Biological Amendments and the World of Anaerobic Digestion

In a world as vast and diverse as our earth, filled with wondrous and amazing creatures, would a single organism or element become the cure all for every problem?
This is a common issue facing anaerobic digestion facilities around the globe. Developers, engineers and designers all perceive the microbial portion of the digester as a similar parallel to the mechanical. If the mechanical component of the digester is functioning then shouldn't the microbial component also fall in line? So long as the environmental conditions are appropriate shouldn't it allow the right biology to populate or even evolve to do what we want?

Well let's tackle the question about biological evolution. While its true organisms adapt and modify over generations, it however would be foolhardy to expect these organisms to adapt to your specific needs in a very short relative time. As an example of this there is a sample of e-coli (among the most adaptive of all organisms) that has been contained and studied for decades. The changes? Well, it's bigger and it eats more. However, it eats the same things it ate before, it is simply evolved to eat more by growing itself. So how can we expect that in an uncontrolled environment that our biology would be any more special than those held under a controlled environment?
The correct term is adaptation, not evolution. Evolution implies a complete and extreme modification to suit the organisms' needs. Like shifting from a lung fish to a monkey, that is evolution. Adaptation is a simple modification to handle environmental needs such as the e-coli growing in size to consume more feed.
So with that cleared up and understanding that microbes do not evolve irrationally to

suit our needs, then we are left with the native biology of our surroundings.
This is where it gets more complicated. With our surroundings these bacteria and methanogens are those to whom the conditions and feed best suit their needs. So those organisms we may seek out to suit a digester of Dairy manure, but doing so in an environment that has historically been a dessert region will not deliver us the specific organisms that we may want to optimize our particular system. So with that we have to search and look for those specific organisms that may help optimize our digesters. Maybe 1 in 20 digesters currently have the correct biology for their digesters naturally in place, with over 30 I have tested thus far, not a single one has had the most optimal biology and the correct environmental conditions in place for these organisms. A disturbing fact for a system built to produce and generate wealth.

So why the skepticism against biologicals? Why that angst against something with such a proven record? Well historically people have a right to feel skeptical and to feel anxiety against something that they do not understand and cannot fully appreciate as they cannot fully see the product itself. There have been scores of products that are advertised as the one all solution for all digesters. There have been thousands of people who come in and say "I can make your digester double its production"...then they simply disappear.

These solutions are not snake Oil, they have to be based in sound science with sound and straight forward comparable testing performed to determine if a product will optimize your digester or not. So when a company such as Digester Doc or Aquafix comes in based on sound science and develops a range of biologicals that are set for a

variety of situations (not just a single biological for everyone treated the same) and another company like Digester Doc that tests these digesters to optimize productivity within a specific situation. So Digester Doc tests these multiple samples from Aquafix and others to determine the best product for the customer that will deliver guaranteed results in improving the digester and optimizing the production of that digester, through the biologicals of Aquafix and others.

Consider your Digester a Multimillion dollar Olympic quality athlete or top quality race horse that you have just invested in. What are the first things you do to protect your investment? Probably take out a life insurance policy and then to make sure that he is going to excel as your investment with having the best private physical therapist you can find, as well as the best private doctor and nutritionist...right? Of course, afterall what good is an investment if you do nothing with it and let it sit and just try to work on its own. Well this is exactly the mindset of so many in the industry...we bought it, now it's time for it to pay us back, granted they will make investments on its physical appearance with mechanical and engineering corrections like a Physical Therapist or trainer, but are they paying attention to what is going into their digester? Are they focusing on the environmental conditions of this investment? Are they truly looking at what is going on inside the investment to be sure he does not get sick on the big day? Our digesters are very much the same as this athlete or race horse. We invest millions of dollars hoping for the big payday return from this investment.

Digester Doc Optimization Testing

Digester Doc is a proactive anaerobic digester service consultancy laboratory. We use our equipment, knowledge and experience as well as our wide berth of products that companies, like Aquafix provide us with to determine the most appropriate solution for a specific digester.

First thing we do is to gain understanding of a companies feed stocks through testing and questionnaires. In the initial stage of testing we look for micronutrients that may be unbalanced, perhaps with too little or even too much of these essential micro and macro nutrients.

The old adage of too much can kill you, we'll it's very true with a digester especially. One will find these bacteria and methanogenic Archaea to be very picky about their environmental surroundings. Too much of anything can give your digester a very sore belly and upset your gas productions significantly. Likewise too little of one of these nutrients can also create a sour digester gas production.

The second test we look for is fatty acid structures. These fatty acids help us to understand where we are at with a digesters microbial consumption. These fatty acids are essentially carbon chains. The shorter the chain is, generally, the easier it is to convert it into methane utilizing an ancient microbial species called Methanogens, which are called Archaea. These Archaea, unlike bacteria have remained largely the same over thousands of years requiring the same hostile environment now that they required centuries ago. These Methanogenic populations are the key to a good digester. Once we see where the carbon chains (fatty acids) are in the digestate, we can determine better which types of bacterial populations are required to assist the break down of the organic matter remaining fatty acids to a more conforming level for the methanogens.

Armed with these two pieces of information we can then narrow down our testing to roughly 6 or 7 different groups of products from the roughly 20 that Digester Doc carries from reputable companies from around the world.

Aquafix provides Digester Doc with about half of the products we test with.

Before we begin digester simulations with a product, we test it in house against a variety of feed stocks to see if it meets our standards of consistency, gas quality enhancement (increased CH4 percentage in the big as as a whole) as well as increased biogas quantity.

Once we have identified the most likely 6 or 7 products we run simulations in our laboratory utilizing our 2 AMPTS II units, these units are designed to accurately simulate digester situations and ranging from mixing

speeds, temperature levels and even moisture or solids contents within the digester model.
We run these simulations on a batch or continuous stream, based on the customers desires and needs. These are done in triplicates (or more if the customer desires). We also modify the inoculated samples to optimal conditions for the bacteria and the Methanogens.
After a set period of time we are able to compare both production or quantity as well as quality using our handheld gas meter which we test CH4, H2, CO, CO2, and H2S if the client so desires.
Then we compare the final results to determine the best product. When doing this we look for a product that presents 100% successful results and as close to the same production levels from sample to sample, with minimal variations. We look for a product that delivers a minimum of 30% enhancement across the board compared to the standard product.

So often in the industry, people assume the bugs will adapt to suit their needs without realizing that we first have to meet those bacteria colony needs before they can adapt to what we are feeding them. We have to provide the right environmental conditions as well to keep them healthy and strong. However, not all bacteria are created equal. Some are just simply more proficient at breaking down organic strands then others. Breaking down this organic muck faster and more efficiently then it's competitors. Try as we might, bacteria are much like us, some strands and population groups are just better at certain functions then others. It's our job as scientists to find which conditions are best for which population groups and then to trial it.
Digester Doc has yet to find a digester system it has not been able to increase the productivity by using this methodology. In some cases we are seeing tripling production increases.

Digester Doc and it's colleague and top level supplier and ally Aquafix, are steadfast and always there looking for new ways to enhance the digester productivity and quality through these and other means. Together we are your microbial specialists, looking to optimize your production and your profitability.

Give us a call for a risk free assessment of your current digester to see where we might be able to help you reach your top potential.