A Scientific Solution to the Problem of FOG

PROTEIN MATRIX CONVERTS KITCHEN GREASE AT MOLECULAR LEVEL TO ELIMINATE BLOCKAGES AND RELATED ISSUES

Story by Mike Flenniken

Over the years, numerous solutions have been offered to solve the problem of fats, oils, and grease (FOG) clogging sink traps, interceptor wells, and underground pipes in residential and commercial buildings.

These blockages can lead to overflows, sewer backups, fires, unpleasant odors, and increased maintenance costs, as the substances harden and become difficult to remove.

Protein Matrix believes it has the solution, in the form of a crop-based degreaser that converts the FOG into a benign, flowable fatty acid that never reverts to FOG because it has been converted at a molecular level.

Scientist Peter Rehage initially invented Protein Matrix for a purpose other than FOG removal, Protein Matrix, LLC Manager Oscar Plotkin said, but Rehage realized it was capable of converting FOG to a nontoxic compound that would easily flow through pipes.

"What we have discovered is that we are able to convert the grease at its source and keep the interceptors, grease traps, and any other place where grease exists free of grease," Plotkin said, "and when our material flows through the pipeline transport system, it cleans the pipes and reduces the amount of grease."

To see how the product would perform in real-world scenarios, Protein Matrix turned to Albert Robbat Jr., a chemistry professor at Tufts University in Medford, Mass. Robbat, along with Anthony Sillari, chief plumbing and gas inspector for the city of Somerville, Mass., oversaw the pilot project that tested Protein Matrix's effectiveness in the cafeteria at Tufts University. Robbat also tested the degreaser at a large fast-food chain restaurant. Robbat said wastewater treatment systems, whether municipal or private, require commercial kitchens to pump out their traps every three months so the FOG doesn't get into the transport system and create blockages in pipes.

"When we started both projects, the big interceptor trap (at the restaurant) and the Tufts cafeteria sink traps, we started just before they were scheduled for pumping so they were in the worst condition," Robbat said, recalling that the layer of fat, or "fat mat" at Tufts was 4 to 5 inches thick and the fat mat at the fast-food restaurant was 3 to 5 feet thick.

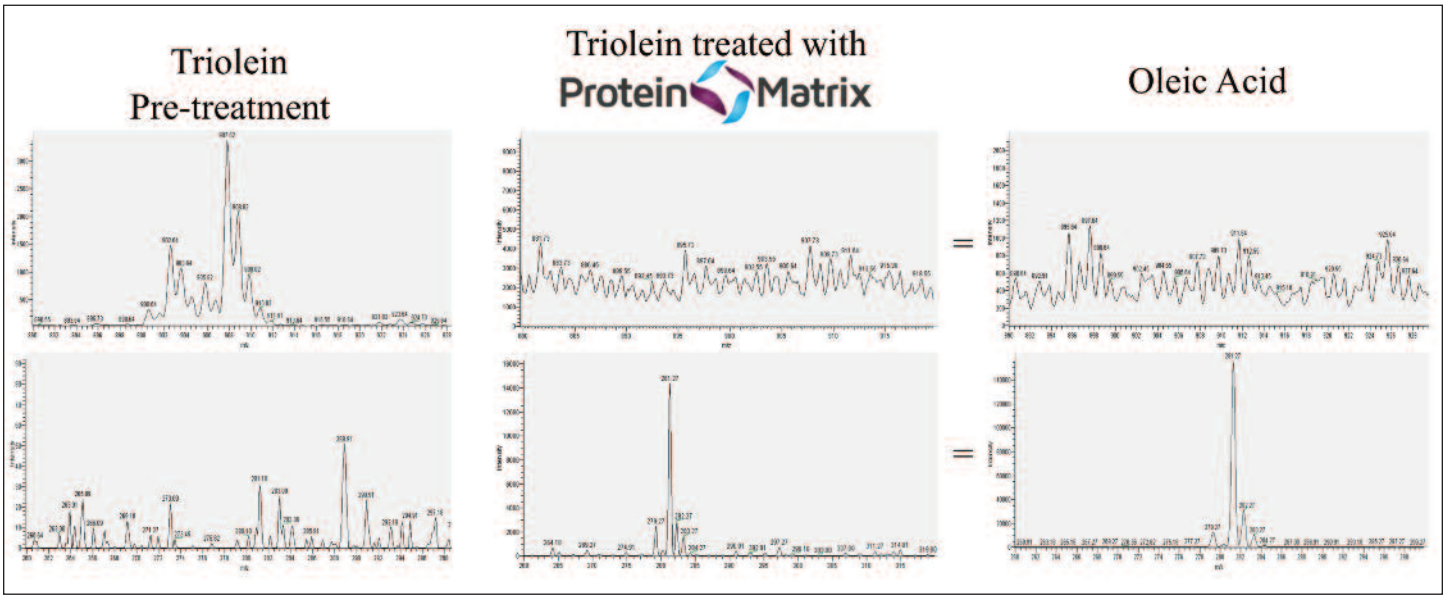
Robbat said he was amazed at how Protein Matrix cleaned the pipes, a distance of seven feet from the sink trap downstream. Pictures taken before the three-month treatment show bulges of fat that had accumulated over time, narrowing the pipe's diameter. In pictures taken after the treatment, not only has the bulge gotten smaller, but the pipe's curvature can clearly be seen.

