Alternative Treatment Technologies

South Florida Water Management District, Applied Sciences Bureau, Water Quality Treatment Technologies

Kim M. O'Dell, PMP, Michael Chimney, PhD, Odi Villapando, PhD, Orlando Diaz, PhD

Introduction

The South Florida Water Management District (SFWMD) is continuing to seek ways to reduce nutrients from stormwater runoff in an effort to improve regional water quality in Lake Okeechobee, the Caloosahatchee and St. Lucie estuaries, and water moving south via the Everglades Stormwater Treatment Areas. To address a number of inquiries from vendors about the suitability of their products for water quality treatment, the SFWMD created a structured process to evaluate these technologies- the New Alternative Technology Assessment (NATA) Program. The NATA Program provided interested vendors the opportunity to demonstrate the efficacy of potential treatment technologies, aside from vegetative treatment, for reducing phosphorus (P) and/or nitrogen (N) concentrations in waters discharged from farms and urban tributaries.

Methods

Selected technologies were evaluated, using either SFWMD facilities or farm lands, and using the SFWMD's laboratory facility for analytical testing. All other direct and indirect costs associated with conducting NATA projects were borne by each vendor. In addition, the SFWMD evaluated a number of other technologies brought to its attention through other avenues.

Criteria for Product Evaluation

- Products must remove nutrients from water, and may focus on any source subject to agency interest/regulation: Estuaries, canals, Lake Okeechobee discharges and soil inactivation
- Products/processes are vetted with a pre-determined set of evaluation criteria by a team of internal scientific staff
- Test sites could be District-owned or cooperating landowner properties
- Evolved into product screening: not a Research & Development process for the vendors

Types of Technology Treatments

Mineral-based applications:

- Phoslock™
- WP1™
- STI
- ViroPhos™
- Aragonite
- NClear

Flow- through processes:

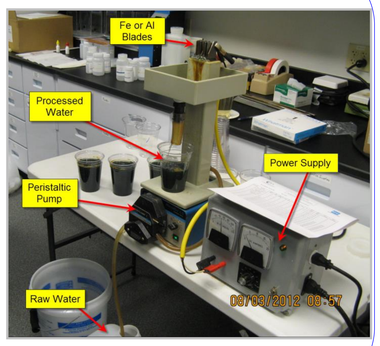
- Ferrate
- AquaLutions/AquaFiber
- Electrocoagulation - EC

Flow - Through Processes Testing

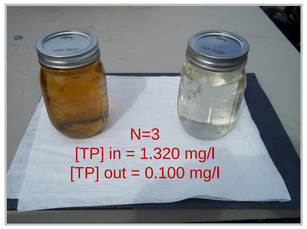
AquaLutions™ (AquaFiber)

Two sites along the Caloosahatchee River

Electrocoagulation - EC



Ferrate



Lab Jar Testing of 4 Mineral-based Products

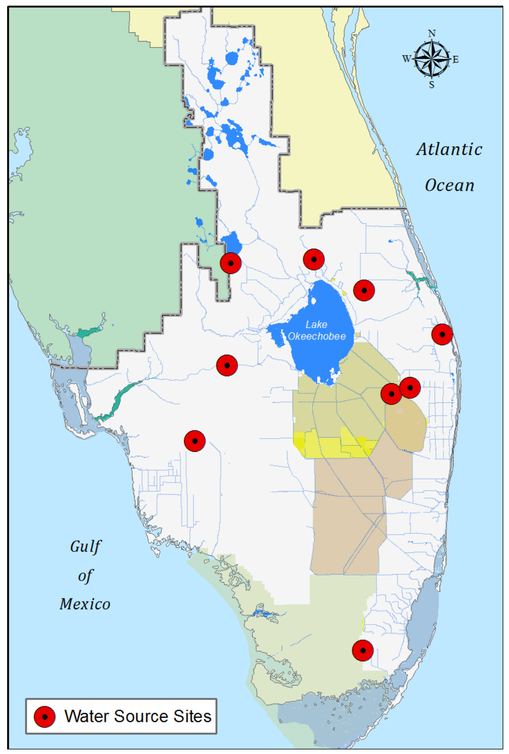
Results and Discussion

Results of different alternative treatment technologies evaluated from September 2011 to June 2013.

