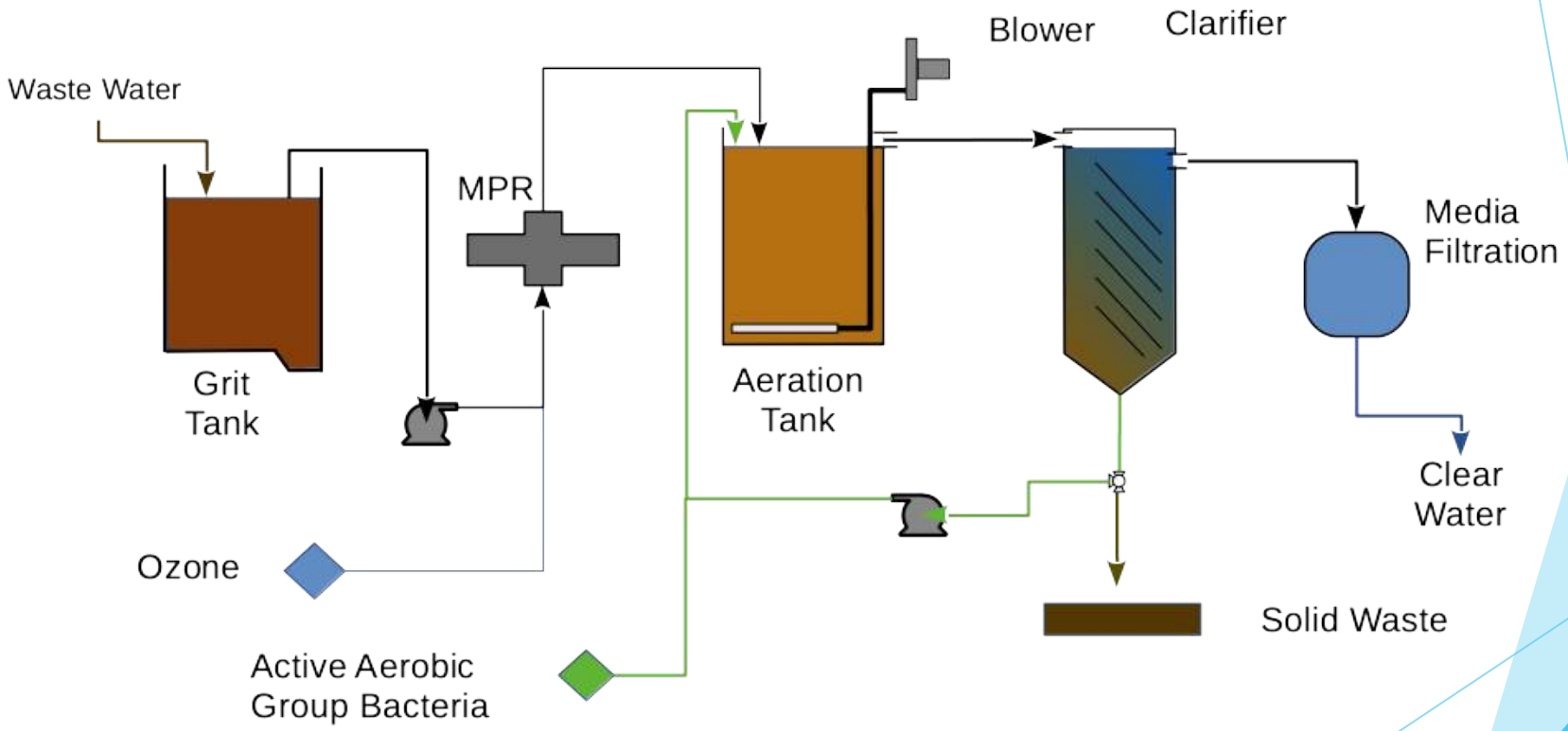
Multi-Phase Reactor

Proprietary Technology for Chemical Free Water Purification System

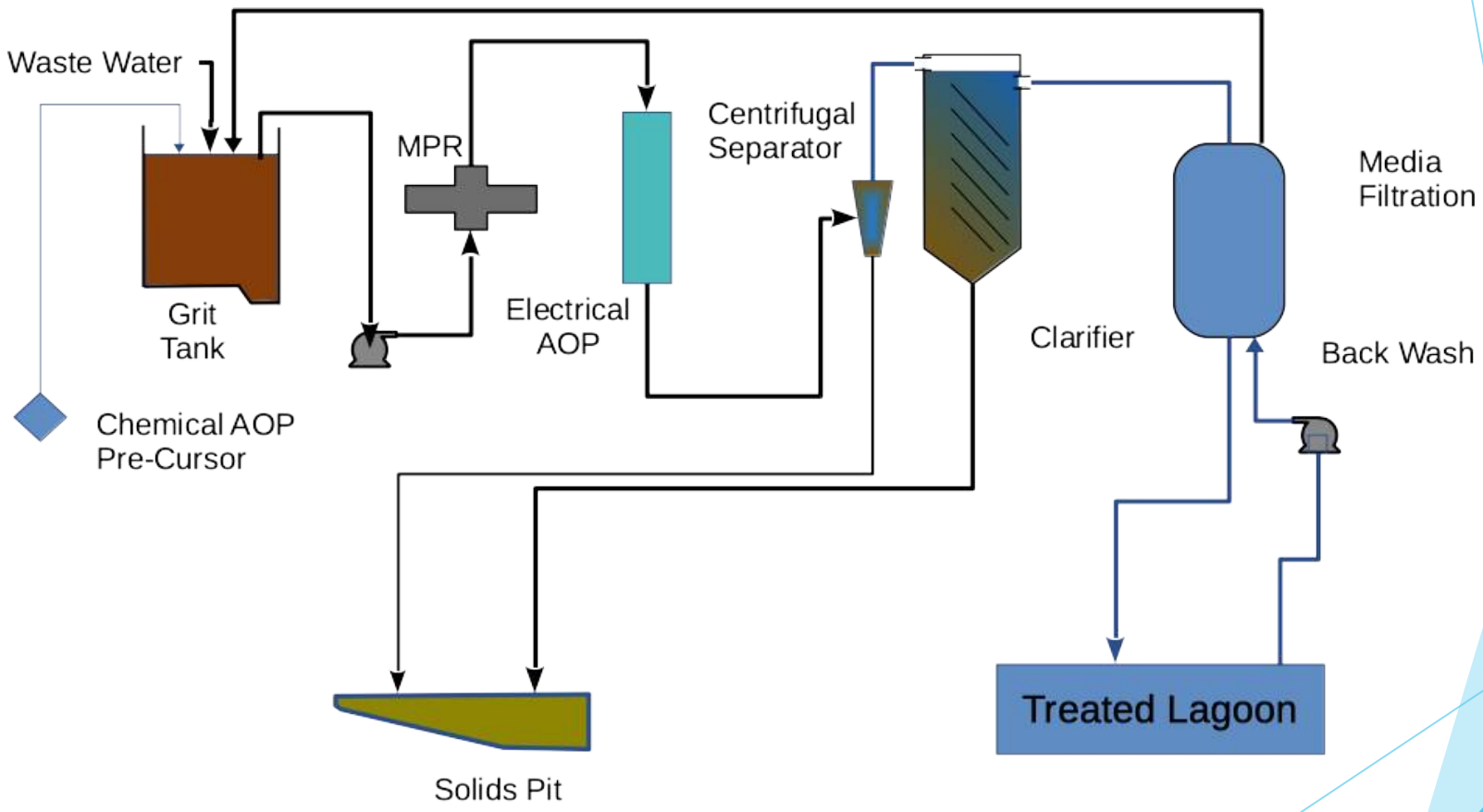
System Highlights

- Patent Pending technology using Advanced Oxidation Principles
- Best system to clean water yield-to-power performance
- Low power consumption (5 to 10 times less power)
- Significantly lower operating cost
- No use of chemicals
- Treats an effluent (except radioactive)
- Treats Sea Water with high yield and lower power consumption vs. Reverse Osmosis (RO) Technology
- Modular and Scalable
- Low maintenance and high reliability
- Remote autonomous operation

