COMPUTERS

CHECKING YOUR RESIN CAN BE CHILD'S PLAY

Top-level performance of any ion-exchange (IX) system requires that the resins be maintained in a clean state with the beads in good condition. Cracked or fouled beads will lead to poor performance.

One of the more useful techniques needed to monitor the condition of the beads is to inspect them through a microscope, which can become even more useful if it is also fitted with a camera. Taking photomicrographs whenever samples become available and placing them in the file enables you to produce chronological results that show how the condition of the beads has changed over time. If the picture is in an electronic form, it can be sent as an e-mail attachment to the manufacturer's technical representative to speed up the diagnosis of any problems over the telephone. A research-grade microscope with a camera may set you back several thousand dollars and never forget, when you're estimating the price, that it's a precise and delicate piece of equipment that requires a prominent and protected location in your field laboratory, assuming you have one.

How does the idea of a simple microscope-camera combination that costs under $100 sound? We found such a microscope for sale in a place you would never consider when looking for technical equipment. What was even more surprising was that it could do an acceptable job. It's called an Intel Play QX3 Computer Microscope and you may find it at your local toy (or electronic toy) shop.

When you think about it, most of us, who claim to be scientists and engineers, are children at heart. We just play with more expensive toys. This microscope is fairly rugged and that makes it ideal for plant usage. You have the choice of lighting from above or below and three scan ranges 10X, 60X, and 200X. That makes it ideal for looking at IX resins.

To get started, plug the microscope's transformer into a convenient electrical outlet and connect the USB cable between the QX3 and your computer. Insert the CD-ROM and, as with most of today's software, it will install itself. Everything that you need is included. All you need is a sample of IX resin or anything else you want to inspect. Fire up the software and you are ready to go. All the instructions are on screen and you can see your image on your monitor. There is a need to wait a few seconds for the camera to redraw and display the image as you focus or move things about. That delay is a bit of an irritant, but you quickly get used to it.

We started with a sample of nuclear-grade mixed-bed resin. This gave us a mixture of cation and anion beads with different sizes and colors. With the cation beads averaging 0.55 millimeters (mm) and the anion beads a bit smaller at 0.45 mm, the 60X magnification, (Figure 1) gave the best overall combination of size and resolution for viewing this sample. Internal faults were seen in a significant number of beads. These are a concern as the beads can fracture if subjected to a rapid pressure change or to repeated freezing-and-thawing cycles. The latter can be a real problem in Canada and other northerly climates. Colder weather conditions necessitate storing resins in heated warehouses and shipping them in heated trucks during the winter.

The consequences of broken beads are increased pressure drop during operation and high resin losses during the backwash phase of the regeneration cycle. To check if we could see the effects of freezing, we put some resin into a small container along with a few drops of water and placed it in a freezer for a few hours and then took it out and allowed it to warm to room temperature. Repeating this cycle half a dozen times produced a good collection of damaged beads (Figure 2).

Nobody is going to *play* with an instrument such as this and not try to see what else it can do or whatever else you can do to get a better image. As a start, we had to find a simple way to get all the resin beads into a single layer to enable the lens to keep them all in focus. We hit upon an interesting trick. We stuck them all to a piece of clear sticky tape and then photographed them with the light coming from below. Should you light IX resin from the top or from below? That one is probably going to end up as a personal choice. The overall appearance will be highly dependent upon the

By Marvin D. Silbert, Ph. D. and Jim Walling

ISSN:0747-8291. COPYRIGHT (C) Tall Oaks Publishing, Inc. Reproduction in whole, or in part, including by electronic means, without permission of publisher is prohibited. Those registered with the Copyright Clearance Center (CCC) may photocopy this article for a flat fee of $1.50 per copy.

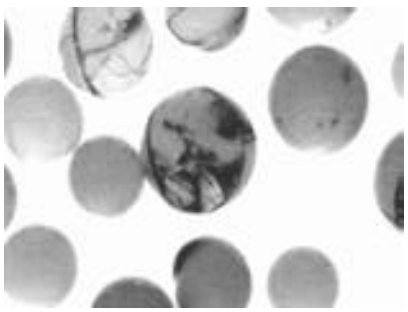

Figure 1. Mixed-bed resin samples viewed at 60X magnification.

