



PRO2 Series Technology

- Gasification Process Efficiency
 - US Patents Pending
 - Process Patent Pending
US 61/558,260 EPPINK
11/10/11
 - Apparatuses Patent
Pending US 61/530,566
EPPINK 09/02/11
 - Dynamox / Therox
Wastewater Patents US
and International





PRO₂ EFFICIENCY AND TECHNICAL REVIEW

- Conventional Methods:
 - Bubble diameter is large; therefore inefficient
 - Most of oxygen is lost back to the atmosphere.
 - Oxygen is lost before it can be used by the microorganisms

Vs.

- PrO₂
 - Pure oxygen is delivered with 96% efficiency
 - Micro-size bubbles remain “neutral buoyant” in water
 - Increased delivery of oxygen to water; more contact time with microorganisms



CONVENTIONAL AERATION EFFICIENCY

- According to section **92.332 part b** of the “10 state standard,” the requirement is that 1,500 cu ft of air needs to be used for aeration
- Section 92.331, design requirements specify 1.1 lbs of O₂ / lb BOD
- This results in 28 lbs of O₂ per lb of BOD being forced into wastewater from conventional methods
- Theoretical Efficiency of ~4%
 - **Source: *Recommended Standards for Wastewater Facilities (2004 Ed.)***
 - **“10 State Standard”**



PRO₂ EXPERIMENTAL EFFICIENCY STUDY

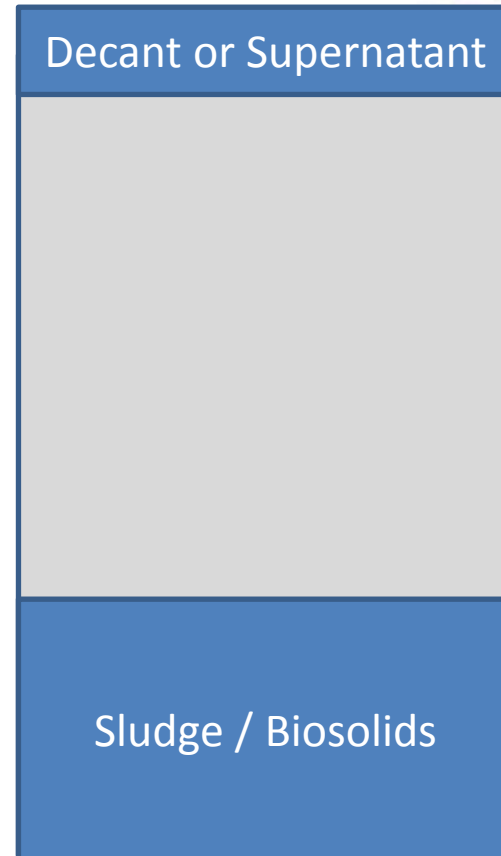
- Performed at Blissfield, MI WWTP
- Analyzed the conversion of bottled O₂ gas to dissolved oxygen in test water using PrO₂
- 0.712 lbs of bottled oxygen was used, which resulted in .688 lbs of DO in test water → **96% efficiency**





EMPIRICAL EVIDENCE OF GPS PRO₂ BENEFITS – PILOT STUDY

- Aerobic Digester for Biosolids Treatment
- Total solids, total volatile solids, phosphorus, and metals were measured Decant and biosolids
- All samples were taken by GPS and tested by A&L Great Lakes Labs (Ft. Wayne, IN)





