Community BioRefineries
The Epitome of American Innovation

Our Bioreaction blog tells the stories of our journey from the simplest to the most complex discoveries made by the Community BioRefinery that will change the way the world looks at 'carbon neutral world' – and how the Community BioRefinery seeks to 'feed and fuel the world'. Our Bioreactions involve a process that leads to chemical transformations from food to fuel and everything in between.

A "bioreaction" (in biochemistry terms) includes five types of general chemical reactions. They include: Combination synthesis; Decomposition; Single displacement; Double displacement; and Combustion. (Don't worry; there won't be a quiz...)

Aquaculture-Hydroponics

"I now say that the world has the technology - either available or well advanced in the research pipeline - to feed on a sustainable basis a population of 10 billion people. The more pertinent question today is whether farmers and ranchers will be permitted to use this new technology? While the affluent nations can certainly afford to adopt ultra-low-risk positions, and pay more for food produced by the so-called "organic" methods, the one billion chronically undernourished people of the low income, food-deficit nations cannot." ~Dr. Norman Borlaug

In 1970, Norman E. Borlaug was awarded the Nobel Peace Prize for his lifetime of work to feed a hungry world. Dr. Borlaug has inspired the Community BioRefinery since its inception. With the advanced technology the CBR applies, we can now look at Aquaponics vs. Hydroponics vs. Aquaculture for the betterment of feeding a hungry world. CBR's Founder and Dr. Borlaug collaborated directly toward what would become the USDA's non-GMO Heart Healthy corn.

Both hydroponics and aquaponics have clear benefits over soil-based horticulture: lessened, unfavorable environmental impacts, reduced usage of resources, faster plant development, and even higher yields. Researchers around the world believe that that aquaponics is a better choice over hydroponics when selecting a soilless expanding system.

What is aquaponics-- and what is the difference between aquaponics, tank farming, and hydroponics? Let us begin with the essentials.

'*Ponics*' is a Greek word that describes: toil, labor, work hard, exhaustion; effort; additionally, suffering (those of us in aquaponics can relate to the last interpretation). *Aqua* is a light bluish-green shade, and hydro describe water.

The straightforward meaning of tank farming is a fish ranch whose primary goal is to raise fish for consumption. A lot more specifically, aquaculture is the farming of aquatic organisms such as fish, shellfish, and plants. The term aquaculture refers to the growing of marine and freshwater varieties and can vary from land-based to open-ocean manufacturing.

Hydroponics is the growing of plants in a nutrient remedy as opposed to soil. Some simply say, 'expanding plants without soil.' In other words, expanding plants is possible by adding plant-specific nutrients to a recirculating water supply. The theory of using aquaponics is the cooperative growing of plants and aquatic animals in a recirculating atmosphere. It resembles a hydroponics system except as opposed to including nutrients; you rely on the fish as nutrient-generators. That is, you feed the fish (this is the only input), the fish create waste, which waste is converted to nitrates (plant food) with a nitrification process (bacteria).

Given these definitions, we can consider the real words, hydroponics, and aquaponics. Aquaponics is the 'working of bluish-green water' or the nutrient-rich water produced via a procedure that imitates nature. Hydroponics would undoubtedly be the 'working of water,' which describes growing plants without dirt.

With the increased demand for food and the harvesting of fisheries worldwide, the need for safe fish products will continue to expand. Currently, the United States imports 84% of its seafood, and about half of those imports are from aquaculture (pond or farm-raised). The U.S. trade deficit in fish products exceeds $9 billion per year. With a decreasing supply of fish available from the ocean's fisheries, there is a growing demand for safe and naturally-grown, farm-produced fish in the U.S. There are excellent opportunities for anyone who can produce a reliable supply of fish products in domestic fisheries.

According to the Turner Tilapia Engineering Study and other aquaculture studies, the single largest cost in producing fish in indoor aquaculture operations <u>is the cost of the fish ration</u>. This cost usually accounts for over 50% of the total cost to produce farm-raised fish. The largest cost in fish rations is the cost of quality protein. Today, hundreds of millions of pounds of 'trash' fish meal are imported and dumped into the U.S. annually from China, Malaysia, and India. This type of fish meal usually consists of ground-up offal (guts and leftover remains of fish after filleting).

Aquaculture studies sponsored Illinois State University/USDA tilapia feeding trials confirmed that the amino acid balance in feed rations has the greatest influence on feed to weight gain ratios. These ratios determine the amount of feed required to grow fish effectively. With this ratio, the cost per pound of fish grown can be determined.

To maximize the use of our feedstocks in our CBRs, CBR Collaborators sponsored feeding trials using leftover proteins not recovered during our food protein processes. By blending these remaining proteins, the amino acid balance becomes very high and effective with an approximate 2.8 Protein Efficiency Ratio (PER).

According to the Illinois State feeding trials, ration demands on tilapia grown with the CBR leftover proteins were reduced by almost half. Since these were waste proteins, the cost of producing fish rations using these proteins was estimated to be as low as $0.10 per pound or less. Typical feed ration usually costs 3-4 times as much, so this will substantially lower our cost to produce high-quality, organic, safe aquaculture species such as tilapia, catfish, shrimp, bass, and salmon.

The second-largest expense in growing indoor aquaculture is typically thermal energy required to warm the water. Warm water leftover from upstream CBR handling is an exceptional medium for tank farming culture as well as the succeeding production of hydroponics using leftover fish manure as all-natural fertilizer, once more creating safe and healthy vegetables for the regional community year-round. (Note: the most considerable price of generating hydroponic plants is generally the fertilizers.) Finally, CBRs will certainly generate substantial quantities of hydrogen, which can be used to supply any added energy required to warm the water for year-round aquaculture operations.