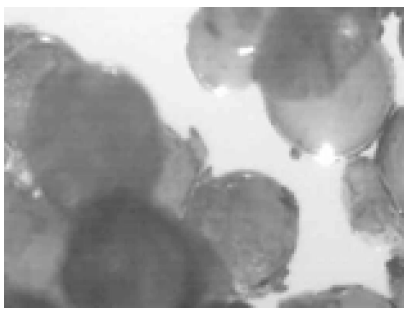

Figure 2. Mixed-bed resin samples showing broken beads after freezing viewed at 60X magnification.

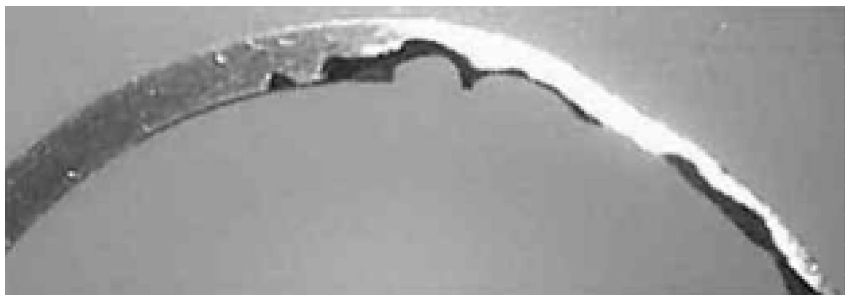

Figure 3. Section of copper pipe experiencing flow-accelerated corrosion, viewed at 10X.

nature of the resin and any surface fouling it might have. When lit from the top, clear beads seem to have a sparkle in them that can change a simple picture into an abstract work of art.

The relevance of this instrument to water-treatment applications is, of course, not restricted to looking at IX resin beads. It can also look at anything else that will fit under the lens and needs magnification within that 10X to 200X range. An obvious example might include examining the corrosion that has occurred in a tubing sample cut from a system. Figure 3 shows a cross section of a 1-inch copper pipe cut from the recirculating hot-water system in a condominium apartment building. The pipe was cut with a hacksaw and polished with emery paper. The 10X magnification gives an overview. Increasing the magnification to 60X gives details of the wall thinning and the scratch marks from the surface preparation with emery paper.

While the microscope package did come with its own graphics package, it was somewhat limited and it seemed a waste of time to look at it in any detail as the JPG file can be viewed and edited with essentially any graphics package to enhance or adjust the colors, brightness, or contrast. For this presentation, HiJaak software was used to convert the colored image to a grayscale and adjust the brightness and contrast for printing. The files for the color images averaged 30 to 40 kB and this was reduced to 10 to 20 kB when converted to grayscale. The images could be printed from any graphics program or imported into document files with most word processors.

One interesting characteristic of the images, whether they were in color or grayscale, is that they always seem to have so much more life to them when they were either viewed on-screen than when they were printed. A few of the examples shown in the figures were incorporated into a presentation and it was quite exciting to see huge resin beads projected on a large screen.

Can anyone seriously consider substituting a research-grade microscope with one that can be purchased in a toy store for $100? Of course not. That would be comparing *apples with oranges*. This instrument does not have either the resolution or the versatility.

The microscope also has a number deficiencies that might be classified more as irritants. You must either accept them or spend a lot more money. First, there is a short delay for the camera to redraw and display as you focus. Then you will find that there are no little knobs to *micro*-position the sample. You do that with your hands and it may take a lot of juggling until you get the exact place.

On the other hand, the QX3 did do what we tried to do and, on that basis, we feel that we can confidently recommended it to people who may need the odd photomicrograph of their resins or whatever and can live with the limitations. You have to decide for yourself whether you get the best return from the simplicity that you get from this *toy* or if you really need to own or have access to a research-grade instrument.

It you decide to go with the QX3, it can certainly do a reasonable job for certain applications. Its ruggedness makes it ideal for field applications. The worst that you might do is drop it and if you did, you would not bother to fix it. For that cost, it is simpler to just go out and buy a new one. When you need it, take it along with your notebook and set it up wherever you want to look at resins or whatever. When you're finished, bring it back; stash it in a drawer and forget about it until you next need it. If you are a technical sales representative, put it in your briefcase and take it with you on service calls. If the airlines lose it, you can always buy another at the other end.

Author Marvin Silbert, Ph.D. is a consultant with Marvin Silbert and Associates in Toronto, Ontario, Canada. He has more than 30 years of water treatment experience in boilers, cooling towers, and process waters in a number of industries.

Coauthor Jim Walling has been a nuclear operator at the McMaster Nuclear Research Reactor and at the Ontario Power Generation NPD and Pickering nuclear generating stations.

Key word: COMPUTERS, ION EXCHANGE