"These findings show the degreaser opened the diameter of the pipe to its original dimension," Robbat said.

What cleaned out the pipe, he explained, was the unused Protein Matrix that was introduced into the trap on a daily basis.

Opposite page: French fry grease.

PHOTO FROM iSTOCKPHOTO



Above: A fat conversion table shows the decrease in triolein levels as it is being converted to oleic acid.

Left column: Examples of how FOG creates problems for homeowners, restaurants, schools, and hospitals.

Right column: The many costs of dealing with FOG. It requires time-consuming and costly cleanouts; there are injuries caused by dangerous sodium hydroxide; bacteria and enzyme treatments have proved to be somewhat ineffective.

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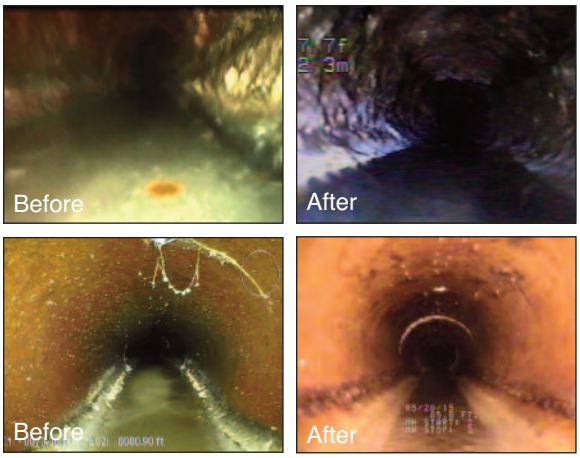


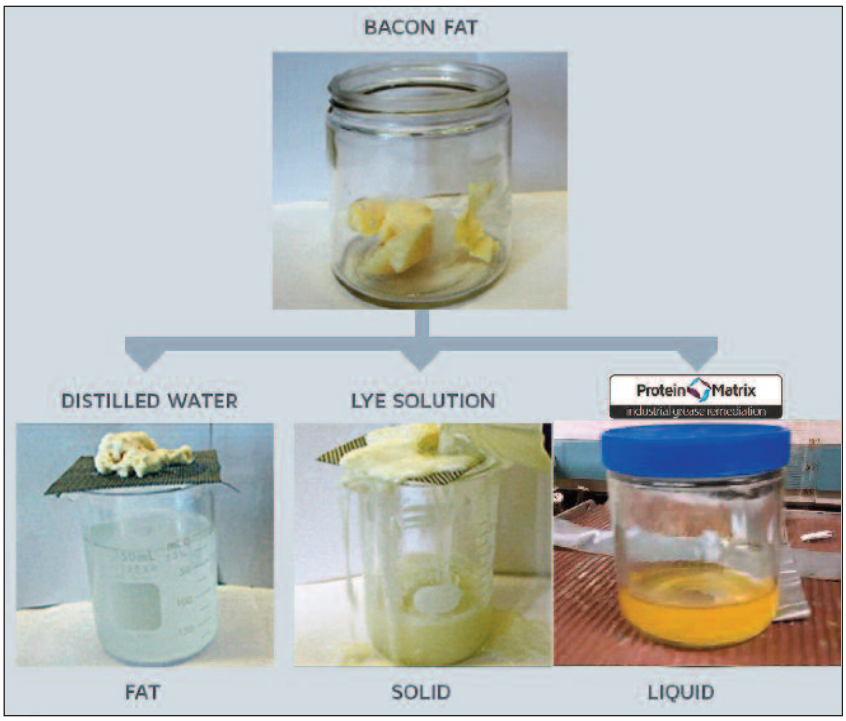
On days when the restaurant is cooking something that produces a lot of FOG, such as bacon, the Protein Matrix will react with that. However, on days when there might not be as much FOG produced, there isn't as much for Protein Matrix to react with, so as dishes, pots, and pans are washed, the Protein Matrix flows out of the trap, down the pipe, and finds and removes the bulges of FOG on the wall of the pipe.

