



**CALIFORNIA STATE SCIENCE FAIR  
2009 PROJECT SUMMARY**

<b>Name(s)</b> <b>Andrew A. Palosaari</b>	<b>Project Number</b> <b>S0828</b>
<b>Project Title</b> <b>Ultrafiltration/Nanofiltration Membrane Water Treatment for Urban Vernal Marshes</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> Contaminants such as fertilizers, pesticides, pharmaceuticals, bacteria, viruses, and various salts are a significant problem for urban vernal marshes. When pollution levels are particularly high, a membrane-based water treatment system could be applied. Such a system would have to include nanofiltration (NF) membranes. The objective of this study was to determine optimal NF pretreatment processes using ultrafiltration (UF) membranes and aluminum sulfate coagulation by evaluating membrane performance (flux decline and fouling).</p> <p><b>Methods/Materials</b> Flux was determined by collecting weight measurements of the permeate at constant intervals with standard coagulation dosages, using a new experimental pressurization procedure. Flux was normalized by temperature, pressure, and clean membrane flux with distilled water. In addition, a new application of pore blocking laws with membrane cleaning over multiple runs was used to identify periods of cake filtration fouling.</p> <p><b>Results</b> Results show that aluminum sulfate is a suitable primary coagulant for UF membranes. The optimal 50-mg/L coagulant dosage should be decreased to 15-mg/L over the rainy season. However, coagulation is not needed as a pretreatment of UF membranes since, even without coagulation, final permeate flux is within industry standards. It was also determined that the higher resistant UF-70kDa membrane is less affected by fouling and more easily cleaned due to its reversible cake filtration blocking mechanism.</p> <p><b>Conclusions/Discussion</b> This bench-scale study shows that a membrane-based water treatment system for urban vernal marsh ecosystems could incorporate UF-70kDa membranes as a pretreatment for a NF system.</p>	
<b>Summary Statement</b> This study determined optimal nanofiltration water pretreatment processes using ultrafiltration membranes and aluminum sulfate coagulation for environmental remediation of an urban vernal marsh.	
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