Removal Of F.O.G. (Fats, Oils, And Grease) Deposits

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Abstract: A current review of the latest Green Technology to address F.O.G. removal and the various devices applied to this problem by DO_2E Wastewater Removal Systems is presented. The nature of F.O.G. deposits, both physical and chemical, are examined in some detail. Emphasis is placed on cost-control, lowered power profiles, reduced maintenance, employee safety and efficacy.

FOG deposits are the bane of the wastewater industry affecting both the collection and treatment functions. Over the years, there have been many attempts to “get a handle” on this problem, and there have been many different ways proposed in these efforts. Let us examine one of the latest that is proving to be successful.

To begin with, we should understand both the chemical and physical identity of what actually comprises FOG deposits. They are an unholy “gemisch” of various lipids of widely different chemical and physical behaviors. They vary from oils (which are in liquid form), to greases (which may be solid or semi-solid depending on their chemical identities), to fats (which are usually solids, though they too may exhibit liquid or semi-solid form) as well as waxes (which are almost always solids). They also can contain compounds that are lipid-soluble such as steroids, various pharmaceutical agents, and even organic solvents.

Currently, the most successful removal method involves the breaking down of these FOG deposits into microparticulates. These engendered microparticulates may be emulsoids (usually oils in a liquid suspension) or they may be solids which exhibit very small sizes. As a consequence of these small sizes, the surface area is increased dramatically; and, chemical reactions which are slow to non-existent with larger particles can be of great importance in the degradation of these really small particles. This is particularly evident in the microbiological degradation of these FOG compounds.

We all know that increased surface area, *per se*, virtually always results in increased reactivity. What we tend to dismiss is that the actual physical configuration of these compounds in the particulate characteristics also attribute mightily to the chemical activity. For example, it is well-known that saturated fats are much harder to degrade microbially than unsaturated or polyunsaturated fats. Now why this is the case resides in both the chemical sites of attack by different microbial enzymes involved in this as well as how these enzymes are able to operate on these differing sites.

It is analogous to comparing the surface of a lamellar structure (such as graphite or a composite material) to a piece of steel wool. The graphite surface present few active sites for an enzyme to attach to; whereas, a tortuous surface such as steel wool provides many such attachment sites for an enzyme to take advantage of. In a similar (or analogous) manner, saturated fats present a very limited opportunity for enzymatic degradation as opposed to that found in both unsaturated and polyunsaturated fats.

The DO_2E Digesters are designed to modify the substrate (in this case, the FOG deposits) by converting them into microparticulate surfaces in which the microbial enzymes find ready access to these hard-to-breakdown compounds or molecules. At the same time, these Digester devices are providing extreme turbulence (to facilitate collisions and subsequent attachment) for the benefit of these degrading microorganisms to “work their magic” and feeding them a most digestible diet of nutrient-rich particulates delivered in an oxygen-rich environment. Although it is well to remain mindful of general principles, in the real world of waste treatment, success or failure depends on how well the system is engineered to deliver these considerations in a practical manner.

In their design by DO_2E technical personnel criteria were carefully taken into account to ensure that the final design was practical in every sense to address the everyday problems encountered in the removal of FOG deposits. The actual sites of deployment of these devices were to be grease traps and lift stations, but other sites might be used from time-to-time – especially wastewater treatment facilities. To these ends, designers determined that the most important criteria to address were sizing with respect to air/wastewater movement and aeration; operational costs with respect to maintenance, parts replacement, and accessibility; and, operator safety with respect to change-out, cleaning, and electrical issues.

This particular technology (and the devices incorporating these principles) are unique from several perspectives. There are no moving parts; they are all essentially modified air-lift devices; they are constructed of high-grade non-corrosive material; and, the electrical systems employed as well as the blower systems are removed from the "business end" of the devices. All of these factors make them the safest devices for FOG removal on the market.

They operate from a remote blower that provides high-volume, low-pressure air through a central manifold containing a multitude of air outlet orifices of specific sizing that enables a maximum air-lift effect and an air exchange aeration (oxygenation) effect as well. This Venturi formed draws wastewater and its fluid column through inlet orifices, which are quite large. As the fluid is accelerated up this pathway, entrained solids are impacted at high velocity against fixed concentric edges and blades at the top of the device and thereby broken down into much smaller fragments. This mixture is repeatedly recirculated as the fragmentation results in ever smaller particles being realized.

These particulates are so small and fissured that they provide a ready carbon source to the many microorganisms within the wastestream and sludge. This is why these devices are so efficacious in destroying FOG deposits and preventing their reformation.

Data have been collected showing that these FOG deposits do not reform, even in force mains that are miles long. Simple experiments can readily affirm this, but municipalities must rely on actual results from the field for their decision makers in this regard. A primary design object has been to make these devices as efficient as possible, and to that end the designers have provided a three-phase power capability with the larger units as well as providing specific units for differing voltages (115V, 240V, 480V, 600V) as well as differing frequencies (50 Hz or 60 Hz) so that these units may be used in different electrical systems world-wide. Other specialized requirements may also be fabricated as necessary for a particular application.

The actual impact on most wastewater collection and treatment systems is that the use of these Digesters expands the functions of the collection system as a pre-treatment component of the entire wastewater treatment system. This occurs as a result of lowering the BOD/COD challenge to the waste treatment facility as well as by changing the operational influent flow to assist in the elimination of blankets and rafts of paper products that are a major problem of FOG build-ups. This, in fact, reduces the loading on influent screening requirements and subsequent build-ups on any of the aeration diffusers employed in the waste treatment plant.

The technology provided by the DO_2E Digesters enables both the operational personnel as well as the design engineers to practically eliminate the impact of FOG deposits and their reformation on operations at a minimal cost.

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