MPR MWWT System Overview



Industrial Waste Water Treatment

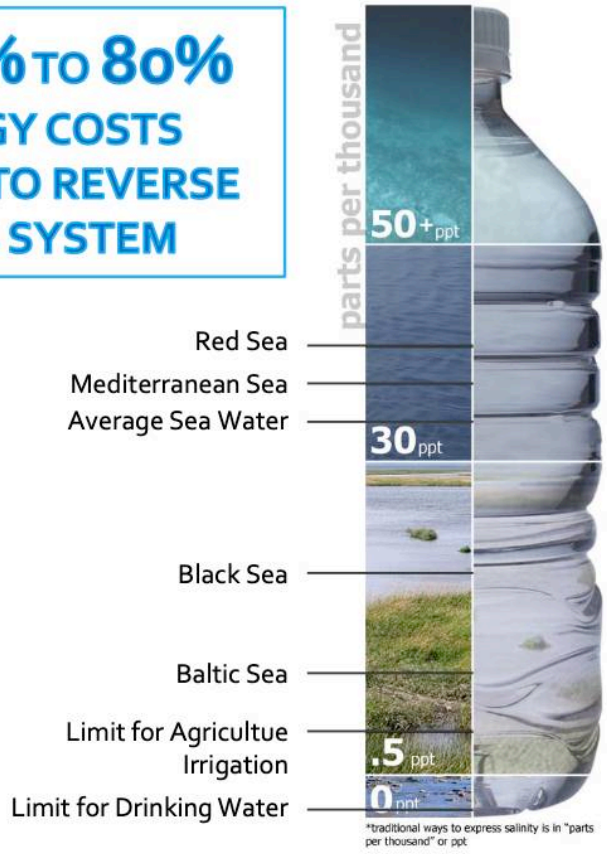


Best of the Breed ~ State of the Art

- Multi-Phase Reactor
  - Integration of Multi-Physics into a single package
    - Advanced Oxidation reaction intensified in the reaction zone
    - 3D Nano cavitation with complex hydraulic mixing
  - Hybrid design integrates multiple AOP reaction processes
- Proven to achieve 100% sterilization
- Much lower pressure than RO (15 – 45 psi v 600 to 1,200 psi for RO)
- High flow rate capability – 100k BPD in a single CONNEX container
- Simple Robust design, comparable to heavy duty centrifugal pump.

Saltwater Desalination

SAVES 60% TO 80% OF ENERGY COSTS COMPARED TO REVERSE OSMOSIS SYSTEM



Brine Water
Brine Pools and Fracking/Drilling Ponds
50 to 150 ppt

Saline Water
Sea Water and Salt Lakes
30 to 50 ppt

Brackish Water
Estuaries and Brackish Seas and Lakes
18 to 30 ppt

Fresh Water
Ponds, Lakes, Rivers, Streams, and Aquifers
0.0 to 0.5 ppt

Advanced Oxidation Reactor

- Water enters from bottom and flows out through the top.
- This generates the OH and H_2O_2 radicals and conditions the dirty water for the Electro-Chemical Oxide Reactor.
- The unit consists of two motors and rotors, one on each side of the reactor.
- At a 4,000 BPD process rate, the motors are operating at 40% power.

