Sludge Minimization Achieved Through Grinding and Reaeration

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Outline

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- Background
- Goals
- Materials and Methods
- Results and Discussion
- Summary and Conclusions

Introduction

- Sludge treatment and disposal costs make-up approximately 50% of treatment costs.
- About 0.187 lb of dry sludge produced per capita daily.
- In 2000, approximately 7 million dry tons of sludge produced.
- Sludge industry (production and hauling costs)is about $5.6 billion yearly.

Technologies to Reduce Sludge

- Temperature
- Dissolved Oxygen Concentration
- Chemical uncouplers
- Process changes and redesigns
- Cellular disruption

Goals

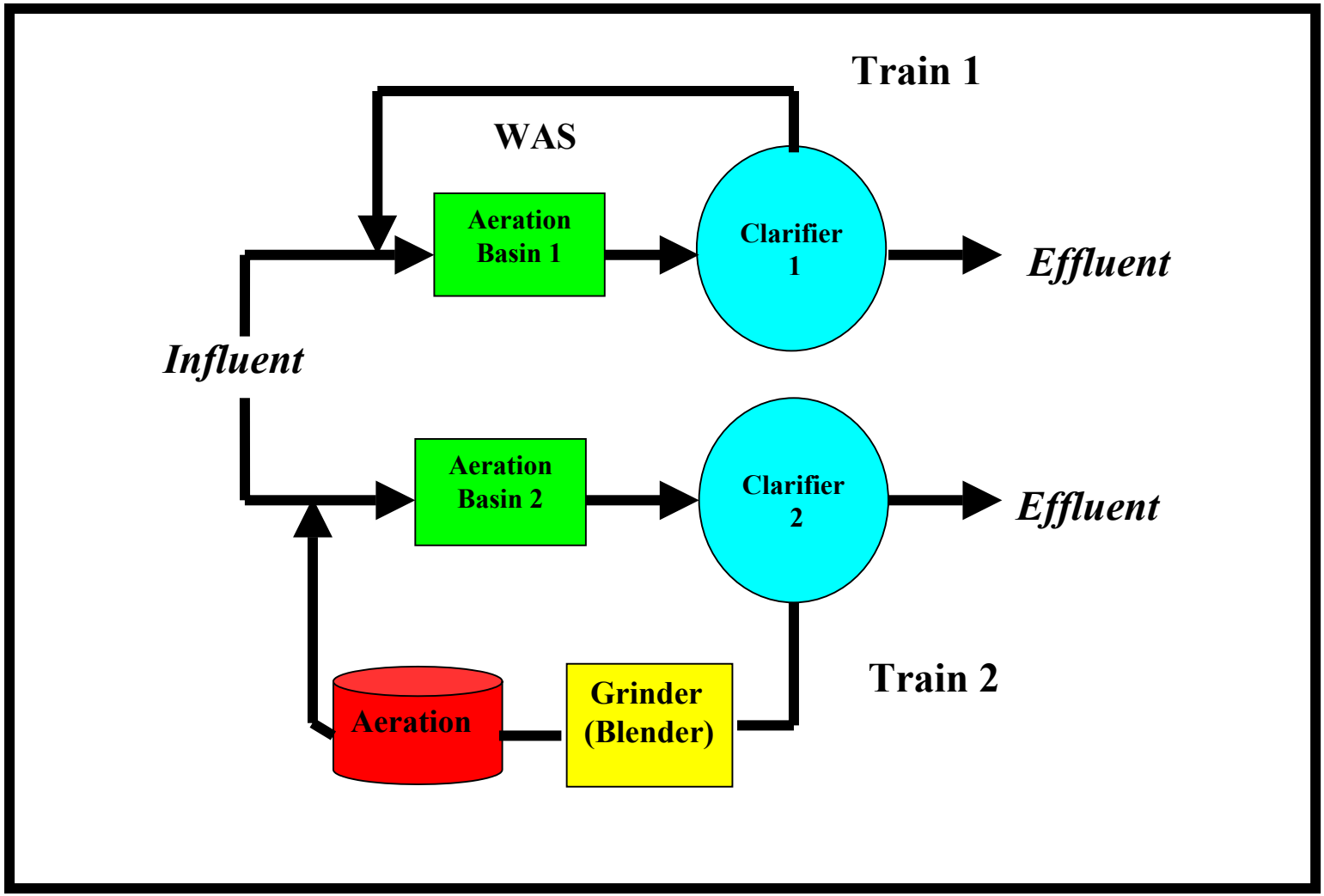
- To determine if cellular disruption through mechanical grinding and subsequent reaeration could reduce overall sludge production.

- To determine the biokinetic coefficients used in designing biological treatment systems.

