

# Oil Water Separator

## Oil Water Separator Study, Kuala Lumpur, Malaysia

### Executive Summary

BiOWiSH Technologies carried out a 6 week validation at 3 petrol stations in Malaysia to assess the impact of dosing *BiOWiSH™ Aqua FOG* into oil water separators.

The key objectives were to visually observe reductions in hydrocarbons and confirm any improvement in the quality of wastewater. A secondary objective was to assess if BiOWiSH™ could remove blockage within the wastewater drainage system in one of the stations.

After 6 weeks, the validation showed significant improvements in water quality. The validation has shown that just by simple batch dosing and spray of separator surface, the hydrocarbons are digested from surfaces and the visual quality of water is immediately improved.

Independent testing by the Universiti Teknologi MARA (UiTM) in the first week of the validation program showed the following results:

- Reduction in Biological Oxygen Demand (BOD) by up to 97%
- Reduction in Chemical Oxygen Demand (COD) by up to 95%
- Reduction in Fat, Oil and Grease (FOG) by up to 99%

In the subsequent weeks, BiOWiSH™ was able to maintain pollutant levels at initial reductions, which are well below expected levels.

Additionally, the secondary objective of unblocking drains in one station was met. After 2 weeks of dosing, the blocked drains were unclogged, resulting in clear flow through of wastewater.

The validation program presents a number of key benefits for the station owner/operators:

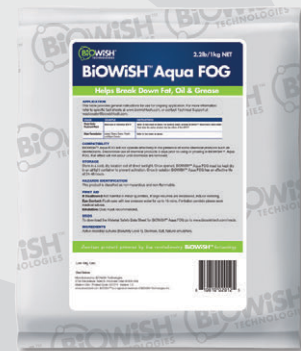
- Reduced pump out costs due to decreased pump out frequency, resulting in substantial savings for the operator.
- Drastically improved quality of wastewater, potentially resulting in lower disposal costs due to less concentrated waste disposal.
- Reduced maintenance costs due to unclogging of drains, potentially reducing external contractor costs to clear blocked drains in the stations.
- Improved cleanliness of the station for customers due to unclogging of drains.

### BiOWiSH™ Aqua FOG Benefits

- Reduces pump-out requirements
- Reduces sludge production and handling
- Eliminates odorous emissions
- Long shelf life
- 100% natural and non-toxic

### Available Sizes

- 100g
- 1kg



## Introduction

A 6 week validation program was carried out to assess the impact of dosing *BiOWiSH™ Aqua FOG* to reduce hydrocarbons in oil water separators at 3 petrol stations.

Petrol station owner operators have identified that significant cost is required to manage and maintain their oil water separators. The validation aimed to show that with dosing of *BiOWiSH™ Aqua FOG*, a visual reduction in hydrocarbons and positive impact on water quality could be seen within the separators.

These separators typically receive small amounts of diesel and oil from localised spills and wash down. To maintain effluent water quality and reduce odor, these oil water separators must be cleaned and emptied on a monthly basis. The high pollutant loadings experienced can lead to high handling and disposal costs passed on by external contractors.

The primary objective of the validation was to assess impact on reduction in hydrocarbon build up and assess if maintenance costs could be reduced. An additional objective for one of the petrol stations was to unblock its fuel spill drainage system that had been blocked with oils over years of use.

To confirm the impact on water quality, regular samples were taken and independent testing was carried out by UiTM.

## Station locations

Three petrol stations were selected that were considered typical petrol stations in Malaysia.

Each station typically has a discrete fuel spill collection system that collects and drains localised diesel spills into an oil water separator. All small scale fuel spills are washed down into the fuel spill collection system as carried out by attendants.

Each station has a discrete storm water system that is designed to collect storm water and station wash down and is separate to the fuel spill collection system.

All three sites undergo a thorough weekly site clean where the majority of cleaning water is sent to the storm water system. Any water that is contaminated with fuel is directed to the fuel spill collection system where it is collected in the separator. All three sites were noted to be well cleaned and owners and operators were diligent in their cleaning and maintenance duties.

Maintenance regime of the oil water separator is as follows:

- Pits are opened for inspection and any plastics or garbage removed.
- The accumulated pit oil is then emptied and transported off site on a monthly basis by contracted services.