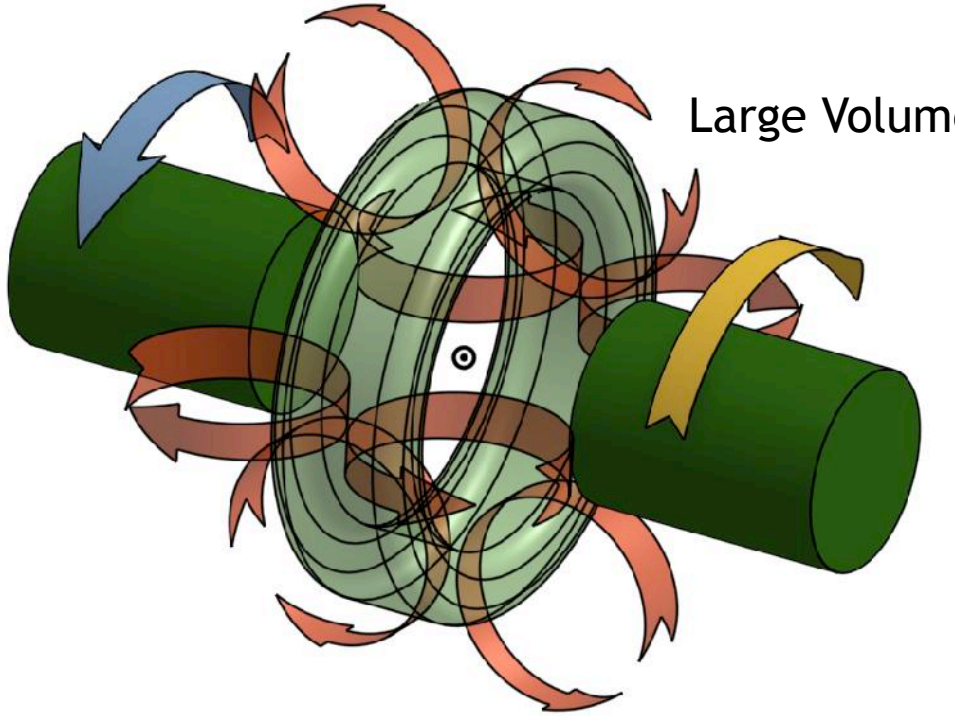
It Works

- Moving from left to right:
  - Dirty Water at inlet to trailer
  - Water exiting Electro-Chemical Oxide Reactor
    - Iron is seen as sediment at bottom of middle jar
    - Water clarity is not yet obtained.
    - Oxidation process continues in the final weir settling tanks and final clarifier
  - Water discharged at the holding pond after Media filtration

Effectiveness Summary

- Modular and scalable with high volume production
- Destroys and removes contaminates and microbes
- Desalinates
- Produces US EPA guideline drinking water from any source
- Low maintenance
- Field Tested and commercially proven
- On-line monitoring and data logging