Technology	Study Type	Water Source	TP	TDP	SRP	DOP	PP	TN	TON	DON	NOX	NH4	AL	CA	FE	SO4	PH	COND	TURB
AquaLutions™	Field	C-43 Canal	↓	↓	↓	↓	↓	↓	↓	↓	–	↓	na	na	na	↑	↓	↑	↓
Aragonite	Jar test	Taylor Creek	↓	↓	↓	↓	↑	↓	↓	na	↑	↓	na	↑	na	↑	↑	↑	↑
Electrocoagulation	Bench-top	C-51 Canal	↓	↓	↓	↓	↓	↓	↓	na	↓	↑	↑	na	↓	↓	↑	↓	na
Electrocoagulation	Bench-top	C-51 Canal	↓	↓	↑	↓	↓	↓	↓	na	↓	↑	↓	na	↑	↓	↑	↓	na
Ferrate	Field	Istokpoga Marsh	↓	↓	↓	↓	↓	↓	↓	na	↑	↓	na	na	↑	↓	↓	↑	↓
Nclear®	Jar test	MacArthur Lake	↓	↓	↓	↓	↑	↓	↓	↓	↑	↑	na	↑	na	↓	↑	↑	↓
Phoslock®	jar test	C-51 Canal	↓	↓	↓	↓	–	↑	↓	na	↑	↑	↑	na	↑	–	–	–	↑
Phoslock®	Field	MacArthur Lake	↓	↓	↓	↓	↑	↓	↓	na	–	↓	na	na	na	na	–	–	↑
STI	Jar test	C-51 Canal	↓	↓	↓	↓	↓	↓	↓	na	↑	↑	↓	na	↓	↓	↑	↑	↑
STI	Jar test	Lake Trafford	↓	↓	↓	–	↓	–	–	na	*	↓	–	na	↓	na	–	–	↓
ViroPhos™	Jar test	STA Test Cells	↓	↓	*	↓	↓	na	na	na	na	na	↑	↑	↑	↑	–	↑	–
ViroPhos™	Jar test	C-51 Canal	↓	↓	↓	↓	↓	↓	↓	na	↑	↓	↑	na	↑	↑	–	↑	↑
ViroPhos™	Field	Dairy pond	↓	↓	↓	na	↑	–	–	na	↑	↓	↑	↑	↑	↑	–	↑	↑
WP-1™	Field	STA Test Cells	↓	↓	*	↓	↓	↓	na	na	↑	↓	↑	↓	↓	↓	–	–	na
WP-1™	Jar test	C-51 Canal	↓	↓	↓	↓	↓	↓	↓	na	↑	–	↓	na	↑	↑	↑	–	↑
WP-1™	Field	Blue Heron Pond	↓	↓	↓	↓	↑	na	na	na	na	na	↑	↓	↓	na	na	na	na

Water Quality Parameter Key: TP= total phosphorus; TDP= total dissolved phosphorus; SRP= soluble reactive phosphorus; DOP = dissolved organic phosphorus; PP = particulate phosphorus; TN = total nitrogen; TON = total organic nitrogen; DON= dissolved organic nitrogen; NOX = nitrite + nitrate - N; NH4= ammonia-N; AL= total aluminum; CA= dissolved calcium; FE= total iron; SO4= sulfate; PH= pH; COND= conductivity; TURB = turbidity.

Test Result Key: ↑ = concentration increased (> 5% increase): ↓= concentration level decreased (< 5% decrease): – = little appreciable change in concentration level (≤ 5% increase or decrease): na = not evaluated: *= initial concentration level at MDL - could not evaluate performance of technology



Conclusions

- The tested technologies reduced TP (and some reduced TN) in surface water.
- These assessments represent screening level studies - not Research & Development. There are scale-up challenges and site specific product and processes which makes direct comparisons difficult among technologies. Other potential (unintended) impacts (no acute toxicity risk) would also need to be addressed for any full-scale implementation.
- Although there are no current plans to conduct additional laboratory or field tests, the SFWMD remains interested in potential water treatment technologies.

Reference

Chimney, M., O. Diaz, O. Villapando, K. O'Dell. SFWMD Technical Publication WR-2013-03. December 2013. West Palm Beach Fl.