ENVIRONMENTAL
REMEDIATION THROUGH
MOLECULAR KINETICS

THE WASTEWATER SOLUTION FOR FATS, OILS, AND GREASE

INTRODUCTION

Fat, Oils, Grease are major problems for wastewater treatment, sewerage catchments, food service establishments (FSEs), and public municipalities, leading to blockages and flooding, which can cost millions of dollars to rectify. The lack of successful biological solutions for FOG-burdened industries has been disappointing to say the least. Why introduce new colonies of bacteria when the indigenous population is already well adapted for the local environment? New bacteria colonies often die off, so why introduce them when instead, you can stimulate the indigenous bacteria to produce natural enzymes inside the system.

INTRODUCING NEXT-FOGSTOP

Adding Next-FOGStop, an FGX3 dilution, to the sewer prevents the build up of FOG all the way to the sewage pumping station and sewage treatment works. Next-FOGStop's Molecular Kinetics technology works with the indigenous bacteria, and is proven to be a much more effective solution. Next-FOGStop, a metabolite-like solution, behaves as an uncoupler in bacteria's internal phosphorylation process, enabling a proton leak during ATP production. The indigenous bacteria must compensate for the ATP deficit with an increase in nutrient uptake, which increases FOG breakdown without stagnation as the indigenous bacterial population is utilized. The formula is less costly and more sustainable in the long run when compared to expensive bacteria enzyme treatments that may have only short term local effects, but not long term benefits.... particularly downstream.

HOW IT WORKS

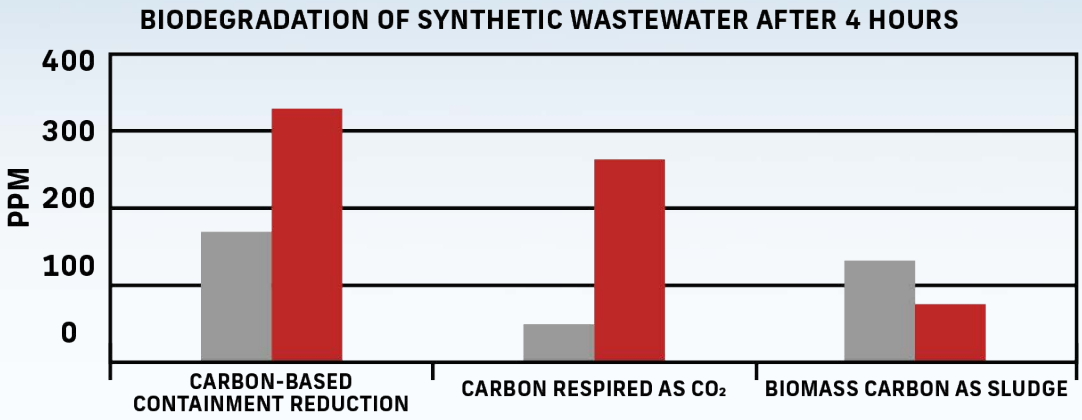
FOGStop combines biologically active proteins, produced by a hybrid fermentation process, micronutrients, enzymatic cofactors and surface-active agents in a proprietary formulation. The mode of action for the formulation does not require a direct chemical reaction between the active ingredients of the formulation and the organic contaminants, rather the synergism of the individual components leads to a product effectively promoting the biostimulation (bioactivation) of indigenous micro-organisms. Research data suggest that the 'stimulatory' effect is partly caused by a process similar in nature to the 'uncoupling' of the microbial metabolic pathways. Laboratory experiments demonstrated that the formulation not only amplifies the metabolic rate of organic carbon degradation, as indicated by the accelerated reduction of total organic carbon (TOC) and increased oxygen uptake rate (OUR), but also lowers the amount of biomass. This technology is know as Molecular Kinetics.

The carbon mass balance shown in Figure 1, demonstrates how this accelerates the metabolism of organic carbon without a concomitant increase in biomass production compared to the control. The excess carbon metabolized with the treated sample was off-gassed in the form of CO_2 rather than being converted to biomass or biofilm. These observations were confirmed in field trials, where feeding the formulation into the inlet stream of municipal and industrial wastewater facilities led to a decrease of biological oxygen demand (BOD) and total suspended solids (TSS), and an increase of dissolved oxygen (D.O.).