BLISSFIELD WASTEWATER TREATMENT PLANT SAMPLING – AUGUST 2011

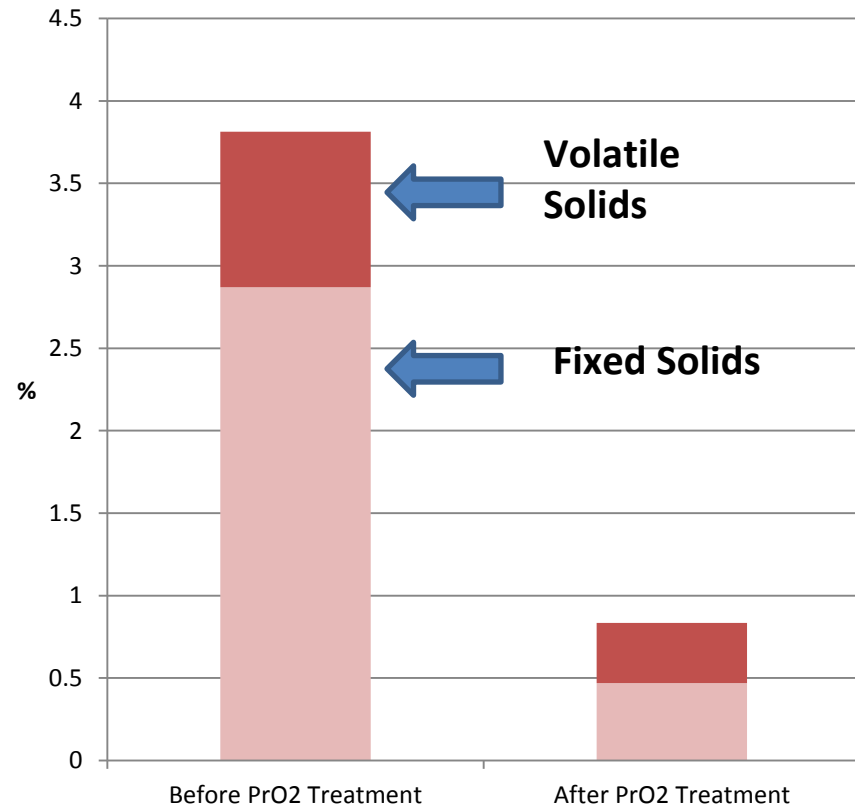




SUPERNATANT SOLIDS DATA: AUGUST 2011

Comparison of solids before and after treatment with GPS PrO2

	Supernatant	
	Before	After
% T Sol	2.87	0.47
% T Vol Sol	32.86	77.53
T Phos.	381	0