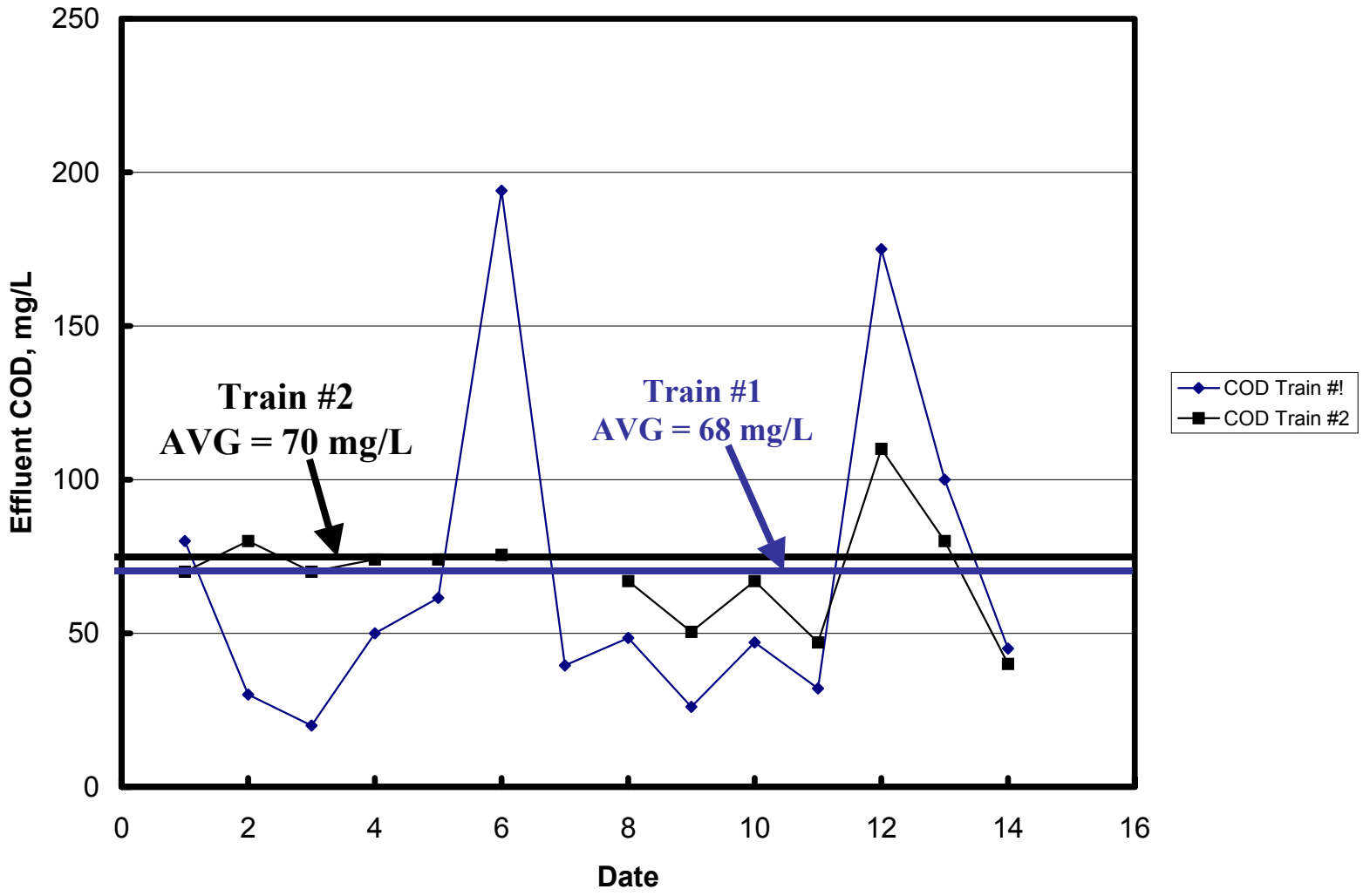
Materials

- Two, parallel, bench-scale treatment trains.
- Waste sludge from Train #1 recycled directly back to the aeration basin.
- Waste sludge from Train #2 was ground in a blender and aerated for 24-hours prior to recycling it back to the aeration basin.
- Systems operated at two different temperatures, 14 ° C and 25 ° C, respectively.