Multi Phase Reactor Advanced Oxidation Process

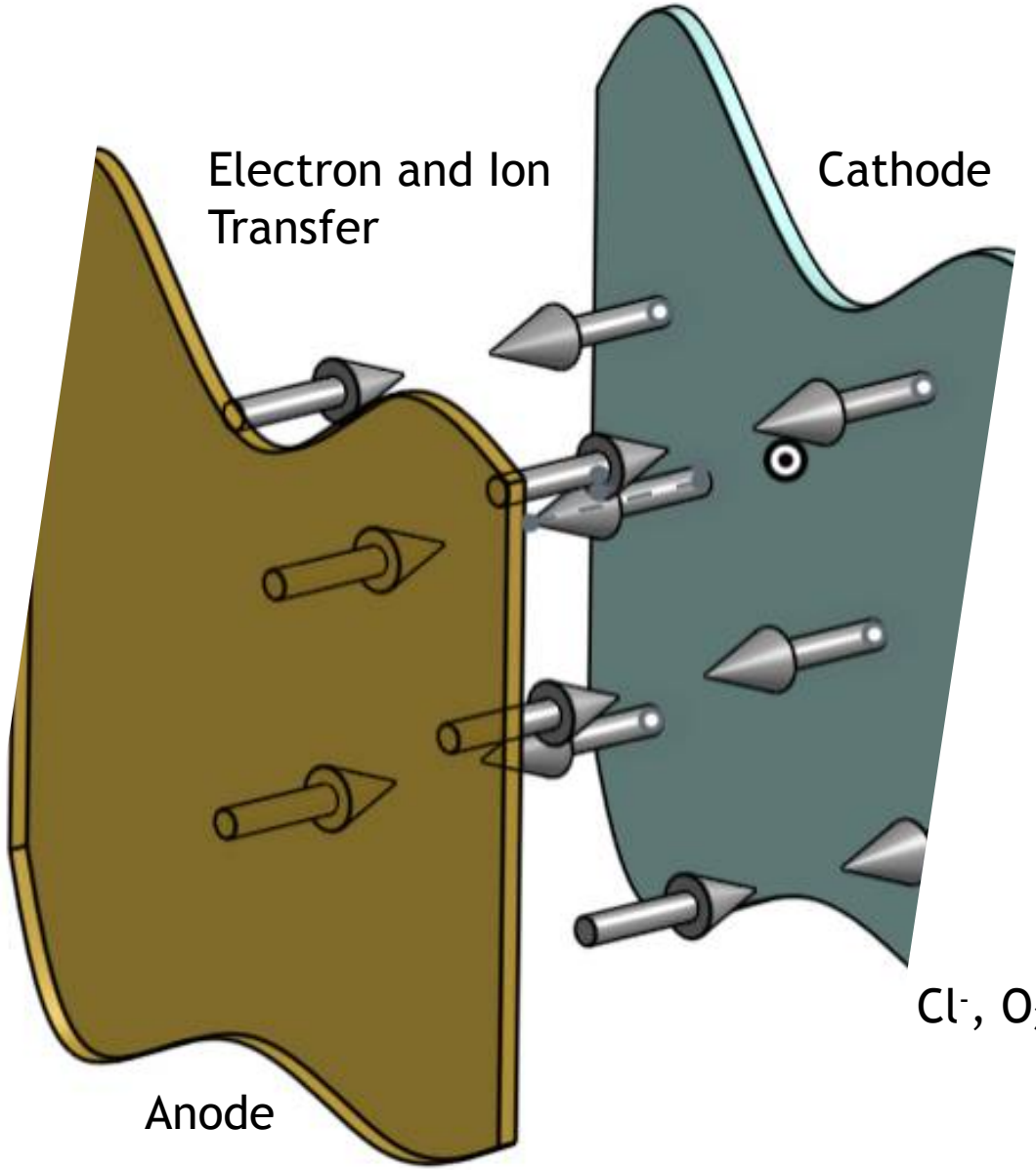


Large Volume Cavitation Zone

Counter Rotating Electric Motors Drive Process

Complex Mixing and Reactionary Flow

- Hydroxyl Radicals
- Hydrogen Peroxide
- High Shear Mixing



Electro-Chemistry

Advanced Oxidation Species

- Ozone
- Hydrogen Peroxide
- Chlorine Dioxide
- Free Chlorine

Municipal Wastewater Treatment

- Water treatment with Bio-Solids
  - MPR treated biosolid loaded water break down the bio-solids reducing the solids content in the effluent by up to 80%
    - Proven to lower BOD and COD by 90 – 95%
    - 85 – 90% Removal of Nitrogen
  - Break down of filamentous bacteria and release of intracellular matter that increases biological reactivity, reducing digestor exposure time to hours instead of days.
