

The Internet As A Resource

As I travel the state, I am finding more utilities are connecting to the Internet as a source of information and problem solving. The information that is available can be of help to operators and managers. The Alliance of Indiana Rural Water's website at www.inh2o.org has links to websites that you may find beneficial. At one of these links, the National Rural Water Association's web site, www.nrwa.org, I found this article that I have chosen to pass along to you. This article is a brief overview of F/M ratios. I think operators may find this article informative.

Food To Microorganism Ratio (F/M RATIO)

The F/M compares the pounds per day of food coming into an activated sludge system with the pounds of bugs available to eat the food. The food is measured as pounds per day of Biochemical Oxygen Demand (BOD) or Chemical Oxygen Demand (COD) in the influent to the aeration tanks, (*which is usually primary effluent*). The bugs are considered to be the pounds of Volatile Suspended Solids (VSS) in the aeration tanks, (Note: The pounds of Volatile Suspended Solids are found using a muffle furnace and burning off the volatiles in the suspended solids.) Most people don't include the clarifiers in F/M calculations.

Conventional F/M BOD	0.1 to 0.5 mg/l
Extended Aeration BOD	0.02 to 0.1 mg/l
High Rate Range BOD	0.5 to 2.5 mg/l

For example a F/M ratio of 0.5 means that each pound of bugs receives one-half pound of food each day. That's a lot of cheeseburgers.

The F/M is inversely related to the MCRT. If you decrease the number of bugs by wasting more, the MCRT will get shorter and the F/M will get higher. A high F/M means a short MCRT and vice-versa.

Unlike MCRT, the F/M can change very quickly. If a food processing plant discharges a bunch of BOD all at once, your plant's F/M goes up immediately. At night when some industries are shut down and most people are asleep, the F/M gets lower. If your Return Activated Sludge (RAS) pumps quit and most of your bugs stack up in the clarifiers, the F/M in the aeration tanks gets very high, allowing BOD to escape in the effluent. If the clarifiers fill up to the weirs with activated sludge, the bugs will escape too.

You should not try to calculate the amount of sludge to waste based on the F/M. For one thing, it can change too much from hour to hour and day to day. It is my opinion that the best way to control the amount of solids in an activated sludge plant is by wasting to maintain a target MCRT.

Even though it is not used directly to control the solids inventory, the daily average F/M is still an important parameter to look at. If you see that it has been running excessively high, and then your MCRT target may be too low. Before raising the MCRT though, be sure you are not approaching nitrification (*if you are trying to avoid it*).

A high F/M may encourage filamentous organisms to predominate, leading to poor settleability in the clarifiers. Researchers have found that the higher the F/M is, the higher the Dissolved Oxygen (DO) in the mixed liquor must be to prevent filaments from taking over. If you have extra aeration capacity, it may be worth it to maintain a higher DOES rather than lowering the F/M. If you do lower the F.M, you will get a higher MCRT, which can lead, to nitrification and more oxygen consumption.

Most Activated sludge plants in Indiana are required to operate in the nitrification mode.

My email address is ttaylor@inh2o.org. If you have websites that pertain to Water and/or Wastewater and you think that other operators or managers may find them helpful, please email them to me. I will list them in my next article in the Hoosier Pipeline. Happy surfing.

Tony Taylor
Wastewater Technician
Alliance of Indiana Rural Water