The Natural Mud-Filter Method

by Mike Paletta (Tropical Fish Hobbyist, April 2001)

Over the years numerous individuals have come to be associated with the development of various reef technologies. Examples of this include Lee Chin Eng with the 'Natural System," George Smit with the 'Dutch Mini-Reef," Dietrich Stuber with the "Berlin System," Dr. Jean Jaubert with the 'Jaubert System,' and Dr. Walter Adey with the 'Algal Turf Scrubber System.' After using a new methodology for the past 3'/2 years and viewing numerous other tanks using this method I am confident that an alternative method for maintaining marine tanks has emerged. This methodology successfully utilizes and hybridizes techniques from the above systems in a completely unique manner that I had never seen before. Leng Sy developed this method, best described as the natural mud-filter method.

I must admit to being skeptical when I first heard this system described. I have seen over 500 reef tanks set up with just about every method ever known, from systems using undergravel filters to beautiful Berlin displays. Therefore, my original opinion before seeing the mud-filtered tanks was that they were simply using a slightly modified Jaubert or algal turf scrubber system. I was still skeptical when I first viewed this system and did not initially see the method of filtration, which was hidden in the cabinet underneath the tank.

When first viewing mud-filtered tanks my initial reaction was that these tanks were simply meticulously maintained Berlin tanks. Bright lights over absolutely crystal-clear water revealed a lot of really healthy growing corals in each tank. On closer inspection one factor stood out more than any other: the polyp extension of the corals was absolutely phenomenal. Leather corals had polyps that were extended well over 2 inches and were fully open, and the branches of a Sinularia looked like a cat's paw, its polyps were so furry. But the clincher for me was a colony of Stylophora pistillate from which I had a fragment from the same original colony. In my tank the colony's polyps were extended a couple of millimeters, giving it a fuzzy appearance like sandpaper. In the mud-filtered tank the polyp extension was so great I could not tell that this was the same coral that was present in my tank. The polyp extension in this Stylophora was the greatest polyp extension that I had ever seen in a Stylophora. This same maximal polyp extension similarly occurred on virtually every colony of small-polyped stony (SPS) corals in the tank as well as every soft coral in a nearby tank that was run in the same manner but on a separate system. What this indicated to me, along with the amount of encrusting the corals were doing on the rocks, was that these corals were extremely healthy in these tanks.

Once I was convinced that there was indeed something different about these tanks and this system I sat down with Leng for eight hours and discussed virtually every aspect of the method. Leng considers himself a lazy aquarist, but he has been perfecting this system for over the last nine years. As I discuss the details of this system, it will become apparent that some of the techniques have been utilized in the past. However, Leng has made many modifications to these techniques that make his method unique. Leng's overall goal was to allow his corals to thrive, while at the same time making the system as uncomplicated and easy to maintain as possible. Very little gadgetry is involved, so there is little need for adjustments of any kind, nor can many things fail. In addition, with this system very little maintenance is needed, so the system requires very little time to set up or operate.

The natural mud filtration method starts off in the same manner, as do most other systems; water is drawn off the top of the tank via an overflow box from where it flows into the sump. The tank water flows into a narrow first chamber, which holds bioballs. These balls are submerged, not dry, and they act primarily to break up any large pieces of detritus as well as to dissipate any large air bubbles that occur from the water splashing down; they also help oxygenate the water. The water then flows through two outlet slots near the bottom of a partition and into the main filtration chamber.

This central chamber is where virtually all of the filtration actually occurs and it contains two separate components that work synergistically with each other. In the bottom of this chamber and running from front to back are several 2-inch- high partitions. Resting within these partitions is a special "mud" substrate. This 'mud" is the crucial component of this system. Leng has also informed me that when setting up a system this mud is initially unpopulated by digging organisms. Upon my viewing it after several years of use this was no longer the case: the 'mud" was now full of worms, copepods, nematodes, etc. that populated it from the live rock.

Leng said that over the years he had tried numerous types of "mud," but that the formulation that he was now using seemed to be the crucial element in the system. Sitting above the mud in this chamber is a large bed of Caulerpa. Initially Leng and I both used Caulerpa taxifolia, but we have now used a variety of species and have not seen any differences in the outcome.

