Kelly Polk (left), district manager of the Montalvo Municipal Improvement District, with Stan Rusk, chief operator of the district's wastewater reclamation plant.

A New Approach

A CALIFORNIA DISTRICT USES AN EFFLUENT ACIDIFICATION PROCESS TO REDUCE PERCOLATION POND MAINTENANCE AND OPEN OPPORTUNITIES FOR WATER REUSE

By Ted J. Rulseh

Soil aquifer treatment is a practical solution for small wastewater treatment plants where effluent characteristics or other factors rule out discharge to a stream.

The Montalvo Municipal Improvement District, on the coast of California between Santa Barbara and Los Angeles, serves a residential and agricultural area with a 1,500 population. Its sequencing batch reactor treatment plant produces advanced secondary effluent at 360,000 gpd.

The district uses soil aquifer treatment for its effluent, but found the process limited because alkaline soil causes a buildup of bicarbonate and carbonates beneath its percolation ponds that limited downward water movement.

The district worked with Earth Renaissance Technologies of Bakersfield, Calif., to develop a process for acidifying the effluent, thus improving soil penetration and reducing maintenance on the percolation pond bottoms.

Tests also demonstrated that the process would enable the district to use its water for irrigation, even on salt-sensitive crops such as lemons and avocados, despite a relatively high effluent salt content. Kelly Polk, manager of the district, sees great potential for the effluent acidification technology to help other small treatment plants where salinity and soil alkalinity are concerns.

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KELLY POLK

Polk, and Terry Gong, managing partner with Earth Renaissance, which provided the acidification system, talked about the process and its results in an interview with *Treatment Plant Operator*.

tpo: Historically, how has the district managed its effluent?

Polk: We have five percolation ponds that cover a little over six acres. Over time, natural alkalinity causes binding of the soil that reduces percolation rate. Therefore, the ponds need maintenance. Normal maintenance was to remove the water from a pond, use a bulldozer to rip the bottom to loosen the soil, and then rest the pond. Resting allows the nematodes, bacteria and other soil organisms to do their magic and reopen the soil pores.

tpo: What are the specific challenges your district faces in making secondary-treated effluent available for irrigation?

Polk: We are producing reuse-quality water. Our BOD discharge is less than 20 mg/l, TSS less than 20 mg/l, and total nitrogen is less than 10 mg/l. The problem is that we have a salt issue. We initially found that in order to provide the water for irrigation, we would have to remove the salt. The only way we knew to do that was with reverse osmosis (RO), which is very expensive.

Using RO, we would have to charge more than $450 per acre-foot for irrigation water, whereas local farmers are now paying $100 to $150 per acre-foot for purveyed water. We asked how could we use our reclaimed water for irrigation without having to remove the salt. But salt is not the only problem. Soil alkalinity also restricts percolation of water through the root zone.

tpo: What is the source of the salt in the effluent?

Polk: Municipal purveyed water in our area usually contains greater than 40 ppm of salt. By the time it is used in the household for bathing and washing and is discharged to the sewer system, at least 60 ppm of salt has been added. We are then receiving wastewater at the treatment plant at perhaps 120 ppm or greater.

tpo: Can you describe the treatment you're using to address the salt and soil alkalinity issues?

Gong: We acidify the effluent using a Harmon Systems SO_2 sulfurous acid generator. We oxidize raw elemental sulfur by burning, and then wet-scrub the SO_2 that's produced with a sidestream of the water that is to be treated. The resulting sulfurous acid solution has a pH of about 3.0. We then blend that water back into the wastewater stream. As a result, the pH of the effluent going into the percolation ponds is usually about 6.5.

tpo: What exactly happens in the soil as a result of applying the mildly acidified effluent?

Gong: In Wisconsin, where you live, you receive a lot more rainfall that we do in the West and Southwest. Rainwater is naturally acidic, and so your soils tend to be more acidic, as well. The ecosystem has lost its natural buffering. Out here, we receive about 16 inches of rainfall a year, and some areas receive less than two inches. So the soils tend to be alkaline.

In essence, the acidity in the effluent neutralizes some of the alkalinity in the soil. It dissolves some of the otherwise insoluble soil carbonates, allowing the water to penetrate, and also allowing the salts in the effluent to leach through.

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tpo: What has been the impact of this treatment on the efficiency of the percolation ponds?

Polk: Without this treatment, effluent pH would be about 7.5. The difference the acidity makes is amazing. The acidification markedly improves water penetration. It has reduced the amount of pond surface required by half, and it has reduced the frequency of the ripping cycle by half, as well. That saves an awful lot of cost.

tpo: What were the results when the acidified effluent was tested on salt-sensitive crops grown in the area?

Gong: The acidification allows deeper percolation of the water and the salt through and out of the root zone. Therefore, we found that with the sulfur treatment balanced with calcium addition, we can use the plant effluent to irrigate even the most salt-sensitive crop, which is avocados, without having to remove the salt.

And we found that there was no negative effect on the growth of the trees as compared to irrigation with purveyed potable water. We simply had to add a little more nitrogen to the wastewater. In the test, we only lost two trees out of the 150 trees we measured. One of those was ruined by wind damage, and the other was sickly anyway. The two groups of trees were grown side by side and were irrigated with wastewater and purveyed water.

We have found that we could use our effluent to irrigate fruit trees, landscaping, and other crops, especially the grass crops and alfalfa, which accounts for more acreage locally than we have reclaimed water for. The nutrients in the wastewater are such that we only have to add a very small supplemental amount of nitrogen to get the growth farmers would expect by using well water and nitrogen fertilizer.

tpo: What would be the price of this reclaimed water if sold for irrigation?

Polk: We've already borne the cost of acidification as part of the cost of treatment, so the sale of the water would be a bonus. We would just set the price the market would accept and create an added revenue stream for the plant. The price would be competitive with what the farmers are paying now, and it would have the added value of the nutrients, eliminating some of their cost for fertilizers.

tpo: Does the Montalvo district plan to begin marketing its effluent for use in irrigation?

Polk: Not at this time. If we had a user right next to the plant, it would be easy, but the user who really wants the water is a mile and a half away. That would require conveyance costs that would be prohibitive for our plant.

And selling the water for irrigation would not eliminate our percolation ponds. Our growing season is about 10 months, so for two months we would be unable to sell the water and would need to put it into the ground. While there is potential in the future for us to sell the water for irrigation purposes, right now the benefits to us are in lower costs for soil aquifer treatment and the maintenance of our percolation ponds.

tpo: Do you see potential for other smaller treatment facilities to benefit from effluent acidification?

Polk: Yes. For smaller plants that can't meet open stream discharge requirements, this could become an important technology. Soil aquifer treatment is a common practice for smaller communities in Southwestern states like Arizona, New Mexico and Nevada. Many of them could use this acidification technology — wherever there are soil alkalinity issues and low water percolation.

Ammonia nitrogen added to the waterways is causing great havoc to ecosystems. To remove that ammonia nitrogen mechanically is very expensive. If we can create approaches where we can use effluent by applying it to the land in such a way that it will not cause an accumulation of salinity in the soil over time, that is a winner.

We alleviate water shortage issues and allow more water to flow naturally through the ecosystem, and we let the crops, whether they be food and fiber or biofuels, harvest the nutrients out of that water. It's a very green approach. tpo

more info:

Earth Renaissance Technologies LLC
925/250-4559
www.earthrenaissancetechnologies.com