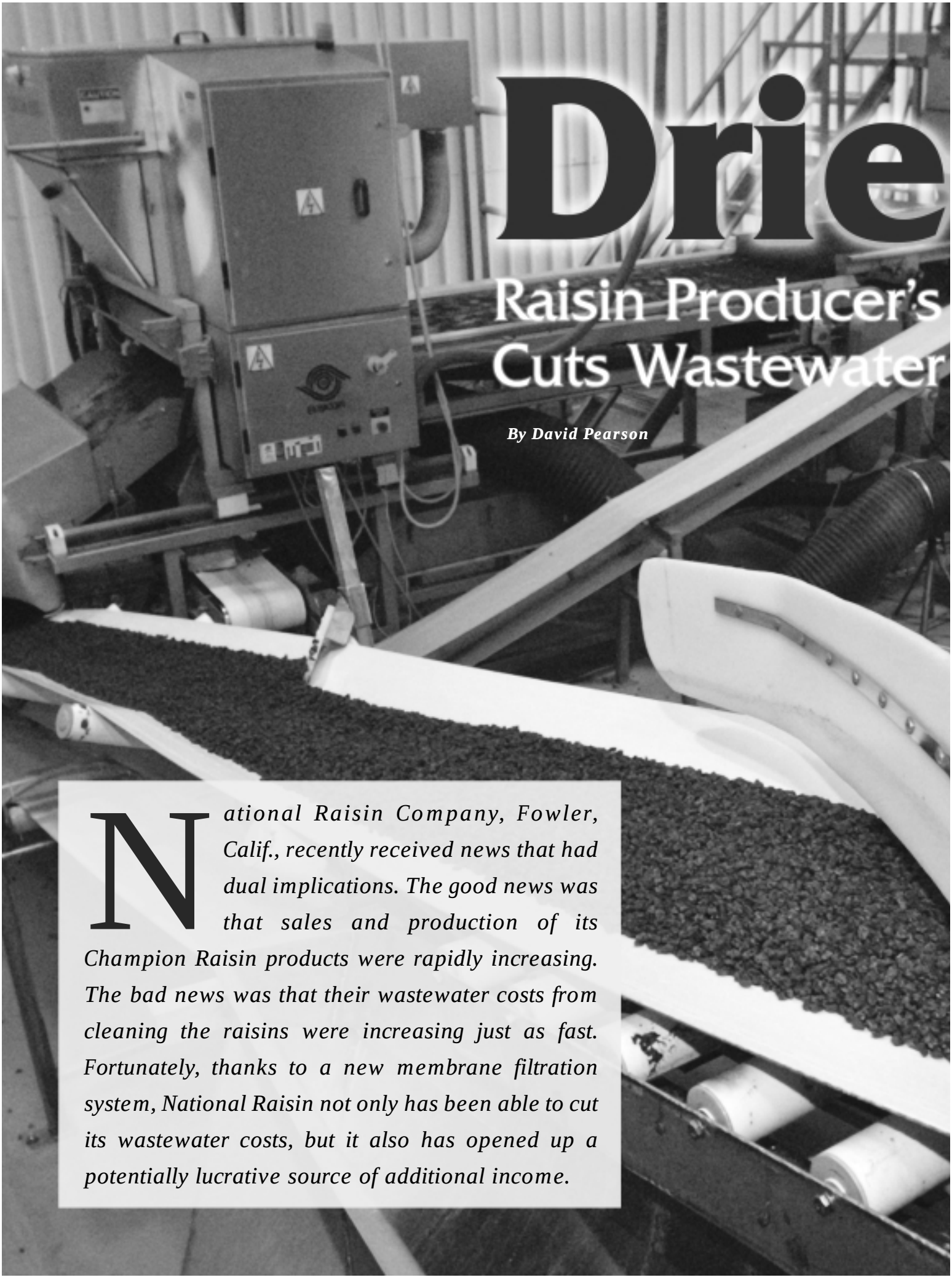

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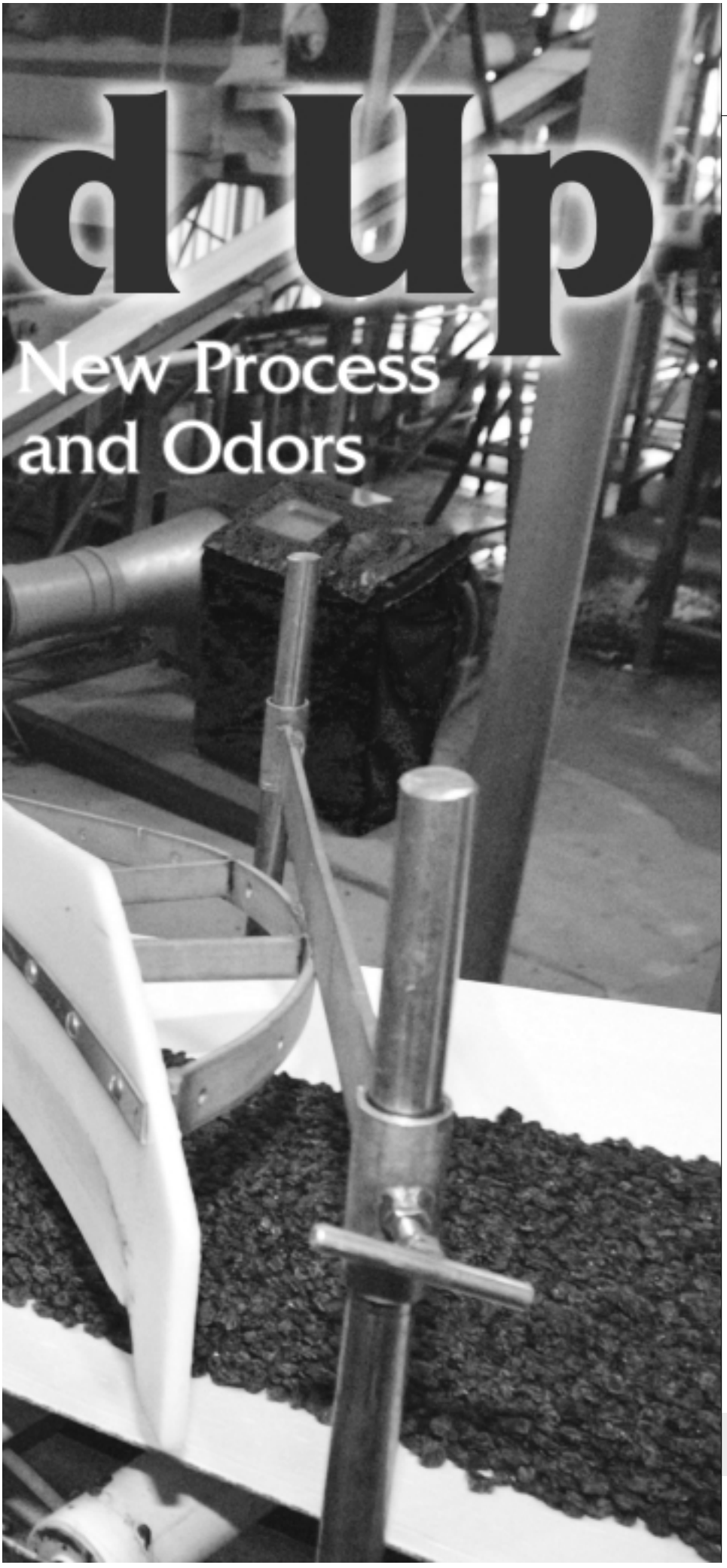
Raisin Producer's Cuts Wastewater

By David Pearson

National Raisin Company, Fowler, Calif., recently received news that had dual implications. The good news was that sales and production of its Champion Raisin products were rapidly increasing. The bad news was that their wastewater costs from cleaning the raisins were increasing just as fast. Fortunately, thanks to a new membrane filtration system, National Raisin not only has been able to cut its wastewater costs, but it also has opened up a potentially lucrative source of additional income.

dUp New Process and Odors



While this particular solution currently is used only in raisin processing, producers of any dried fruit (prunes, dried apricots, etc.), as well as many other sugary waste streams, likely would find similar benefits.

Processing about 50,000 tons of raisins per year (200 tons per day), National Raisin is the second largest processor and distributor of raisins in the United States. However, the company generates between 60,000 and 80,000 gal/day of wastewater, primarily from the raisin-washing process. Raisins have a fine coating of dust blown onto them from the sandy soil in the Central Valley of California, and this needs to be washed off before packaging.

Removing the sugar from the wash water would reduce municipal wastewater charges and eliminate the environmental concerns that came with land application.

If this dust was the only problem, simple settling tanks or filters could eliminate it and the wash water could be re-used for irrigation and other purposes, or disposed of at the local wastewater plant at very minimal cost. However, the real problem with the wash water is that, when it washes away the dust on the raisins, some of the sugar in the raisins also dissolves into the water. The wash water now has sugar in it, creating a high biological oxygen demand (BOD). To complicate matters, land application (irrigation) of water with BOD requires a special permit that can be time-consuming and expensive to obtain. In addition, more paperwork and ongoing regulatory review are necessary to maintain permits, and regulations for land application in California are getting tighter all the time. This regulation is considered necessary to maintain general groundwater quality. Offensive odors also

Raisins enter the washing system by conveyer at a rate of 200 tons per day.

