

# Sustainable water treatment & biodiversity and its implications for public health & global warming



Dryden Aqua are marine biologists specialising in marine and freshwater chemistry, as well as the design of water treatment systems. The systems include drinking water, sewage & industrial effluent and marine aquaculture life support systems. We are possibly the only marine biological company in the world specialising in water treatment, so we have the tools required to relate water treatment to the wider aspects of environmental pollution, and the impact that certain types of pollution have on marine biodiversity and public health. A possible link between aquatic environmental pollution and Global Warming is presented along with a potential solution to the problem.

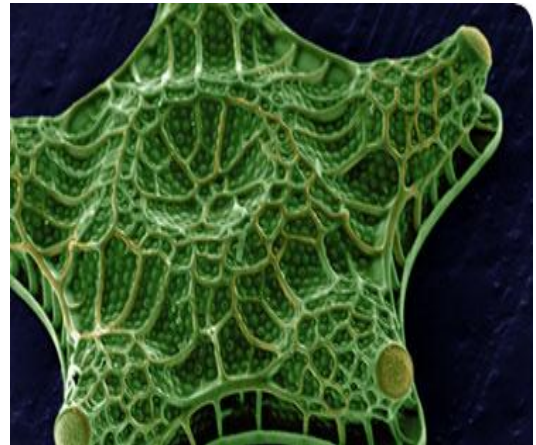


Figure 1 Marine diatom algae are the power house for the planet

Sewage and industrial effluent contains a low concentration of chemicals such as PCB's (polychlorinated biphenols) and TBT (tributyltin), indeed the concentration may be below detection level. However the chemicals will be concentrated by many times in the marine environment through a process known as chain amplification. Wastewater should not contain the chemicals, but it is difficult to avoid because they tend to become concentrated in bacteria and are discharged as suspended solids in sewage effluent. Over the last 60 years there has been a huge increase in the amount and type of chemicals manufactured by industry and used in the home. These chemicals will all end up in sewage effluent, the most dangerous of which are the persistent bio-accumulated List 1 chemicals. We need to set tight discharge consents for solids in wastewater to avoid the discharge of list 1 chemicals. However many wastewater systems in the UK are not even in compliance with the Royal Commission effluent standards of 1898 and very few treatment systems are equipped with the necessary filtration systems to deal with suspended solids.

Marine bacteria and phytoplankton (algae) concentrate list 1 chemicals and recycle them back into the human food chain. By way of example, Minamata disease in Japan was caused by mercury which was turned into methyl mercury by bacteria and then absorbed by shellfish which ended up back in the human food chain. A similar situation exists in the Pacific Ocean with mercury bio-accumulated in tuna. The concentration of list 1 chemicals (PCB's) have increased in the North Sea to the point where it may not be safe to consume more than one oily fish per week, indeed there can be no safe level for persistent bio-accumulated toxic chemicals, because nature has not evolved a mechanism to cope with the chemicals. List 1 chemicals are also implicated in causing many forms of cancer. We may be getting better at treating cancer, but the number of cases is increasing exponentially so now 1 in 3 of us will succumb from the disease.



Figure 2 Typical Sewage effluent on the left and AFM filter media treated effluent on the right.

Marine phytoplankton such as diatoms are responsible for 90% of the world's oxygen production and green house gas fixation, any change to marine biodiversity and phytoplankton productivity will have consequences. We have already seen a 0.1 pH drop in the world's oceans. Most governments and research laboratories around the world relate acidification directly to increased dissolution of carbon dioxide into the sea because of the higher concentration in the atmosphere. This will happen but we believe a more plausible explanation for the acidification pattern is a reduction of carbon dioxide fixation by phytoplankton as a consequence of list 1 chemical toxicity. There has certainly been a huge increase in carbon dioxide emissions from the burning of fossil fuels, but we would have expected phytoplankton productivity and carbon dioxide fixation to increase and reach equilibrium with the carbon dioxide emissions, especially with all the extra nutrients being pumped into the sea, but this has not happened. Perhaps the increase in carbon dioxide green house gases is actually a consequence of oceanic pollution preventing phytoplankton removing carbon dioxide from the atmosphere. This explanation is definitely correct, but it has not been quantified.



The organic matter discharged by sewage works will have an impact on the environment but nature can usually adapt to natural wastes, it is the unnatural list 1 chemicals that are the problem. The chemicals will slow down or prevent phytoplankton growth, oxygen production and carbon dioxide fixation. The tropical rain forests are a very important ecosystem, but in terms of carbon dioxide fixation they are to some degree irrelevant because they are in a state of equilibrium with the growth of trees and fixation of carbon dioxide balanced off against decomposition of the trees and release of carbon dioxide. Marsh-land, swamps and peat bogs are actually much more important than tropical rain forests from a carbon fixation perspective because the dead plant matter is not subjected to decomposition and release of carbon dioxide. Fixation of carbon dioxide by terrestrial plants only accounts for a small percentage (approx 10%) of the total. The sea is the main driving force controlling the atmosphere and is responsible for most of our oxygen production and carbon dioxide fixation.



Figure 3 we are marine biologists specialising in sustainable water treatment and recycling.

It is remarkable that 99% of all sewage effluent treatment systems do not have tertiary treatment to remove list 1 chemicals. Even if list 1 chemicals are not a major contributor to Global Warming, they are absolutely implicated in causing disease and cancer. Aquatic environmental pollution of rivers, lakes and the marine environment have far reaching consequences that we do not fully understand, but by the time it has been quantified and analysed it may be too late to take remedial action.

The technology for the tertiary treatment of sewage effluent and removal of list 1 chemicals has been developed and is available from many companies. Dryden Aqua received research & development funding from the European Commission to develop a simple low cost tertiary system using recycled glass AFM activated filter media for this purpose. The technology is therefore available and can be retrofitted to most treatment systems.

We have at our disposal the technology that could be a relatively quick fix, low cost solution, or at least partial solution to support marine biodiversity and help prevent global warming; it just needs to be implemented.

.....

**Notes.**

**AFM (Active Filter Media) is manufactured by Dryden Aqua from reprocessed glass as our raw material, the glass surface structure is then altered to increase the zeta potential and catalytic properties. The research was funded by the European Commission under the Life Environment initiative. For more information about afm please go to [www.DrydenAqua.com](http://www.DrydenAqua.com) or [www.AFM.eu](http://www.AFM.eu)**

