

Evaluation of Equalized Dosing and High-Strength Wastewater
on the Performance of Aerobic Treatment Units (ATU)

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Summary:

This research effort addresses two of the four eligible projects listed in TCEQ Solicitation 582-19-9377, **RT-2.3.1** and **RT-2.3.2**, questioning the adequacy of National Sanitation Foundation (NSF) Standard 40 (STD40) Aerobic Treatment Unit (ATU) designs under increasing organic strength, and the effect of equalized dosing on STD40 ATU designs. Multiple concentration-flow-dosing combinations will be evaluated to answer questions regarding ATU performance under changing water-use paradigms. Two identical ATUs will be installed and operated in parallel to address both topics simultaneously in order to maximize experimental efficiency. Four flow rates at 7 organic concentrations yielding 5 organic loads will be evaluated under demand-dosed and equalized time-dosed operation. Performance will be assessed by measuring differences in influent and effluent BOD₅ and TSS concentrations. Effect of equalized time dosing will be determined by comparison to simultaneous demand dosing results.

Objectives:

1. Identify the ATU most commonly used in Texas, based on issued permits and expert opinion;
2. Select experimental scenarios based on TCEQ rules, feedback from TCEQ, and TOWA;
3. Install two identical ATUs at the AgriLife On Site Sewage Training Center;
4. Utilize a common tank upstream of parallel ATU trains to control influent concentrations;
5. Assess individual ATU performance by using influent and effluent BOD/TSS concentrations and comparing them between demand dose and equalized time dose conditions.

Goal Matrix:

Goal 2 - Dosing Method

<u>Goal 1 – Organic strength (BOD₅, TSS)</u>		STD40	Equalized
		STD40	Does ATU performance improve?
Increasing	Is ATU design adequate* for use?	Does ATU performance improve?	Does ATU performance improve?

*Adequate = meets NSF Standard 40 effluent requirements

Note: STD40 = 3 doses per day, @35%, 25%, and 40% flow and Equalized = 12 equal doses per day

Research Questions:

Q1: Is current ATU design adequate when BOD₅/TSS concentration increases due to:

(a) water conservation fixtures and/or (b) graywater reuse?

Q2: Does equalized time dosing improve ATU performance under:

(a) STD40 design concentration (b) increased concentrations and loads?

Tentative Experimental Design:

Research Topics 2.3.1 and 2.3.2						
Test Run*	Week	Unit A (demand dose)		Unit B (equalized dose)		Load
		[gal/day]	[mg/L]	[gal/day]	[mg/L]	
TR1	6	225.0	300	225.0	300	0.56
TR2	12	180.0	375	180.0	375	0.56
TR3	18	157.5	430	157.5	430	0.56
TR4	24	112.5	600	112.5	600	0.56
TR5	30	112.5	800	112.5	800	0.75
TR6	36	157.5	900	157.5	900	1.18
TR7	42	180.0	1000	180.0	1000	1.50
TR8	48	225.0	1000	225.0	1000	1.88

**6 weeks per run: 2-week equilibration, 2-week sampling, 2-week review and prep for next run*

Hypotheses (generalized)

TR1-4

H₀: Current Standard 40 ATU design is adequate* under increasing BOD₅/TSS concentrations resulting from water conservation fixtures and/or greywater reuse flow reductions

H_a: Current Standard 40 ATU design is not adequate

TR5-8

H₀: Current Standard 40 ATU design with equalized dosing is adequate* under increasing BOD₅/TSS concentrations and loads due water conservation fixtures and/or greywater reuse flow reductions

H_a: Current Standard 40 ATU design with equalized dosing is not adequate

*meets NSF Standard 40 effluent requirement

Deliverables:

1. Determination of the most common ATU make/brand used in Texas;
2. Justification for experimental influent concentration, flow, and dosing schedule selections;
3. Experimental design with formal research questions and testable hypotheses;
4. Field and laboratory reports and records for all measurements;
5. Quarterly progress and budgetary reports;
6. Final report describing all results and findings.