This membrane filtration plant incorporates 80 filtration modules and is designed so that it can be easily expanded 50 percent to 120 modules to meet increased demand in the future.

Millions of raisins are spread out in preparation for washing.

can be produced when sugar-laden wash water is disposed of via land application.

For all of these reasons, the Bedrosian family, owners of National Raisin Company, wanted to find an alternative to land applications of their sludge. They were raised in the Fowler area near the raisin processing plant and are involved in local civic activities. They take pride in their community and the company always has been committed to protecting the local environment.

"This is a small town," said president Ernie Bedrosian, the eldest of three brothers who own the company. "There are only four or five thousand people and we know just about everybody. There are cheaper ways to dispose of the raisin wash water, but we wanted to do the right thing for the community."

As time-consuming and environmentally unfriendly as land application of wastes can be, sending the water to the local municipal wastewater plant is not an attractive alternative. Since it costs more to process water with high BOD, municipal wastewater plants charge their customers more—about $50,000 per month more in National Raisin's case.

Not surprisingly, the packer decided it would be more economical to remove the sugar (the source of the BOD) from the wash water. This plan would reduce municipal wastewater charges and eliminate the environmental concerns that came with land application.

So, the decision to remove sugar from the wash water before disposal was easy. In fact, as an added benefit, if the grape sugar concentration in the wash water was high enough, it could be sold to local distilleries to make grape alcohol. This type of alcohol is used to make fortified wines such as sherry and port as well as brandy. One local distillery said it would be interested in purchasing the wash water if it was a minimum of eight percent sugar. This meant that the sugar content had to be doubled or quadrupled from the two to four percent normally released in the raisin wash water.

The more difficult decision would be to pick the best process to concentrate the raisin wash water, since there were several options.

Wastewater Options

The most logical choices were using evaporation or reverse osmosis (RO). Even state-of-the-art, high-efficiency evaporators operating under vacuum require a lot of energy to boil away enough wash water to concentrate the sugar to the desired level. On the other hand, reverse osmosis only requires energy enough to generate pressure that forces water

through a membrane that retains and concentrates the sugar. Thus, RO seemed the most likely approach.

Plant Engineer John Minazzoli first considered spiral RO elements that are relatively inexpensive and require the least amount of floor space. However, dust and other grape solids (bits of stems and skins) were found to block the small channels in these spiral elements. Conventional pre-filters used upstream from the spiral elements also became blocked.

At this point, Minazzoli raised the question of treatment with Dr. Jatal Mannapperuma from the California Institute of Food and Agricultural Research (CIFAR). Mannapperuma consults with growers all over California and operates a mobile trailer that houses several membrane options for experimentation.

First, they tried using tubular ceramic membrane ultrafiltration (UF) as the pre-filtration prior to the spiral RO. The filtrate from the ceramic UF unit provided an acceptable feed for the spiral RO, but unfortunately, the dust flowing through the ceramic membrane eroded the membrane surface, reducing its life.

At this point, Mannapperuma recommended evaluating polymeric tubular RO membranes and Peter Allan, sales engineer for PCI Membrane Systems, Inc., was brought in. The tubular channels in PCI RO membranes do not require prefiltration, and the polymer membrane surface is more resistant to abrasion than inert materials such as ceramics. In other words, National Raisin could accomplish their goal of sugar concentration in one step instead of two.

The initial trial in the CIFAR trailer proved that the tubular RO membranes concentrated the sugar up to the 8 to 10 percent levels required by the distillery, and additional scale up trials were then arranged to determine the size of the final system. The larger scale trials also were successful, and a full-scale system was installed.

Re-Use

Once the concentrated sugar water (called "retentate" in membrane-filtration parlance) has been removed, the remaining water (called the "permeate") is actually lower in dissolved solids than the well water that feeds the plant. Therefore, it can be reused in the raisin washing process or sent to irrigate nearby vineyards without any concerns about odor or soil contamination.

Above: *Raisins cascade through the washing process, which yields between 60,000 and 80,000 gallons per day of wastewater.* ***Below:*** *Fresh from the washing cycle, raisins are sprayed with clean water.*

The membrane filtration plant installed at National Raisin Company incorporates 80 Model B1 filtration modules and is designed so that it can be easily expanded 50 percent (to 120 modules) to meet increased demand in the future. Membrane life is guaranteed for a year, and the first set was replaced after a year of use.

National Raisin is continuing their program of optimizing RO use for maximum return on their investment. Demand for grape sugar water tends to fluctuate (even dropping to zero occasionally), but these savings on Champion Raisin's sewer bill alone amount to around $300,000 per year. These savings are enough to keep the system return-on-investment within the original plan of 3 years. Any additional income that comes from selling the concentrated sugar water to distilleries will just speed things up.

About the Author:
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