Robbat said he is unaware of any drawbacks to using Protein Matrix for FOG removal. He said in the past, people have tried to use enzymes and bacteria as "green" approaches for getting rid of fat, but he said such approaches liquefied the fat at the injection point but it would resolidify downstream.

"All you're doing is pushing the blockage from one location to the next," he said. "And in our study you can see from the video and from the pipes that that's not the case. We permanently change fat, not just move it."

Robbat said that given the success of the studies, he has proposed a project to the cities of Medford and Somerville in which their high school students would learn about wastewater and wastewater treatment, what it takes to maintain a wastewater collection and transport system, and what goes into the sink traps at their schools. Then the plumbers from their respective cities would help the students collect samples from the sink traps like they did at Tufts, and the students would measure them for fat content.

"Students will collect samples before the study begins like we did at Tufts and (the restaurant), and then as the study progresses the students will learn how to dose the Protein



Top left: Pipes before and after using Protein Matrix.

Above: The process of converting FOG into a benign, flowable fatty acid using Protein Matrix.

Left: Grease trap study shows dining hall results after using Protein Matrix.

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Right: A grease trap study shows dining hall FOG measurements of concentration over time.

Below: A demonstration of a two-month FOG breakdown in the main kitchen and bakery traps.

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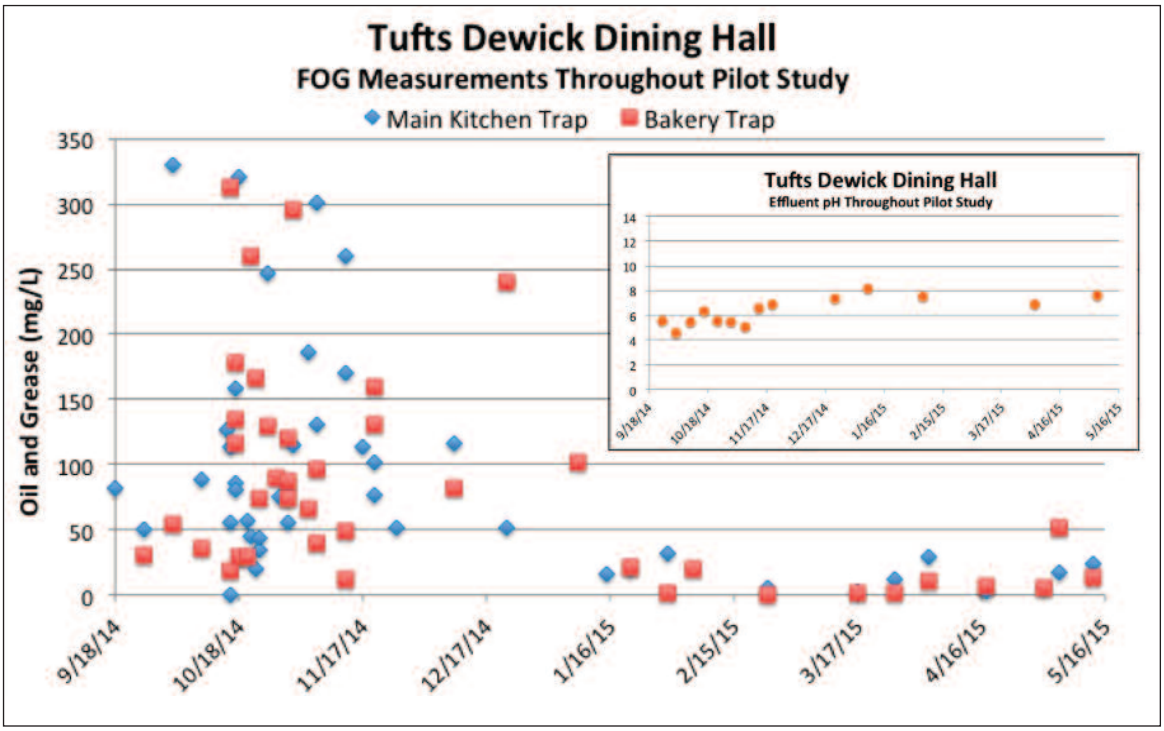
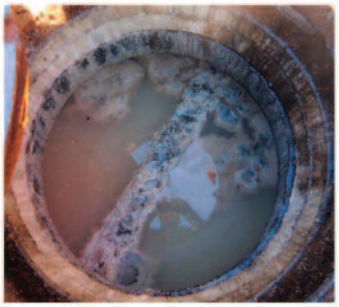
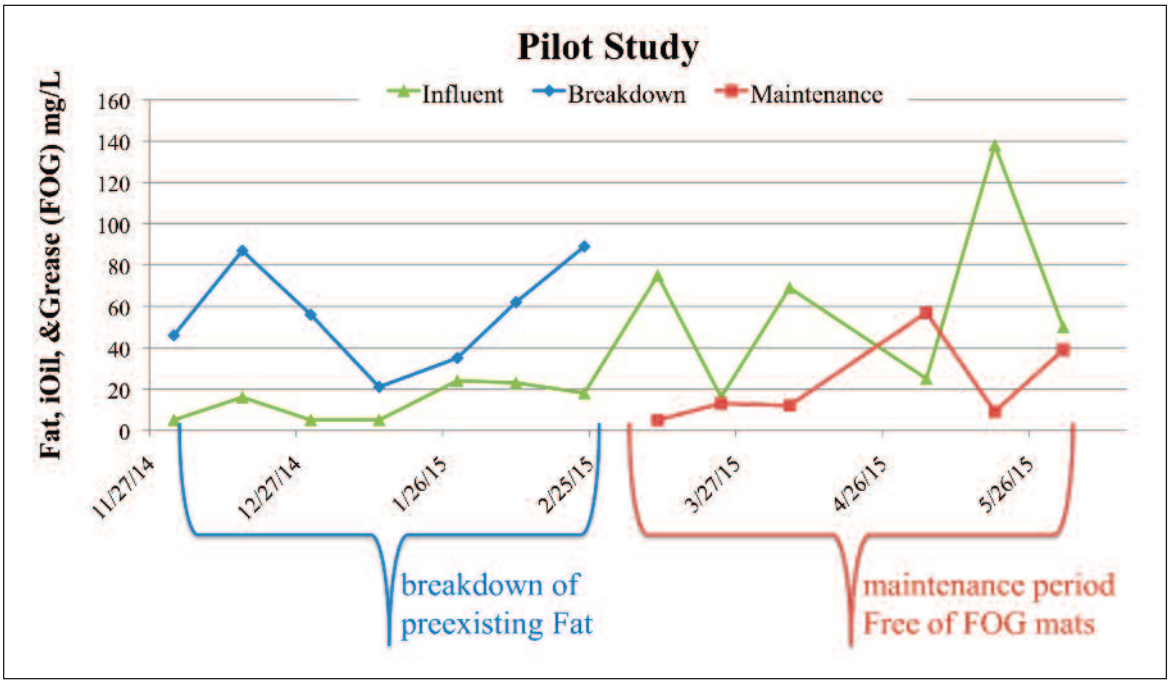


Matrix solution in order to find the optimal amount per day injected that their kitchen cafeteria would need to use," Robbat said. "So, everything will be done in their high school," adding that the objective is to excite high students so that they pursue science and engineering in college.