This system uses algae in a somewhat different manner from algal turf scrubbers. First, this algal bed in the sump is illuminated 24 hours per day by four fluorescent tubes. That is, the lights never go off above the sump. This has resulted in some interesting results. First, the wild pH fluctuations that I have seen on other systems do not occur in this system. The pH only fluctuates .2 during the course of the day. Also the oxygen levels within the tank do not drop at night, as the caulerpa does not become an oxygen consumer. Also, after several years of growth in each system, the caulerpa in the filters has never crashed and gone into sexual reproduction. As a result none of it has found its way into his main tank, which has been a problem in some other algae filtration systems. Even more interesting than this, however, is the clarity of the water. In many reef tanks that I've seen that contained even small amounts of algae, over time the water would become yellow. However in these tanks the water was crystal clear. This may be a result of the 24-hour light cycle, because not having a dark cycle may prevent the production of gelvin (yellowing compounds), which are thought to be a product of algae's chloroplasts breaking down at night and being released into the water.

To continue on to how the system works, once the water passes through the caulerpa and over the mud, it flows over a partition and through slots near the bottom of a second partition and into a chamber containing bioballs, where it is pumped into the main tank. These last bioballs act to prohibit any caulerpa from being drawn into the pump that feeds into the main tank. The amount of water flowing through the filter should be at least three times the tank's volume per hour, with five times per hour being the optimum.

This all may not sound like anything revolutionary, but upon seeing mud-filtered tanks and the corals and fish, and after having used the system myself for three years, I do indeed feel that another methodology for successful reef husbandry has evolved. I feel that this is the case because not only were the corals thriving, but the fish were as well. In this system the fish's colors have remained as vibrant as the day they were collected, even though many of the tank's inhabitants have now been in the system for six years or longer. In addition, this system has shown to be able to reduce and even eliminate ongoing lateral line disease and restore the coloration in fish that have faded over time. Also, some fish that have proved very difficult to keep in other systems have thrived in this system. Angelfish, butterflies, anthias, fairy wrasses, clown tangs, and even Moorish idols have done well in this system.

Besides the overall health of the system's inhabitants there are some other advantages to this system as well. In terms of maintenance this tank requires less than just about any other system that I have seen. Leng maintains these tanks without substrate in order to easily remove the detritus that settles out during the week. Once a week he siphons out ten gallons of water to remove as much detritus that has accumulated as possible. To further reduce the detritus build-up, the current in these tanks is quite high. In the 400-gallon SPS tank there are powerheads and circulation pumps producing over 4000 gallons per hour of circulation that keep detritus in suspension so that it can find its way to the filter. This strong water movement no doubt also helps to explain why the corals are growing so exuberantly. In the 120-gallon soft coral tank the water is circulating at approximately 1500 gallons per hour. I have recently added a thin layer of substrate to my tank with appropriate sand-sifting organisms and have to date seen no deleterious effects.

Other than, removing detritus weekly, the only other maintenance that is performed on this system is the addition of calcium in the form of calcium hydroxide and buffer. These are done to maintain calcium over 400 ppm and alkalinity over 2.5mEq. Other than that, this system virtually runs itself. To date neither iodine or strontium has been added to these systems and this has not produced any deleterious effects on the corals. Having the caulerpa combined with the mud has also produced a system where virtually no microalgae-inducing nutrients are present. Over a daily two-month testing period, ammonia, nitrite, and nitrate remained at 0 ppm, while phosphate initially showed only a trace at .1 ppm and fell to zero once the caulerpa had fully filled the tank. These numbers are despite the tanks' having a large fish and invertebrate load and being well fed.

The results of this system to date appear much better than those I have seen with other natural systems when used on a closed system and with less maintenance. As mentioned above, the 'mud', which Leng has developed, seems to have some very unique properties. It may help in preventing the algae from crashing. It may work to remove the organics released by the algae before they reach the main tank. It also probably slowly leaches iron and iodine as well as other trace elements gradually into the water. This is also probably more beneficial than the typical bolus dosing of these elements, which most hobbyists do. Whatever its effect this system would not work without the presence of the "mud."

Because no skimmer or other form of chemical filtration is present, this system may also allow for iodine to be recirculated by the microalgae and hence none needs to be added. This might explain why even though no iodine is being added the Xenia colonies are thriving and have never shown any evidence of the meltdown that has been observed in numerous tanks over the years. This lack of protein skimming may also allow for plankton to develop within the tank, which may help to feed the corals.

Please note that I am not advocating that everyone immediately take off your protein skimmers and switch to this method of filtration. I am simply reporting on what my experience has been over the past three years and why this may be a viable alternative to the many methods we are now using. So for those of you who wish to try an alternative method for maintaining a saltwater system or for those of you who are unhappy with your current system, the mud-filter method may be an alternative method to try."