A summary of the validation sites and key details are as follows:

Station	Location	Total pump stations	Diesel pump stations	Approx Size of separator (m)
Site 1 (A)	Kuala Lumpur	8	6	1 x 2.5 x 0.9
Site 1 (B)	Kuala Lumpur	8	6	1 x 2.5 x 0.9
Site 2	Kuala Lumpur	14	10	1 x 2.5 x 0.9
Site 3	Kuala Lumpur	15	6	1 x 4 x 0.9

*It is important to note that site 1 has two collection systems which have been identified as (A) and (B)*

## The Solution

BiOWiSH™ is a revolutionary biocatalyst technology platform that is based on a microbial consortia that can rapidly oxidise pollutants in wastewater applications. Developed using the core BiOWiSH™ technology, *BiOWiSH™ Aqua FOG* is a wastewater treatment product that has the ability to complete complex functions co-dependently thus rapidly carrying through hydrocarbon oxidation much faster than independent biological or enzymatic remedies. Additionally, the mixed microbial consortia are significantly more robust in the treatment of multiple substrates. Differing fuel concentrations and fuel type can be treated due to the adaptive nature of *BiOWiSH™ Aqua FOG*.

The theory of microbial consortia is one well researched and shows strong application in the remediation of hydrocarbons in soils as well as wastewater<sup>1</sup>. *BiOWiSH™ Aqua FOG* has demonstrated oxidation of pollutants in a number of waste water applications and hydrocarbon remediation falls well within its abilities.

Additionally to its abilities to break down non-living organics much faster than existing technologies, *BiOWiSH™ Aqua FOG* is 100% natural and is safe to handle, activate and dose.

## Results and discussion

It is critical to reinforce that the oil water separators at site 1 and site 2 were cleaned prior to the validation beginning. This cleaning operation was carried as part of the regular ongoing maintenance program and not at the requirements of the validation.

### Visual hydrocarbon reduction

In all three sites, *BiOWiSH™ Aqua FOG* has significantly reduced the accumulated hydrocarbons within the oil water separator. Before and after photos taken of the traps were as follows.

Site 1 results were as follows:



Before



After

Site 1 (A) results



Before



After

Site 1 (B) results

<sup>1</sup> Engineering microbial consortia: a new frontier in synthetic biology; Trends in Biotechnology Vol.26 No.9: 2008: Katie Brenner, Lingchong You and Frances H. Arnold



Site 2 was cleaned out prior to validation commencement, however, it can be seen that there is a notable reduction in Hydrocarbons in the before and after photos. The walls were notably freer from grease and oil and hydrocarbons had been removed from walls.

Additionally, it can be seen from the photos that there is a significant difference in water quality and again the cleanliness of the system is vastly improved from the validation.

Site 2 showed similar results:



*Before*



*After*

*Site 2 results*

Again, the validation shows significant improvement in the cleanliness of the oil water separator. The results show that hydrocarbons have been reduced by the addition of *BiOWiSH™ Aqua FOG*.

The operators at site 2 noted that immediately after dosing *BiOWiSH™* the water in the receiving pit would begin to bubble. All three station operators confirmed that there was a notable visual difference in water quality and that the pit walls and surfaces were cleaner.

Site 3 also showed similar results:



*Before*



*After*

*Site 3 results*

Note that there is a significant reduction in Hydrocarbon build up on the walls and surface of the water. Site 3 was not cleaned out prior to commencement of validation. Note the cleanliness of the pipe in the after photo which is a good indication of the impact of the *BiOWiSH™ Aqua FOG* dosing.



*Increased bubbling observed immediately after dosing of BiOWiSH™ Aqua - FOG*

Note the bubbling within the oil water separator, indicating the increase microbial activity immediately breaking down the hydrocarbons as a result of the dosing of BiOWiSH™.

### Site 3 site drain blockage

BiOWiSH™ was also successful in unblocking the oil water drainage system. It was noted that after 4 days the flow rate within the system began to improve and after 2 weeks the drains unblocked themselves. It was also noted once the drains were unblocked the solids flowed into the oil water separator and drains were unblocked.



*Before*



*After*

*Site 3 drain before and after*

As a result of the validation, the owner of site 3 has commissioned a further trial on a section of fuel stained pavement to see if spraying BiOWiSH™ will improve the cleanliness of this section.

## Water treatment quality

Independent analysis of water quality within the pits was carried out by UiTM. A sample was taken immediately before the first dose of *BiOWiSH™ Aqua FOG*.