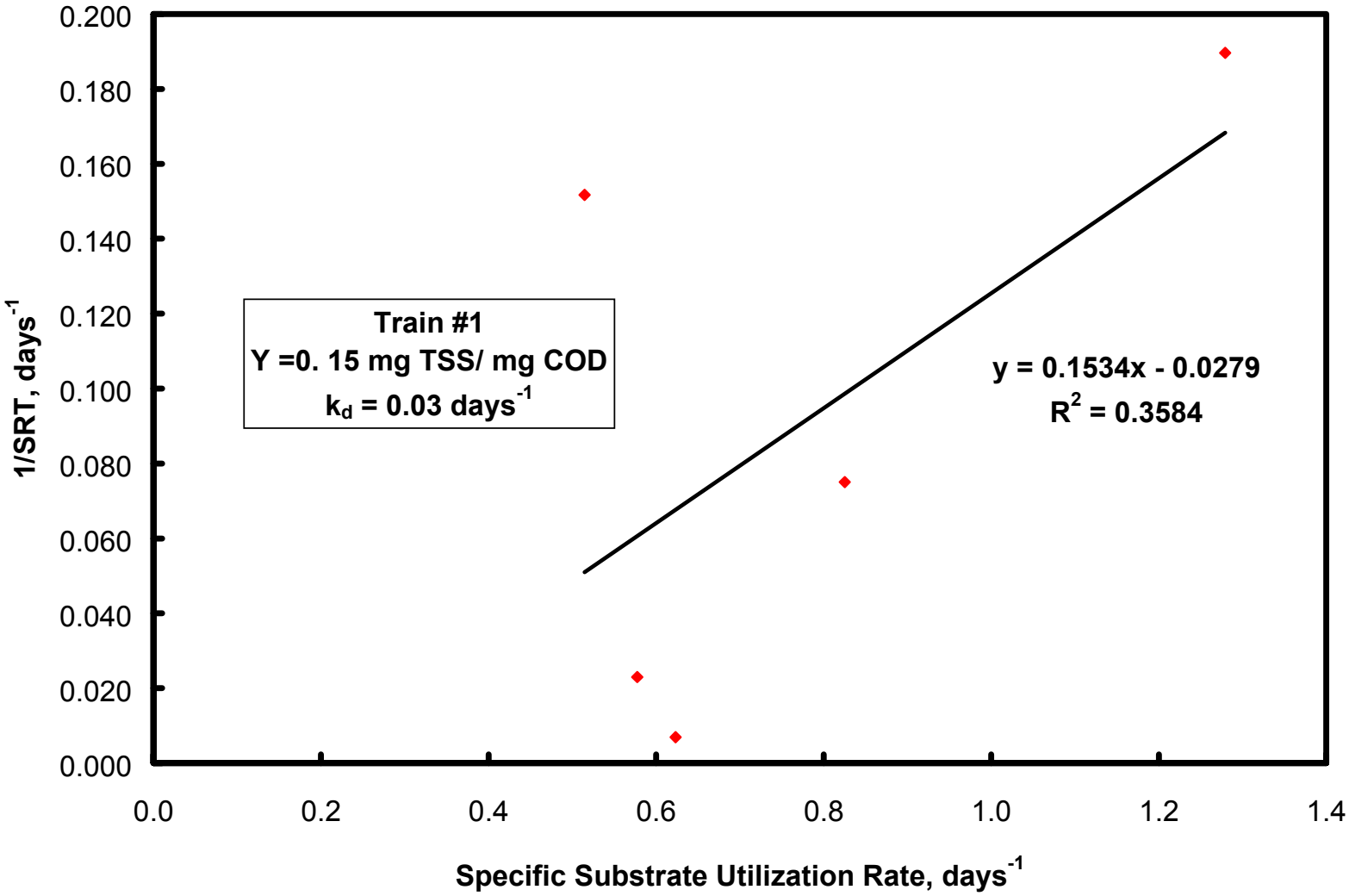
Schematic of Systems



