



# Project Fact Sheet

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## *Membrane Applications in Grape Juice and Wine Processing*

### **BACKGROUND**

Fruit juice and wine productions are major components of the California food and beverage industry. Production of both involves refrigeration and separation of unwanted residues making them energy intensive processes. By applying new membrane technologies the PIER program was able to save energy in one wine making process and to alleviate a waste disposal problem in juice processing. It also allowed for recovery of chemicals and to reduce water usage. Based on this research the company decided to incur major expenses to install equipment to scale up the benefits demonstrated by PIER RD&D research.

### **GOALS**

- To demonstrate wine stabilization and clarification using membranes and by electro dialysis as alternatives to conventional cold stabilization.
- To demonstrate microfiltration of distillation residue to alleviate disposal problems
- To demonstrate membrane treatment as an alternative to conventional grape juice treatment process.

### **PROJECT DESCRIPTION**

California is home to over 800 wineries that produce in excess of 500 million gallons of wine annually. The wine industry is faced with many challenges due to the increasing costs of electricity, water, waste disposal and stringent environmental regulations. Conventional processing methods used in wine and juice making consume large amounts of electricity and water and produce large volumes of liquid and solid waste. Membrane separation technology has the potential to reduce energy and water use in wine making and also to reduce effluent volumes. A membrane demonstration unit was stationed at a large winery in the Central Valley during the 2000 and 2001 seasons. Several different membrane applications and electro dialysis for wine and grape juice processing were demonstrated.



**Microfiltration System**

The electrical energy consumption for conventional stabilization of wines by cooling requires energy intensive refrigeration. Electro dialysis is an electrically driven membrane process that can achieve tartrate stabilization of wines using 80% less electricity, it can also produce better quality wines with less waste produced. This application was demonstrated successfully on a pilot scale and the winery has decided to procure a pilot electro dialysis system to apply the new technologies to possibly improve upon other product characteristics.

The residue from wine distillation process is high in suspended solids that cause clogging of soils when disposed by land application. Separation of suspended solids by microfiltration was demonstrated successfully. The separated solids can now be used in compost while the filtrate can be land applied without clogging the soils. This change alleviated the waste disposal problem that had become environmentally unacceptable.

The winery treats grape juice and some wines by ion exchange. The ion exchange columns are regenerated using sulfuric acid. Disposal of waste acid had become a major concern. Membrane trials indicated that the waste acid could be concentrated two-fold by reverse osmosis while recovering water for reuse and treated further by nanofiltration to recover sulfuric acid also for reuse. This saved cost of chemicals and saved water.

The present method of juice treatment is expensive, time consuming and produces high waste volume. PIER RD&D successfully demonstrated a continuous juice treatment system using ultrafiltration was proposed as an alternative. This on-line process is less costly and produces less waste.

### **BENEFITS TO CALIFORNIA**

Cooling and cold storage are the most energy intensive operations in wine making. Tartrate stabilization by electrodialysis can reduce the electrical energy consumption by about 80%. Acceptance of this technology by the wine industry at large has the potential for high electricity energy savings.

The demonstrated technologies help eliminate the disposal cost and reduce water use in juice processing. Reduced water use eliminates need for pumping large amount of ground water thus reducing electricity consumption. Easing the environmental concerns of the large wineries using membrane treatment would help the industry and the economy of the state in the long term.

### **PROJECT STATUS**

Two of the twelve membrane applications investigated have already been implemented on full scale. A full size microfiltration system to process 600,000 gallons per day of distillation residue was installed within six months of the demonstration. This installation has reduced the solids load to the land application by diverting it to compost and alleviated the disposal issues. A full size membrane system for treatment of waste acid from ion exchange regeneration was also installed at the plant within six months of the demonstration. This system concentrates the waste acid by reverse osmosis while recovering water for reuse in the first stage and concentrates it further by nanofiltration while partially recovering sulfuric acid for reuse.

### **FOR MORE INFORMATION**

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