It is important to note that the samples were taken within the last cell of each pit and not from any discharge point. Taking samples from the any actual discharge would lead to even better treatment outcomes as the full utilisation of the oils separator would come into effect. A summary of the results from the water quality tests is as follows:

Site 1 (A)								
Parameter	Unit	Pre dose	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
pH		6.69	7.49	6.58	6.75	6.9	6.01	6.22
BOD5	mg/L	84	29	201	423	448	209	77
COD	mg/L	904	55	900	1486	843	1186	358
TSS	mg/L	23	32	1218	1484	1092	1910	96
FOG	mg/L	1	12	35	509	599	678	46

*Oil Separator was cleaned out before the trial*

Site 1 (B)								
Parameter	Unit	Pre dose	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
pH		7	6.83	6.7	7.2	6.74	6.2	6.48
BOD5	mg/L	82	26	159	2	95	90	57
COD	mg/L	4685	33	1200	35	172	269	189
TSS	mg/L	32	32	51	7	80	16	64
FOG	mg/L	1	4	14	3	25	26	25

*Oil Separator was cleaned out before the trial*

Site 2								
Parameter	Unit	Pre dose	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
pH		6.98	5.43	7	7.23	6.75	6.46	6.65
BOD5	mg/L	154	208	158	46	105	52	38
COD	mg/L	3123	633	1050	1189	169	152	124
TSS	mg/L	24	52	540	466	56	50	108
FOG	mg/L	1	20	28	138	21	3	11

*Oil Separator was cleaned out before the trial*

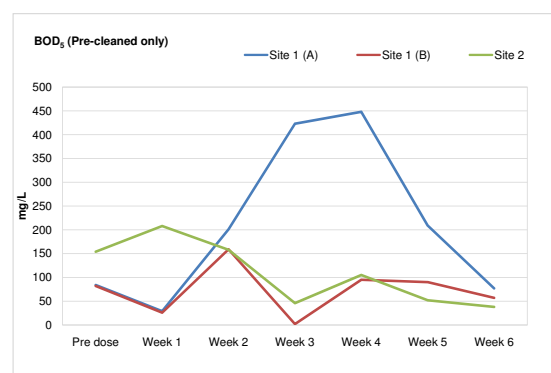
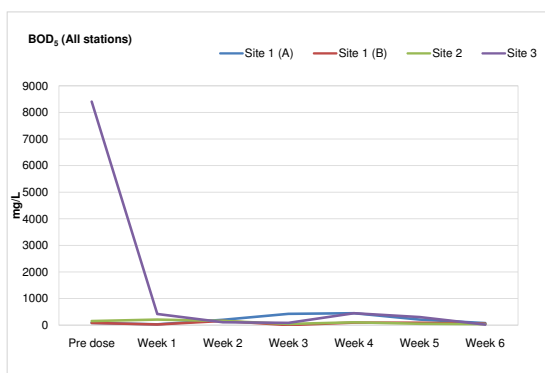
Site 3								
Parameter	Unit	Pre dose	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6
pH		7.17	6.9	6.69	6.93	7.4	6.8	7.44
BOD5	mg/L	8403	419	109	85	447	302	19
COD	mg/L	22192	767	1125	1709	1262	966	63
TSS	mg/L	8382	1668	164	133	3282	1490	24
FOG	mg/L	112660	1598	123	45	1843	139	5

*Oil Separator was not cleaned out before the trial.*  
*Release of solids from pipe system after week 2.*

The results show an immediate impact on the water quality from dosing of BiOWiSH™. All pits, regardless of being cleaned or not show immediate improvement. Site 3, as expected from not being cleaned prior to validation, shows the highest immediate improvement. All the other pits show notable reductions within the first week.

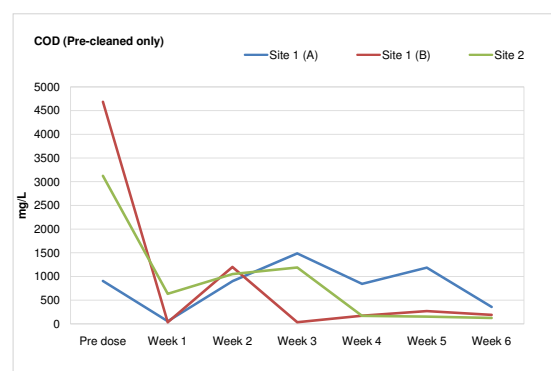
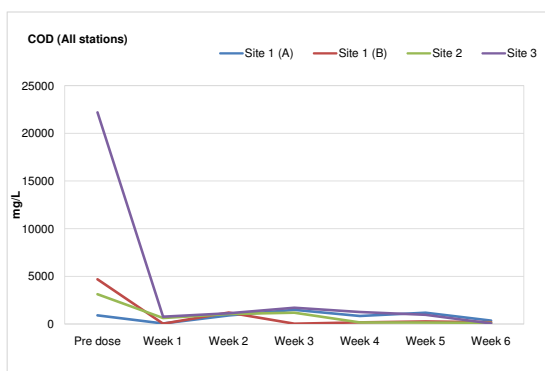
Reductions within first week				
Parameter	Site 1 (A)	Site 1 (B)	Site 2	Site 3
pH				
BOD5	65%	68%	-35%	95%
COD	94%	99%	80%	97%
TSS	-39%	0%	-117%	80%
FOG	NA	NA	NA	99%