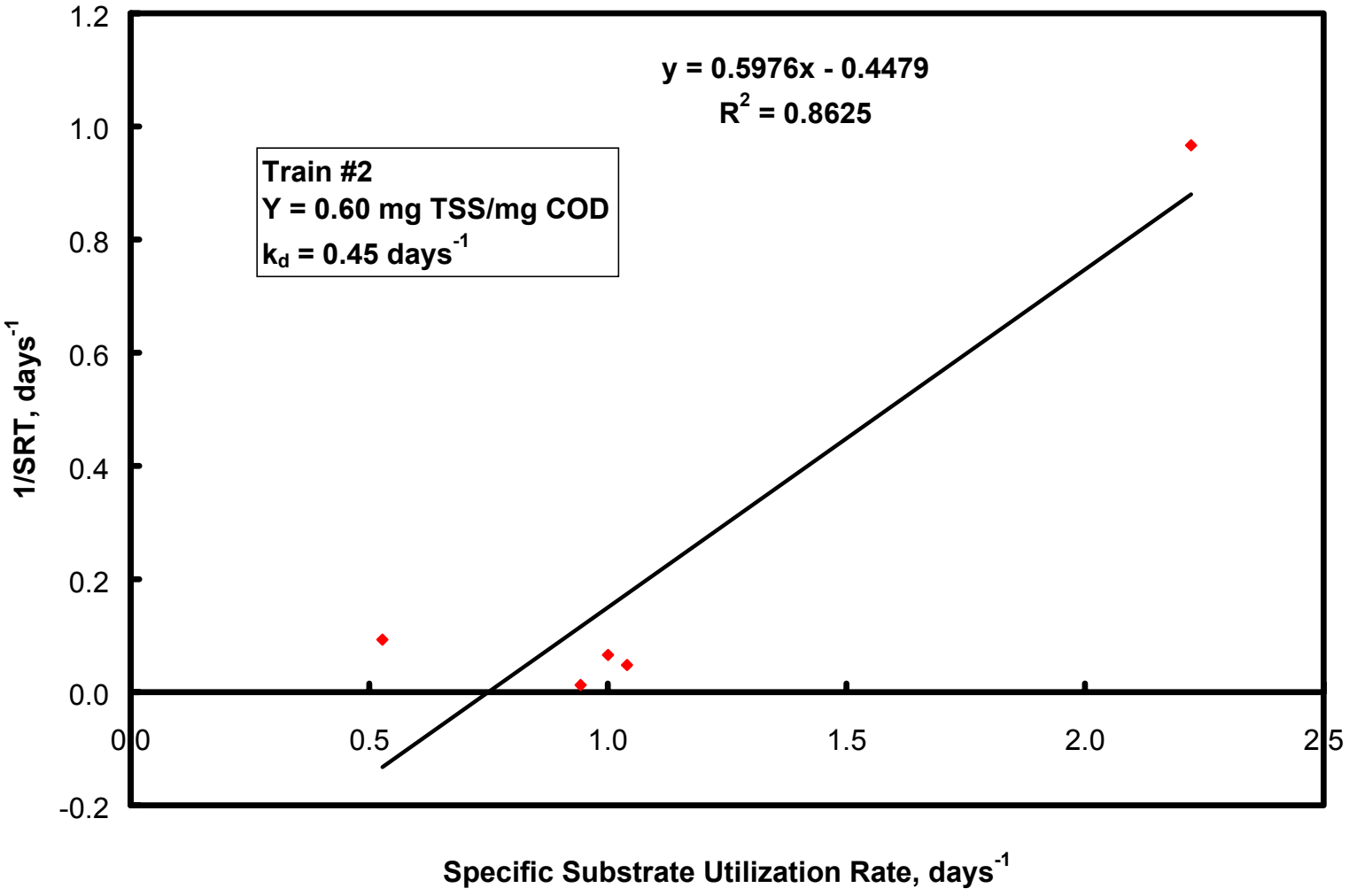
Effluent COD



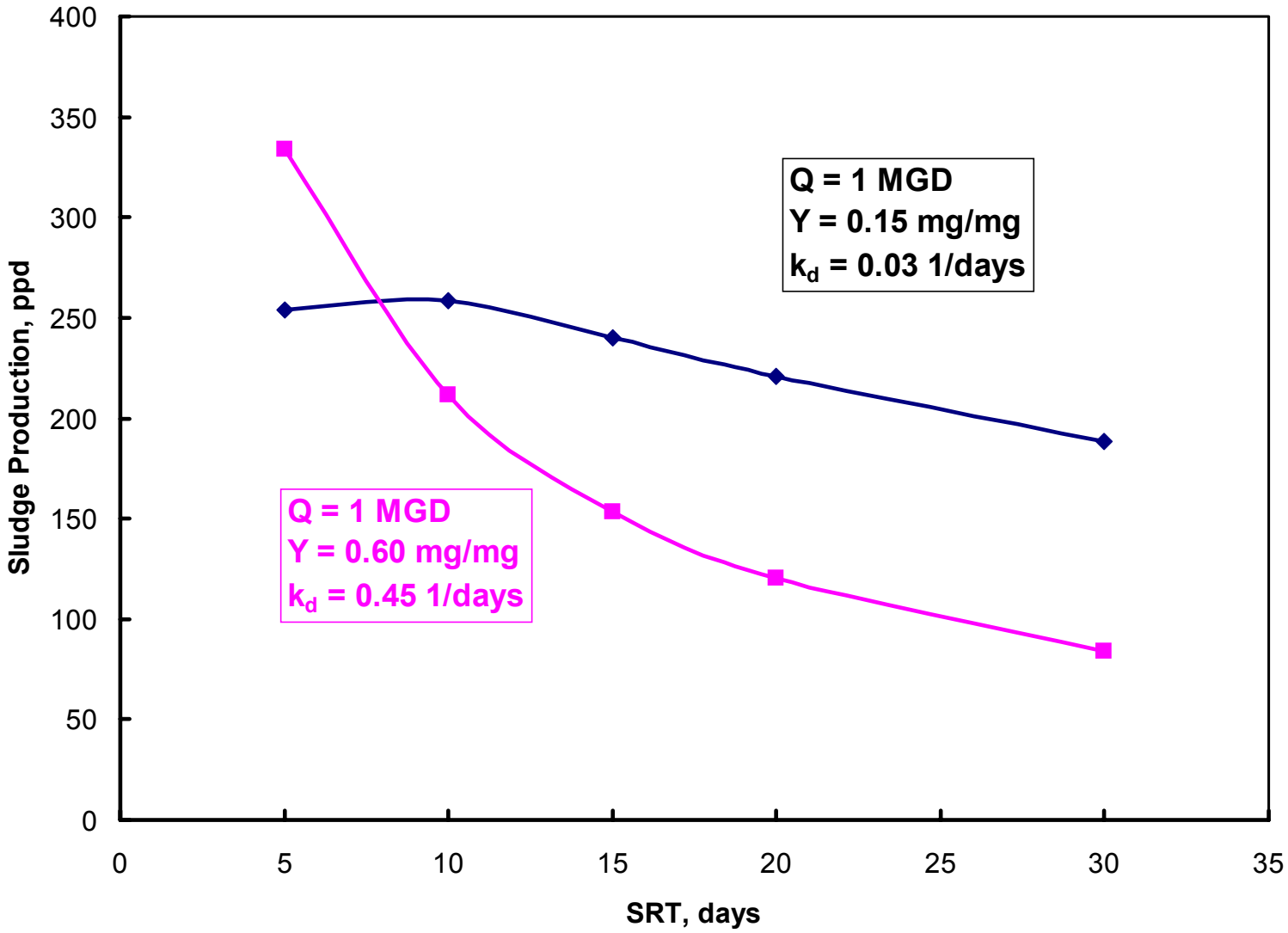