Nutrient metabolism without a concomitant increase of biomass can be achieved by uncoupling biochemical degradation (catabolism) from biochemical synthesis (anabolism). Uncoupling can occur during the oxidative phosphorylation resulting in lower adenosine triphosphate (ATP) formation, or by dissipating generated ATP through 'energy spilling' (Russel and Cook, 1995). Low and Chase (1998) demonstrated the use of chemical uncouplers for reducing biomass production during biodegradation by adding various levels of para-Nitrophenol (pNP) to a monoculture of Pseudomonas putida. These studies demonstrated:

1. The addition of the organic protonphore pNP reduced biomass production and increased the specific substrate uptake rate.
2. When there was reduced energy availability as a result of uncoupling by pNP, cells satisfied their maintenance energy requirements (membrane potential, motility, etc.) prior to providing energy for growth (protein, DNA synthesis etc.).

CARBON MASS BALANCE COMPARISON STUDY: NEXT-FOGSTOP VS CONTROL



CONTROL Next-F.O.G.Stop™

	UNTREATED	Next-F.O.G.Stop	% DIFFERENCE
CARBON-BASED CONTAINMENT REDUCTION	175.3	328.6	↑ 87.5
CARBON RESPIRED AS CO_2	49.5	263.8	↑ 432.9
BIOMASS CARBON AS SLUDGE	142.8	76.8	↓ -46.2

TOTAL PLATE COUNTS - 4 HOURS	6.9×10^7	6.0×10^6

Figure 1: Carbon mass balance study showing the formulations ability to metabolize twice as much carbon as the control, while producing 50% less biomass from the assimilated carbon. These results are further corroborated by an almost 10-fold lower amount of bacterial colony forming units during the total plate count. In addition, the process caused an approximately 5-fold increase in the formation of carbon dioxide.

High costs associated with the use of synthetic uncouplers for wastewater treatment have been at least partly responsible for why this approach has not found widespread application. Decreasing the ATP available for biosynthesis, reduces the growth rate of bacteria and therefore the amount of biomass or sludge. If microorganisms exhibit a similar behavior to mitochondria in their metabolic regulation, a reduction of cellular ATP would provide a stimulus to the feedback control loop, promoting further catabolism of organic material in order to compensate the 'ATP-starvation'. If use of the formula is discontinued, the bacteria revert to their normal respiration/metabolic rate. Molecular Kinetics affects the rate at which the biomass utilizes oxygen.

As a rule of thumb, 6 kilograms of BOD will require 10 kilograms of oxygen. The use of this formula does not change that fact. However, laboratory and field data demonstrate that it does improve the oxygen uptake/oxygen utilisation rates of the biomass. This might be in part due to an improved oxygen transfer rate, caused by the formulations reduction of the critical micelle concentration (CMC). A more efficient use of the available oxygen and a reduction of oxygen adsorbing soluble and non-soluble carbon, will lead to increased D.O. levels and inevitably to a decreased aeration power consumption. The degree to which the MK formulation facilitates the metabolism of the carbon source is not dependent on the type of carbon source (e.g. carbohydrates, proteins, fats, etc.), but rather the availability of the carbon source. Therefore, if the carbon source is readily available to the bacteria and all other environmental conditions, i.e. temperature, pH, electron acceptor are conducive to microbial metabolism, the formulation will greatly accelerate the degradation of contaminants such as grease and oil, over what would be seen in its absence. Formed byproducts are those that would be naturally produced by indigenous bacteria, with or without the introduction of the formulation, that is; biomass, CO_2, water, and inorganic salts.

High costs associated with the use of synthetic uncouplers for wastewater treatment have been at least partly responsible for why this approach has not found widespread application. The product functions well in aerobic municipal and industrial wastewater treatment systems, as well as in wet wells and gravity sewer lines where there is oxygen available in the head space and turbulence to facilitate oxygen transfer. The formulation is non-toxic and completely biodegradable. It has been cleared by the USDA for the usage in food processing facilities.

Next-FOGStop's Molecular Kinetics technology is successfully deployed across North America, Brazil and UAE. Recently successfully evaluated by an innovative UK water company, and successfully deployed by a Global fast food restaurant chain's UK outlets, and on British Military bases. It is time to rethink your treatment solutions.

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