CHEMICAL INDICATORS FOR RAPID ASSESSMENT OF HUMAN FECAL POLLUTION IN STORM DRAINS
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ABSTRACT
Many coastal cities see high fecal indicator bacteria (FIB) concentrations in recreational waters during periods of dry weather. Microbial source tracking research in Santa Barbara, CA has detected widespread human fecal pollution in storm drains, implying that the untreated waste can reach the ocean and may expose beach-goers to harmful pathogens. However, DNA-based microbial source tracking tools are expensive and time-consuming. Thus, this project seeks to test if colorimetric methods quantifying common chemical indicators for sewage can be used to quickly and inexpensively identify or screen for human fecal pollution in storm drains. The project is in collaboration with the City of Santa Barbara Creeks Division.

MOTIVATION
Identify and localize sources of human fecal pollution in storm drains

OBJECTIVE
Test if colorimetry quantifying chemical indicators can be used to identify human fecal contamination

RESULTS & DISCUSSION

STANDARD ADDITIONS
• Matrix interferences occurred in all samples
• The occurrence of interferences depends on the type of water, the location of the sample, and the chemical indicator of interest

METHODS
Compare COLORIMETRY vs. DNA-based methods
1. Create standard curves
2. Use standard additions to determine if storm drain water interferes with quantification of chemical indicators
   • Spike water sample with known amount of standard solution.
   • If the actual concentration in the sample differs from the expected by more than 10%, there may be interferences.
3. Collect water samples in urban watershed
4. Measure chemical indicators •NH₃-N •SO₄ •Surfactants
5. Measure FIB using IDEXX Enterolert & Colilert
6. Extract DNA with MO BIO PowerWater DNA Isolation Kit
7. Perform PCR assay for human-specific DNA marker Mnf (Methanobrevibacter smithii gene)
   ✓ Select chemical indicators most predictive for human fecal contamination

CHEMICAL INDICATOR CONCENTRATIONS
• High values for nitrate, sulfate, and surfactants can be seen for some samples. Sources of these are unknown.
• Correlation analysis was done for all indicators but only phosphates and surfactants (relative to ammonia nitrogen) had an R² coefficient higher than 0.6.

CONCLUSIONS
• Standard curve method works
• Standard additions matrix interferences with accuracy of quantification
• Concentration of all samples in field were within range of colorimetry kit
• Need to complete DNA extraction and PCR assay for comparison with colorimetric results

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Figure 1: Sample locations in Santa Barbara watershed

Figure 3: Chemical indicator concentrations for all samples. Note that the axis/scale for surfactants is shown on the right. All other analytes are according to the left axis.

Figure 4: Linear correlations of concentrations for phosphates and surfactants to Ammonia-Nitrogen

y = 0.6269x + 0.375
R² = 0.70857