Yield and Decay Train #1



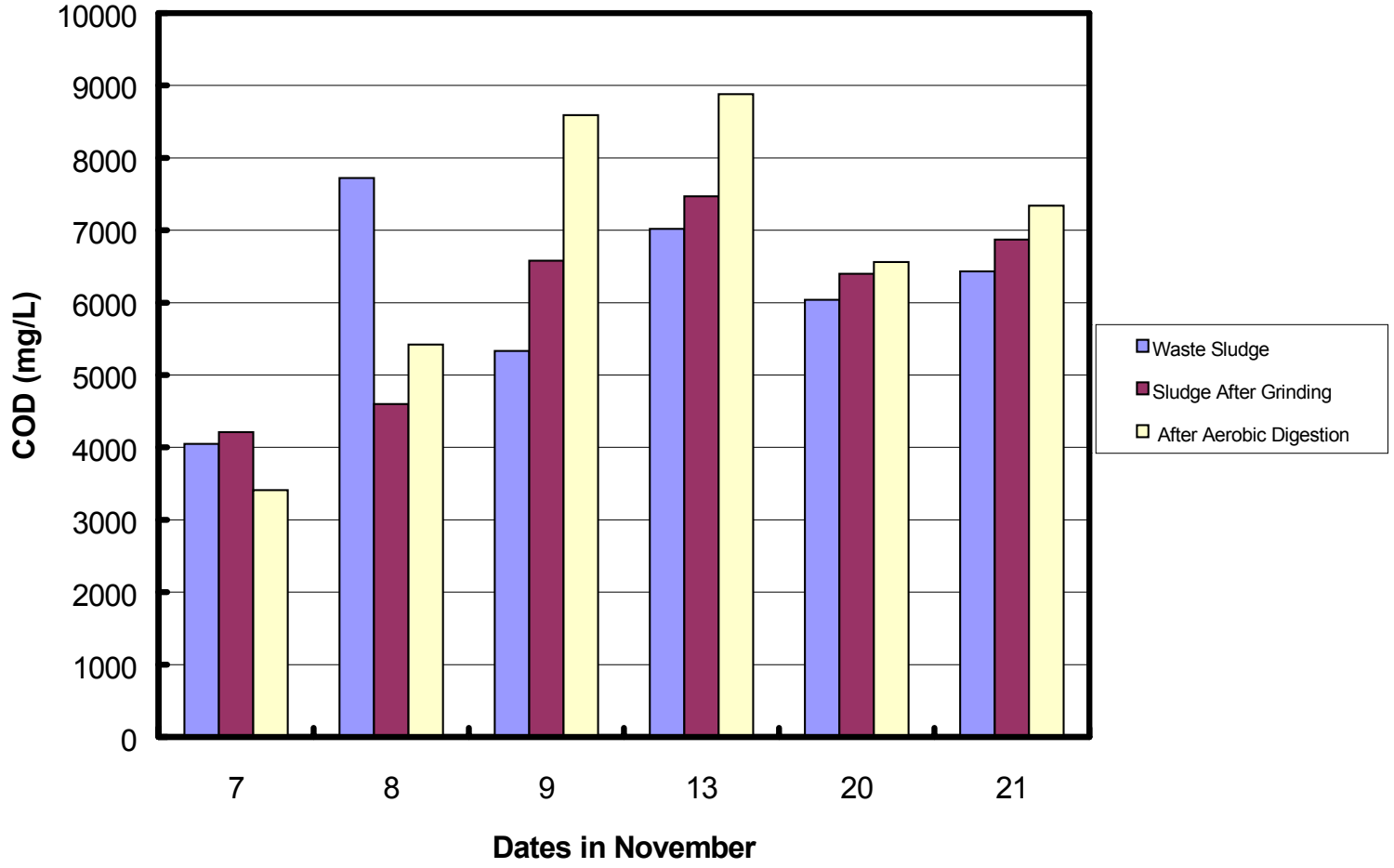
