Fact or Fiction?

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Water Can Be Too Pure

Can water be too pure? If you're a farmer the answer is yes. Desalinated water is one example. The purity drawback is that desalination not only separates the undesirable salts from the water, but also removes ions that are essential to plant growth. When desalinized water is used to replace irrigation water, basic nutrients like calcium, magnesium and sulfate at levels sufficient to preclude additional fertilization of these elements are missing.

An example is a new facility in Ashkelon, on Israel's southern Mediterranean coast. Although the Ashkelon facility was designed to provide water for human consumption, because of relatively modest population densities in southern Israel, a substantial percentage of the desalinated water was delivered to farmers. Recent evaluation of the effect of the plant's desalinized water on agriculture, however, produced some surprising, negative results. Water from the Ashkelon plant has no magnesium, whereas typical Israeli water has 20 to 25 mg/L of magnesium. After farmers used the desalinated water, magnesium deficiency symptoms appeared in crops, including tomatoes, basil and flowers, and had to be remedied by fertilization. Calcium and sulfate concentrations were also low in desalinated water and post-treatment processes were required. Calcium is not just a nutrient required by plants. Its interactions with other nutrients and with growth-limiting factors, including plant disease agents, make changes in its content and relative concentration particularly problematic. To meet agricultural needs, missing nutrients might be added to desalinized water in the form of fertilizers, adding additional costs. If the minerals required for agriculture are not added at the desalination plant, farmers will need sophisticated, independent control systems in order to cope with the variable water quality.[1]

Farmers can also be affected by run-off water that is too pure. Snow-melt run-off from the Sierra Nevada, Cascades or other mountains can be too pure. For irrigation to be effective, it needs to penetrate into the soil, supplying enough water to sustain the crops until the next irrigation and the most important factor for water penetration is salts (or lack thereof) present in the water and/or soil. A lack of calcium in the majority of soils due to snow-melt irrigation water, or poor quality subsurface water, is leading to serious problems in California. Danyal Kasapligil, Agronomist with Dellavalle Laboratory, Fresno, CA, reports, "What we are seeing in the field is, not only

are there more and more water penetration problems, but crop quality is also rapidly declining because of a lack of calcium in our irrigation water." Brent Rouppet adds that for irrigation water to penetrate deeply into the soil, the electrical conductivity of the water needs to be greater than approximately 0.60 dS/m (decisiemens per meter). Irrigation water with less than 0.60 dS/m conductivity contributes to loss of soil structure and increased water penetration problems. The snow-melt run-off from the Sierra Nevada Mountains is so pure that its electrical conductivity can be 0.02 dS/m or less. This water lacks calcium, essential for good soil structure, and any calcium existing in the soil profile is over time leached below the root zone or used by the crops, and is typically not being replaced in quantities required.[2]

Here's another example where absolute purity of water can be a problem. Philip West of Louisiana State University notes, "With productive waters, it is quite apparent that absolute purity is out of the question. If the Mississippi River passing Baton Rouge and New Orleans consisted of distilled water there would be no seafood industry such as we now have in Louisiana. Without copper 'contaminating' the water, there would be no oysters. Traces of iron, manganese, cobalt, copper and zinc are essential for the crabs, snapper, flounder, shrimp and other creatures that abound in Gulf waters. As unpleasant as it sounds, even the run-off from the fertilized fields of the heartland's and the sewage discharges into the Missouri, Ohio and Mississippi River systems pollute and thus ultimately nourish the waters."[3]

One last item. Are you a bottled water fan? If so, you could be giving up a primary source of fluoride which is the public health system's main weapon against tooth decay. What comes in the bottle has either been filtered to remove impurities or is spring water that is reputed to be purer than tap water. But the filtering process also takes out fluoride. Not only does fluoride occur naturally in water, but about half of the nation's public water supplies are supplemented with additional fluoride. The recommended level of fluoride set by the EPA for municipal water systems is 0.7 to 1.2 parts per million. The maximum acceptable level is 4.0 parts per million. If a water supply contains less than 0.7 parts

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cleaners often contain silicates, which are difficult to rinse and may leave residues. One remedy is to use a mildly alkaline first rinse, which can help remove the silicates. Another remedy is to use a mild acid cleaner or a mildly etching alkaline cleaner that will not be left for long times in the cleaner solution.

Over-etching aluminum alloys in the pre-plating process often results in a pitted deposit. Alkaline etches became popular for some alloys of aluminum to aid cleaning. Alkaline etching of aluminum alloys is corrosive to the aluminum and does not have an effect on most of the alloying constituents. Pits can be easily induced, leaving traces of the alkali in the resulting pits. Acids attack the aluminum as well as attacking some of the alloying constituents. This is good if it is not overdone. Silicon-containing aluminum alloys are vulnerable to over-etching even in short time cycles because aluminum is etched around the silicon inclusion. There can be enough etching of the aluminum to leave small capillary holes around the silicon, entrapping acid in the voids. When the zincate solution is introduced the acid is neutralized, and then the alkaline nature of the zincate solution etches further around the silicon particle, increasing the size of the hole. The second zincate solution can etch a little more. By the time the item reaches the plating solution, there are enough voids, with foreign chemicals entrapped, to cause severe pitting of the plating solution.

Pits induced by the plating process

Plating processes that generate hydrogen can cause hydrogen pitting. This is often overcome by increasing the agitation around the surfaces being plated. There is a tendency to blame natural hydrogen evolution for pitting caused by other sources. The plating solution can be contaminated or out of balance chemically. Gas pitting is the usual result. In a sense, most pitting involves hydrogen evolution whether or not it is normal for the particular plating solution.

Overstabilization of electroless nickel plating solutions can also be a possible cause. *P&SF*

Reference

1. R. Duncan, "The Effect of the Substrate on Defects in Electroless Nickel Coatings." *Journal of Applied Surface Finishing,* **1** (2), 127 (2006).

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per million of fluoride, dentists recommend the use of a fluoride supplement, in tablets or liquid, from birth until the late teen-age years.[4]

When researchers in Ohio sampled more than 50 brands of bottled water for fluoride content, they found that 90% of them had levels below the recommended range for dental health.[5] In South Australia, a study found a 71% rise in tooth decay in children, attributed to the lack of enamel strengthening fluoride in the bottled water that has become so popular.[6] *P&SF*

References

1. U. Yermiyahu, *et al.*, "Rethinking Desalinated Water Quality and Agriculture," *Science*, **318** (5852), 920 (November 9, 2007).
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4. Marian Burros, "Eating Well; Bottled Water: Is It Too Pure?", nytimes.com, November 22, 1989; http://www.nytimes.com/1989/11/22/garden/eating-well-bottled-water-is-it-too-pure.html?sec=health.
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