The following graphs highlight the impact in water quality during the validation period from the BiOWiSH™ Aqua FOG dosing. Two sets of graphs are presented per parameter to better show trending of all stations as well as highlighting performance of pre-cleaned stations.



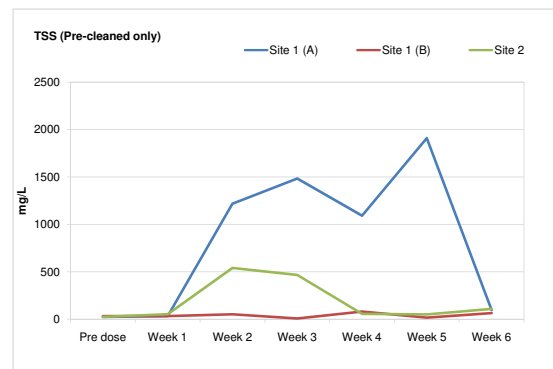
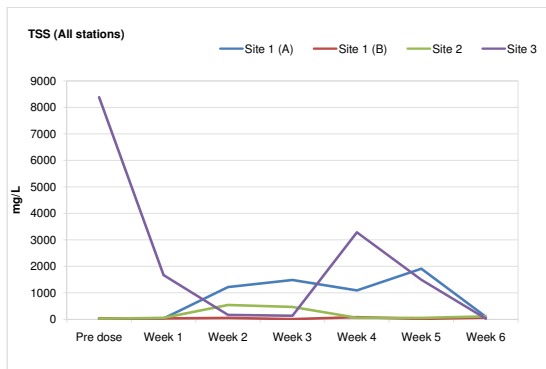
BOD analysis of Waste water across stations

The BOD analysis highlights the rapid reduction in BOD in the first week followed by a relatively steady state. The BOD of site 3 drops in the first week, which could be expected for the other stations if they had not been cleaned prior to validation beginning.



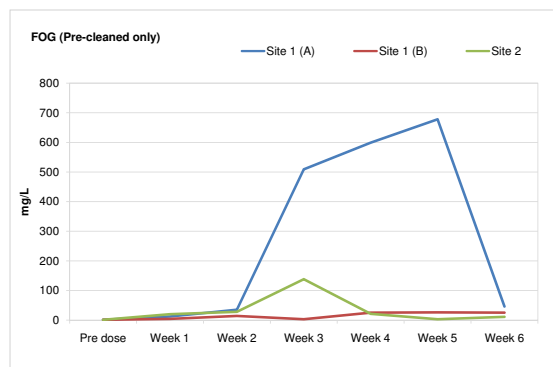
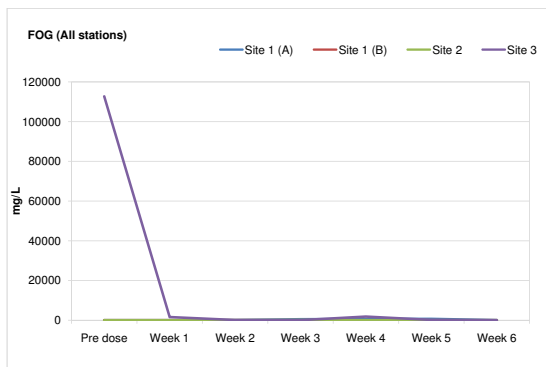
COD analysis of Waste water across stations

The COD in all separators drop immediately in the first week followed by a comparable steady state. Slight increase in COD can be explained by the effect of the hydrocarbons being stripped off the walls, thereby increasing COD. Additionally, the COD for site 3 has increased due to the additional solids that have passed through from the unblocking of the pipe system.



TSS analysis of Waste water across stations

TSS has also been rapidly reduced in site 3. There has been an increase in TSS, however, after a few weeks this trend has levelled off. It is important to note that the trend is well under the initial pollutant loadings.