Yield and Decay Train #2



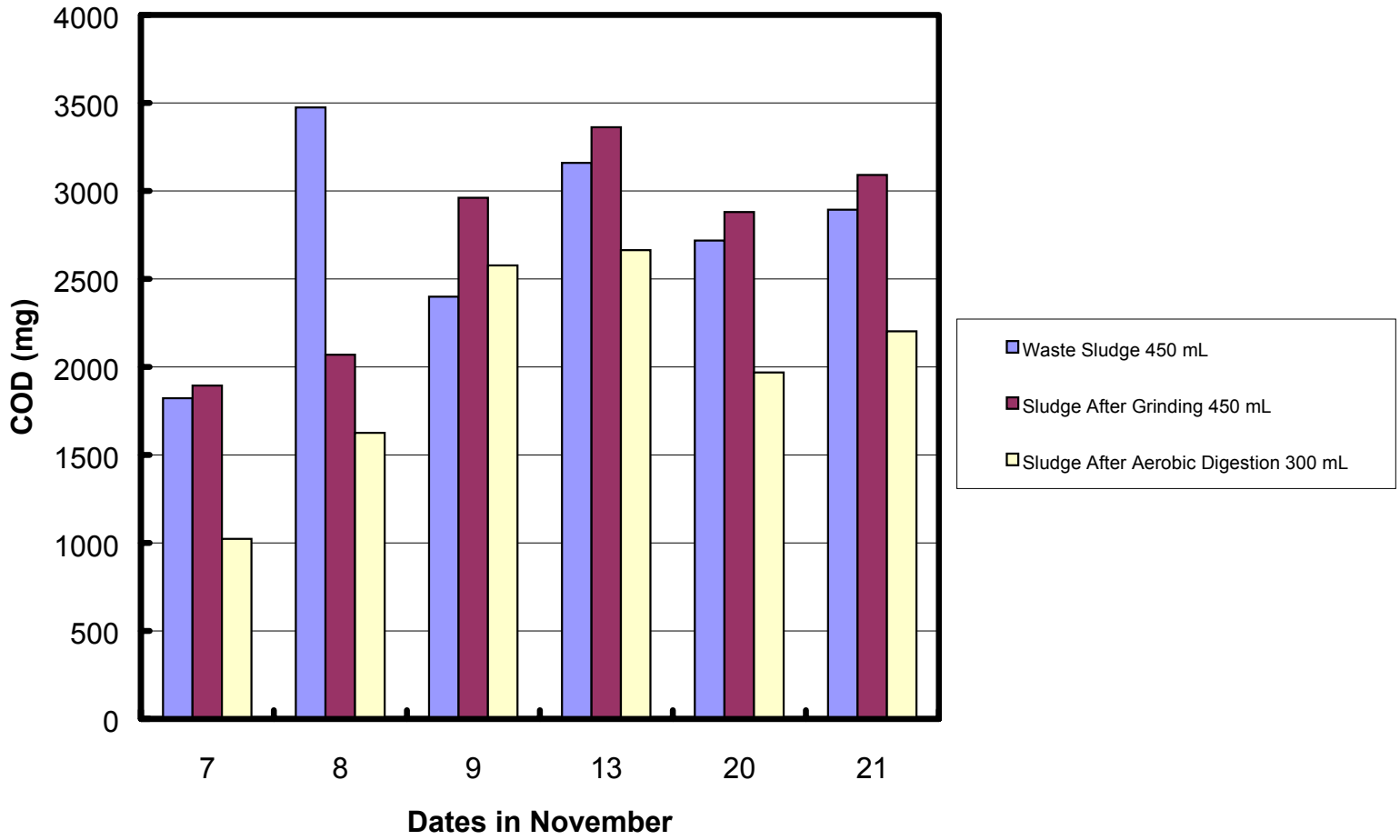
Sludge Production