  - Ozone is organically generated within the MPR is highly effective in sterilizing influent. Remove competitive and hazardous biologics (bacteria, virus, and spores) from entering digestor. Improved quality of clarified effluent and recovered solids.
  - Bio-Solids discharged from clarifier much lower in volume and classified as Class A, suited for direct disposal.

Industrial Wastewater Treatment

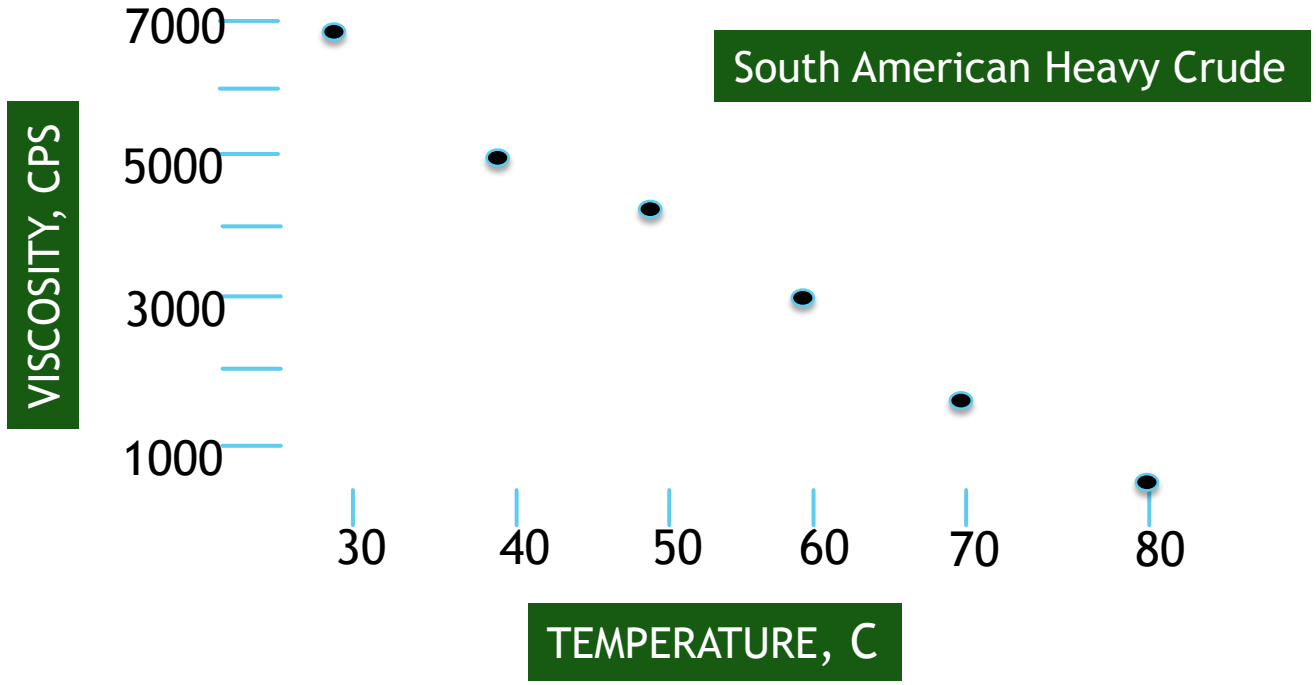
- Treatment of VOCs, TSS, TDS
  - MPR cavitation and electro-chemistry provide perfect storm of advanced oxidation radicals that:
    - Wet Oxidation of VOCs, converting to products of combustion (high concertation of Advanced Oxidation species decomposes VOCs)
    - Expose TDS to oxidation species, converting to insoluble solids, e.g. Fe(+) to Fe_xO_y, H_2S to S_xO_y, etc.
    - Raise ORP >300
  - High Shear fractures long chain organics (hydrocarbons, pharmaceuticals, polymers, etc) and solids (minerals)

