



**CALIFORNIA STATE SCIENCE FAIR
2008 PROJECT SUMMARY**

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Project Title
Evaluating the Effectiveness of Real-Time Surrogate Measures of BOD in the Wastewater of Fruit Processing Plants

Abstract

Objectives/Goals
A key issue regarding water quality is an excess of nutrients. Fruit processing wastewater poses a unique problem due to the high level of nutrients and the lack of prior empirical research evaluating this issue. While a test for biological oxygen demand (BOD) is the government standard, this procedure takes a week for the results. Two other wastewater tests, chemical oxygen demand (COD) and total suspended solids (TSS) can be performed in real-time; however, they are not direct measures of BOD. This study evaluates whether these real-time tests are reliable surrogate measures of BOD.

Methods/Materials
Eleven years of real-time test and BOD test data were used to evaluate the ability of real-time tests to predict BOD levels. The data were consolidated and input in an Excel spreadsheet. For statistical evaluation all data were imported into SPSS. This study also evaluated the effect of contaminants on the reliability of the real-time measures since fruit processing produces different waste products than facilities that existing test reliability data are based on. The lab tests to evaluate contaminants were performed at the Encina Wastewater treatment plant in Carlsbad, California. The three tests (BOD, COD and TSS) were performed on a control (wastewater) and three contaminants (cleaner, bleach and dairy sample).

Results
All three measures were significantly correlated. TSS and COD were significant predictors of BOD, $R^2 = .458$, $F(2,150) = 62.54$, $p < .01$. COD (105 mg/liter, 859 mg/liter) had a lot more variance than the BOD (41 mg/liter, 065 mg/liter); in this case, it was more than twice as much. All contaminants affected the reliability of the measurement of COD but not TSS. Bleach and cleaner invalidated the COD test but did not impact the reliability of the TSS test.

Conclusions/Discussion
These findings indicate that real-time tests to monitor nutrient levels can serve as a surrogate measure of the BOD tests. However, if cleaner or bleach contaminate the water, TSS tests are more reliable real-time predictors of BOD; COD reliability is affected by cleaner and bleach. Industry's overdosing the oceans with nutrients, including sugars, is feeding an excessive growth of harmful algae and bacteria. Real-time tests allow fruit processing plants to quickly respond to nutrient levels and reduce the amount of nutrients that are released into the ocean which serve as a fuel for eutrophication.

Summary Statement
This project's goal is reducing pollution in the ocean by using real-time surrogate measures to predict BOD levels in fruit-processing wastewater.

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