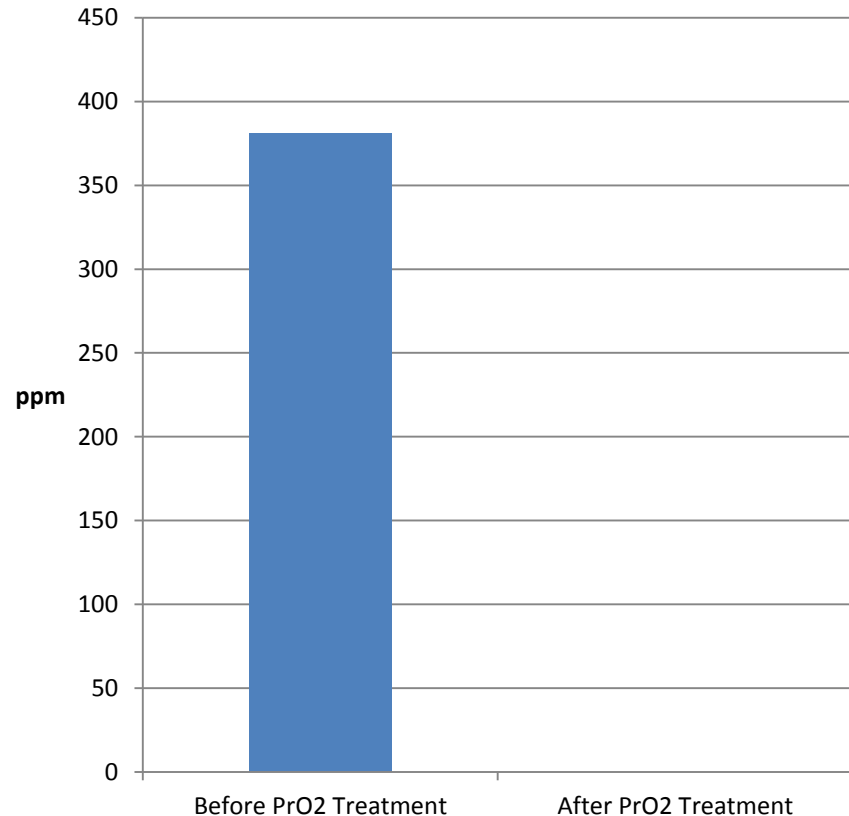




SUPERNATANT PHOSPHORUS DATA: AUGUST 2011

	Supernatant	
	Before	After
% T Sol	2.87	0.47
% T Vol Sol	32.86	77.53
T Phos.	381	0

Comparison of Total Phosphorus from Supernatant Before and After Treatment

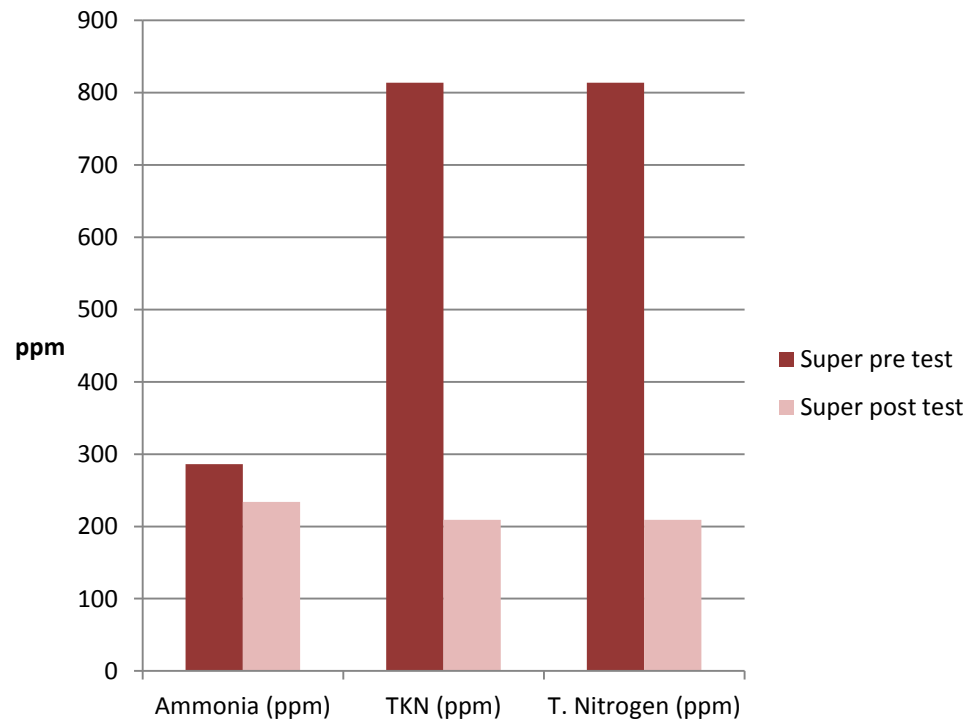




SUPERNATANT NITROGEN DATA

- Increased biological activity improves settling
- Improved flocculation
- Lower TKN (75%) and Ammonia (18%)

Nitrogen Analysis in Supernatant pre- and post- Treatment with PrO2



*Intermediate Nitrogen species (Nitrate and Nitrite) were nondetect



IDENTIFIED APPLICATIONS FOR PRO₂

- **Anywhere oxygen is currently used to treat waste!**
 - Aeration tanks (Mixed Liquor)
 - Lagoons
 - Aerobic Sludge Treatment
 - Lift Stations for control of H₂S or pre-oxygenation of waste
- **Future Potential: Groundwater Treatment**
 - Remediation of contaminated groundwater (exa. BTEX)
 - Help with a myriad of LUST sites throughout Ohio
 - Improve redevelopment/resale of brownfields
- **Emergency Aeration Supplement**
 - Supplemental aeration during peak organic loading
 - Exa. Blissfield WWTP