Desalination

- Approach 1 – Desalination via physical chemistry
  - Cavitation and Electo-Chemical reaction to Oxidize TDS to insoluble mineralized oxides
  - Halides no longer have corresponding (+) ion to associate with. Becomes Free Chlorine, ClO_2, other
- Approach 2 – Vapor Distillation
  - Cavitation, exothermic reaction of VOCs, and Frictional heating raises water temperature to boiling point.
  - High efficiency of heating – non-scaling
  - Flash distillation of water vapor
  - Vapor condenser pre-heat feed water.
  - Energy balance very favorable relative to other phase change processes.

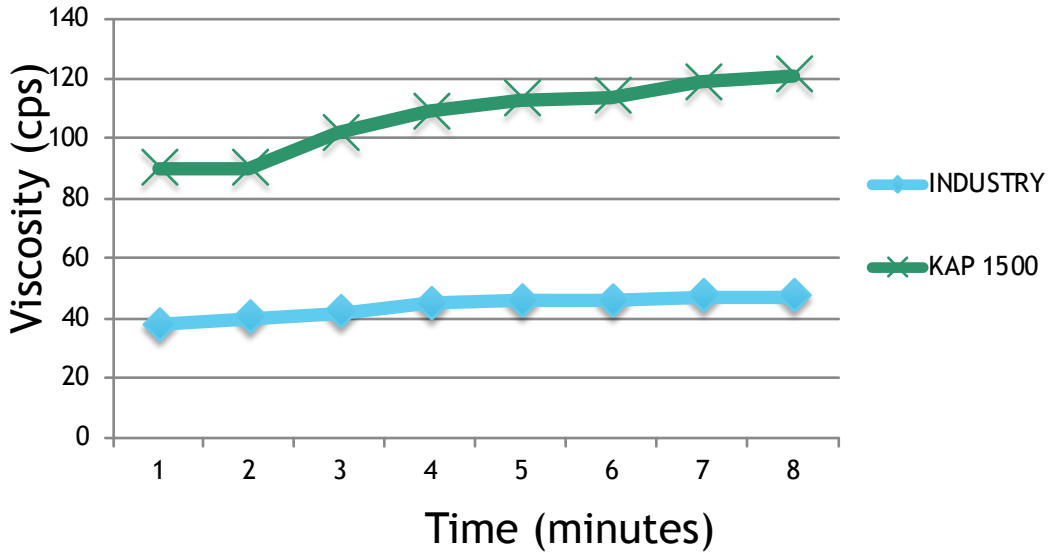
Upgrading Heavy Crude

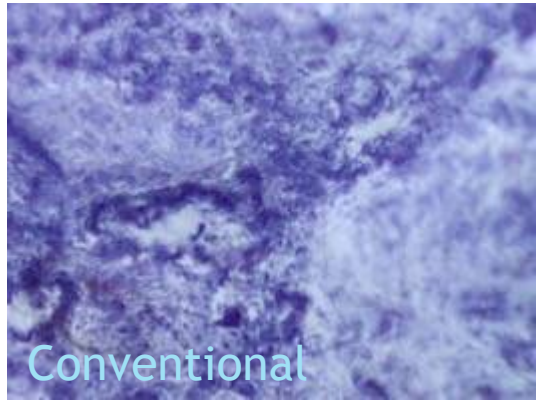
- MPR technology produces high shear in crude
  - Frictionally heats oil
  - Fractures long chain hydrocarbon
    - Creates C_{10} – C_{15} distillates
    - Permanently lowers viscosity, no further heating required for down stream processing.