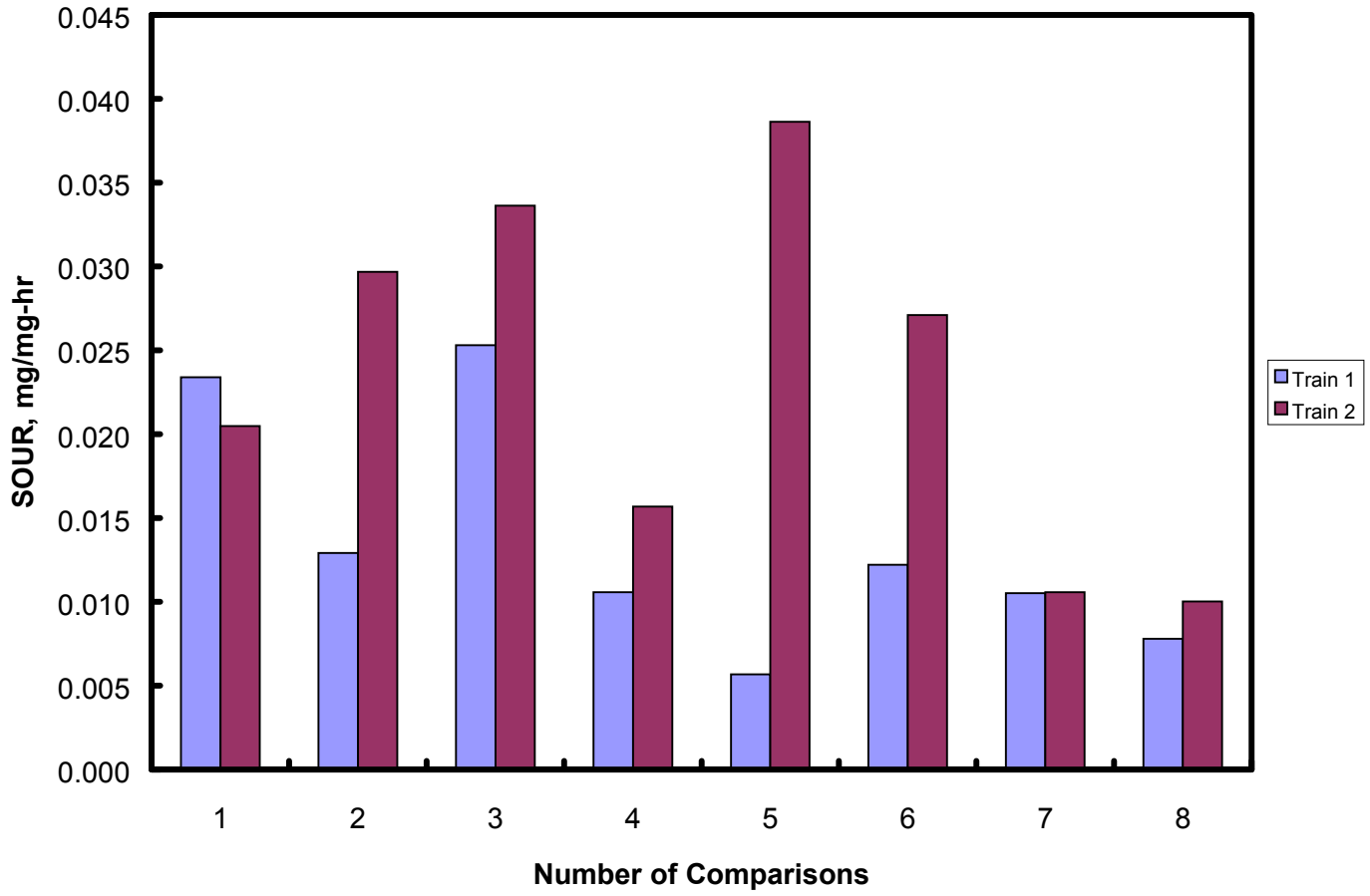
COD after Grinding & Digestion (mg/L)