FOG analysis of Waste water across stations

Fat Oil and Grease levels have been drastically reduced from original loads, which is as expected by the dosing of BiOWiSH™. Levels continue to be negligible compared to initial values observed in un-cleaned separators.

Again, it is important to note that the water samples were taken from within the pits, not from any discharge point. This would signify worst case results as any resulting discharge should have better treatment from the well-designed separator.

## Conclusion

The BiOWiSH Technologies oil water separator validation program has shown significant reduction in hydrocarbons and improvements in water quality. The validation has shown that just by simple batch dosing and spray of the walls, the hydrocarbons are digested from the walls of the separator and the water quality has improved.

In regards to water quality, the independent testing by UiTM show significant reductions in the first week of BiOWiSH™ Aqua FOG dosing;

- Reduction in BOD by up to 97%
- Reduction in COD by up to 95%
- Reduction in FOG by up to 99%



In the subsequent weeks, *BiOWiSH™ Aqua FOG* was able to maintain pollutant levels at initial reductions, which are well below that seen in an existing oil water separator. It could also be expected to have even better results if samples were taken from discharge points rather than from within pits. Even when a significant spill event occurred, *BiOWiSH™* was able to control and reduce pollutant loadings.

Additionally, the secondary objective of unblocking drains at site 3 has been met. After 2 weeks of dosing the drains were unblocked resulting in flow through of waste water.

The validation shows a number of key benefits for the station owner/operators which are:

- Reduced pump out costs due to decreased pump out frequency, resulting in substantial savings for the operator.
- Drastically improved quality of wastewater, potentially resulting in lower disposal costs due to less concentrated waste disposal.
- Reduced maintenance costs due to unclogging of drains, potentially reducing external contractor costs to clear blocked drains in the stations.
- Improved cleanliness of the station for customers due to unclogging of drains. (This result led to site 3 commissioning further work to remove stubborn fuel stains on their diesel truck filling area).

Further work should be carried out to understand how far scheduled pump outs could be spaced to provide true economic benefit for station owner/operators. This should be carried out over a number of stations over a longer period.

## Detailed Implementation Program

*BiOWiSH™ Aqua FOG* was dosed at a constant 5,000ppm. The activated mix was prepared and batched by volume as follows:

Date	Litres of Activated <i>BiOWiSH™</i> Solution at 5,000ppm			
	Site 1 (A)	Site 1 (B)	Site 2	Site 3
21/12	-	-	-	60
22/12	20	20	20	-
28/12	40	40	40	40
31/12	20	20	20	20
6/1	40	40	20	40
8/1	40	40	20	40
14/1	40	40	20	40
18/1	40	40	20	40
21/1	40	40	20	40/ 20 (sprayed)

### Notes

- Dose dates were scheduled to be bi-weekly. A dose was carried out after site was washed during regular weekly clean to immediately treat oil when it enters the oil-water separator.
- Dose was applied by a batch discharge consisting of 75% of mix into the first cell of the separator and 25% then sprayed onto the walls and surfaces of the separator. (unless stated otherwise)
- For site 3, half of the dose was applied to the floor drains and half was applied to oil water separator. This is to meet site 3's objective of unblocking its fuel spill drainage system.

### *BiOWiSH™ Aqua FOG* Dosing

*BiOWiSH™ Aqua FOG* is delivered as an active microbial and requires activation. In accordance with the product instructions, the mix was activated and dosed as follows:

- *BiOWiSH™* was dosed into fresh water at a rate of 5000ppm
- *BiOWiSH™* mix was allowed to aerate and activate over 12 hours

- Activation was easily carried off site to ensure the least amount of disruption to station operations.
- Dosing was carried out by opening up the oil water separator and dosing the activated mix. This operation took no more than 15 minutes.

### Operations to oil water separator during the study

Two of the stations cleaned out their separators prior to the validation. Site 1 and site 2 both emptied and thoroughly cleaned their separators prior to start of any dosing.

During the validation, operators did not carry out any maintenance on the pits other than inspection and removal of garbage caught in system. It is important to note that the separators were not pumped out during this period.

### Data recorded during validation

Following are the key observations and data recorded at each site during the validation:

#### Visual Observations

Parameter	Method
Visual observations of hydrocarbons on surface of water	Photos to be taken for before and after
Hydrocarbons on walls of tanks	Photos to be taken for before and after

#### Water treatment parameters

Parameter	Frequency
pH	Weekly
COD	Weekly
BOD	Weekly
TSS	Weekly
FOG	Weekly

### Contacts

#### **BiOWiSH Technologies**

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Biological help for the human race



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