Mud and Polymer Mixing

- Dramatically increase the Viscosity of Mud for given mix ratio and increases EC values
  - Stronger emulsion stability
  - Improves friction characteristics
- Mix powdered polymers at fracturing location
- Continuous, complete and consistent hydration
- Elimination of hydrocarbons and chemicals for mixing
- Increases yield of polymer systems

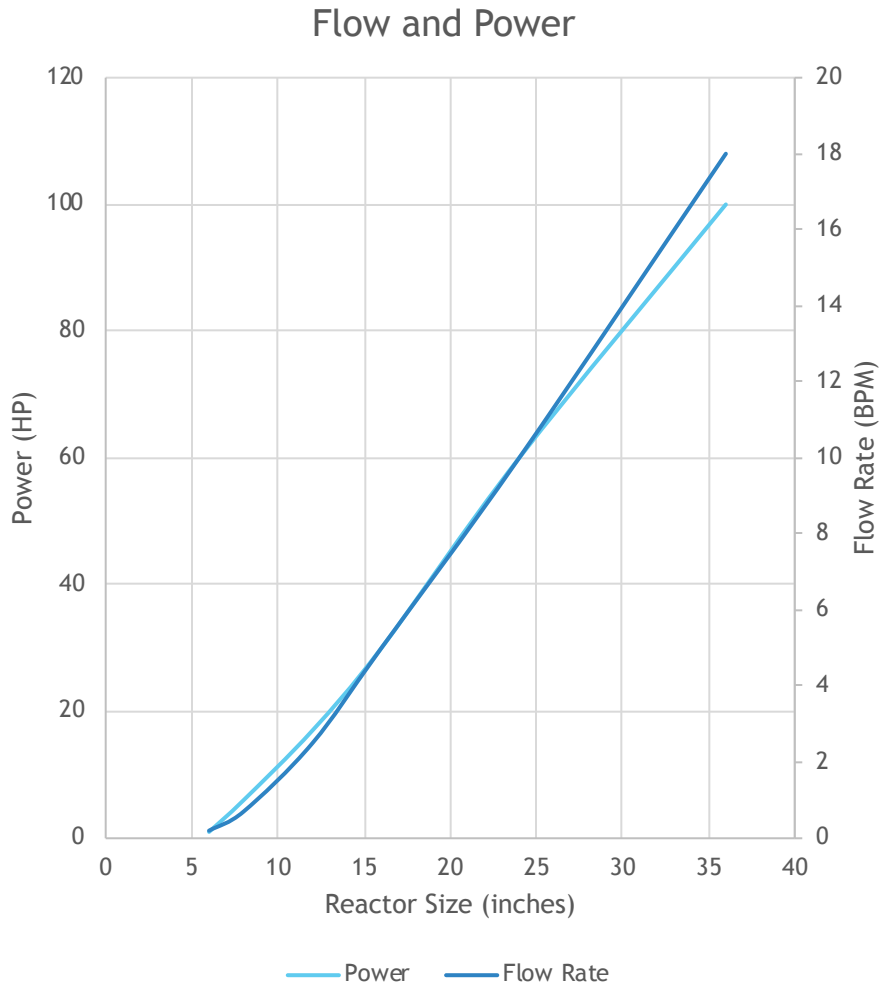




Aqueous Extraction with MPR

- Proven high performance extraction with:
  - Oils - CBD, Olive, Hops, Peppers
  - Proteins - Chicken Biomass
- Protein/Oils/Nutrient brought into solution by breaking cellular structure, not necessarily cavitation which can cause radical formation in extraction product.
- Water extraction yields higher quality and purity, simple and low-cost processing techniques
  - No hydrocarbon solvents to extract
  - No technical complexity with supercritical fluids
  - Retain micro-nutrients lost via conventional extraction

System Scalability



- MPR Technology is scalable to meet flow rate capacity – Reactor diameters 6” to 36” 10 to 750 gpm (0.2 – 18 bpm)
- Small footprint – fit within standard CONNEX.
- MPR technology is based upon simple mechanical elements.
  - Bearing supported shaft
  - Mechanical Seal between shaft and reactor housing (5+ year)
- Few parts and common mechanicals make favorable economics.
  - Low cost per volume treated
  - No chemical costs

“Water to Life”