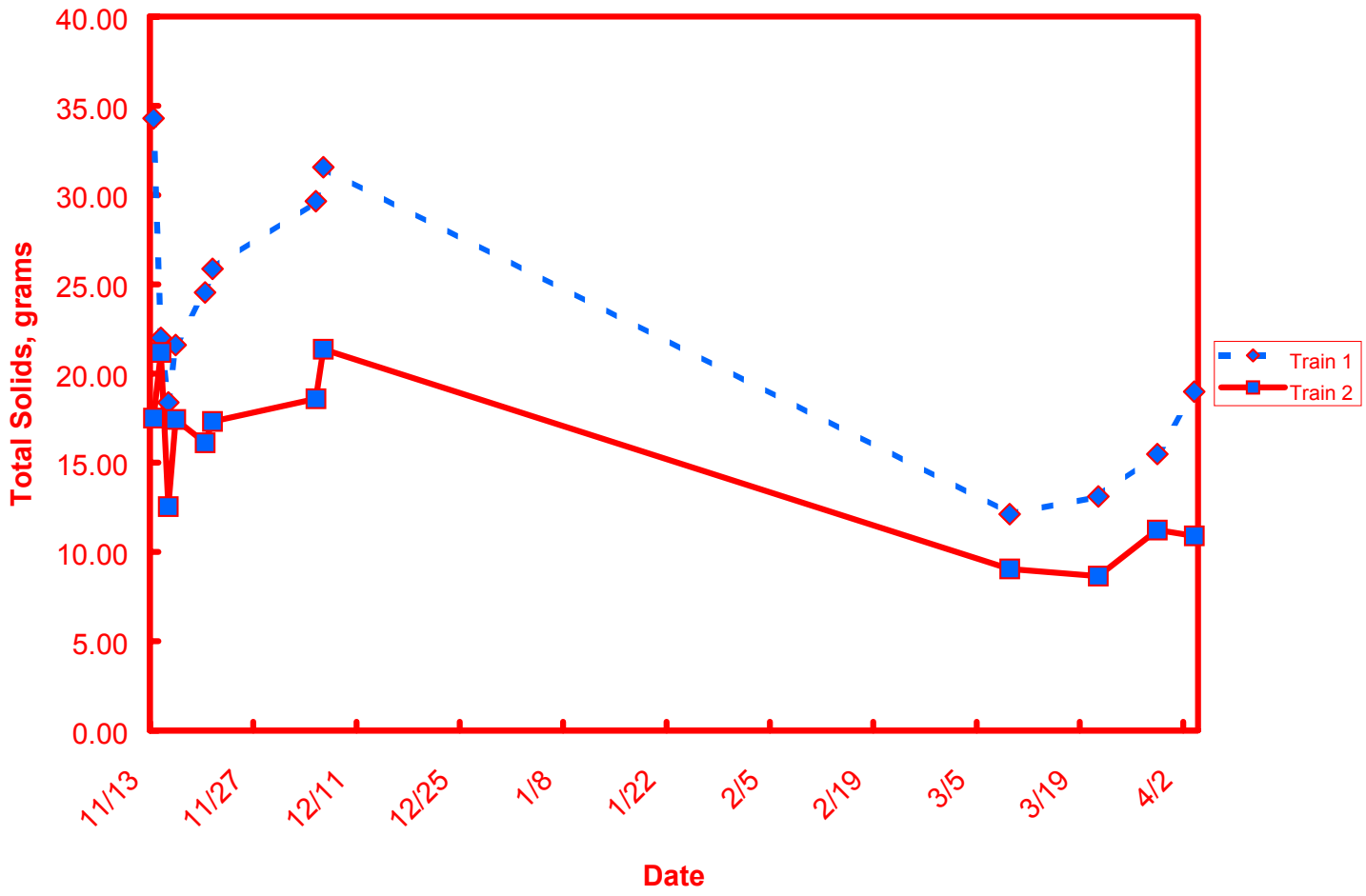
COD after Grinding & Digestion (mg)



Comparison of SOURs



Total Solids Comparison



Summary

- 4-month parallel bench-scale study conducted.
- Control consisted of recycling all wasted sludge from the secondary clarifier to the aeration basin.
- Experimental train consisted of recycling wasted sludge that was ground and then re-aerated for 24-hours prior to returning it to the aeration basin.

Conclusions

- Reintroducing WAS to aeration basins did not detrimentally impact effluent quality with regard to COD and TSS.
- Yield and endogenous decay coefficients for Train #1 were 0.15 mg TSS per mg COD and 0.03 $days^{-1}$, respectively.
- Yield and endogenous decay coefficients for Train #2 were 0.60 mg TSS per mg COD and 0.45 $days^{-1}$, respectively.

Conclusions Continued

- SOURs were higher in Train #2 indicating a higher level of microbial activity.
- Overall quantity of solids (average 15 g) in Train #2 was lower than in Train #1 (average was 22 g). Grinding &blending WAS followed by aeration for 24-hour lowers the overall sludge production by approximately 32 %.

Acknowledgements

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Questions?