Robbat said he has already received agreement from the Massachusetts Water Resource Authority, which governs what can go into the sewer line. He said he hopes the project provides students with a hands-on, laboratory-based experience solving a problem that is vexing the industry.

	GGI 1 (inlet)	GGI 1 (outlet)	GGI 2 (inlet)
Prior to treatment and after 1-month of buildup			
After 3-months of treatment			



Top: A study from a restaurant shows results in the pipes before and after using Protein Matrix over a three month period.

Left: A graph shows the decreased FOG levels at the restaurant over a six month period.

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"My goal is to excite high school students to pursue STEM (science, technology, engineering, and mathematics) fields in college," he said, "by doing the same experiments scientists and engineers who work in the wastewater industry would do if they wanted to decide if the degreaser worked and what the usage costs would be."

Plotkin said the product's long-term goal is to solve the FOG problem, which he describes as having three components. The first component is the source of the grease, which includes fast-food restaurants and food-processing plants. The second is the pipeline transport system, which is governed and typically

Right: A graph shows the dramatic improvement in effluent quality at the restaurant over a three year period.

Below: Protein Matrix also has environmentally friendly cleaning products used for all restaurant and food processing surfaces, from hoods to countertops to floors.

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sample dateHJV	cBOD (mg/L)	FOG (mg/L)	TSS (mg/L)	N AMMONIA (mg/L)	P (mg/L)
10-Feb-13	513	85	266	17.8	31.67
24-Feb-13	370	69	302	80.2	23.83
9-Mar-13	297	49	274	41.6	32.67
23-Mar-13	750	14	216	52.8	21.5
6-Apr-13	467	36	260	18.1	31.5
25-Apr-13	1470	106	672	24.7	30.5
8-May-13	600	10.1	292	40.6	10.3
28-May-13	600	32	722	15.7	31
10-Jun-13	450	103	426	15.6	10.5
23-Jun-13	605	134	108	43.2	27.5
13-Jul-13	371	62	168	31.4	20.5
27-Jul-13	508	6.3	362	23.1	2.6
15-Sep-13	900	141	1310	124	35.5
28-Sep-13	1065	54	340	47.7	28.5
7-Oct-13	303	8.1	288	16.4	7.6
28-Oct-13	198	6	188	27.3	14.3
11-Nov-13	535	42.6	612	37.9	31
23-Nov-13	360	25.4	174	29.4	13.5
7-Dec-13	162	31.2	382	21.3	21.5
23-Dec-13	600	52.3	380	21.1	32
11-Jan-14	413	26.4	204	41.6	31
27-Jan-14	515	19.4	502	39.6	14.3
8-Feb-14	990	33.6	378	5.4	17.3
23-Feb-14	439	46	556	36	7.6
2-Dec-14	608	24	[illegible]	46.8	9
16-Dec-14	750	87	98	48.8	8
30-Dec-14	[illegible]	56	114	28.6	7.2
13-Jan-15	422	21	130	66	7.75
29-Jan-15	585	35	220	24.9	27.9
10-Feb-15	2130	62	290	5.7	15
24-Feb-15	1740	89	308	12.9	10.3
11-Mar-15	1335	5	170	9.5	5.25
24-Mar-15	1245	13	134	19.7	2.1
7-Apr-15	388	12	15	12.4	4.7
5-May-15	2940	57	565	12	2.4
19-May-15	12	9	6.6	0.26	0.12
2-Jun-15	[illegible]	39	60.5	21.7	0.31

owned by municipalities or state authorities such as the MWRA, and the third is the wastewater treatment plant.

Additionally, Plotkin said, they have found Protein Matrix has been able to clean lift stations and pump stations at wastewater treatment plants, and some of the nation's largest wastewater treatment companies have told them that Protein Matrix makes what was once grease more bioavailable to the microbial population in the plant. Plotkin said they are performing additional studies on that issue.

Plotkin said word of Protein Matrix — which is available commercially — has continued to spread.

"We're going to trade shows throughout the country and we're working with many of the larger municipalities doing pilots and hopefully having permanent installations," he said.