SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

Magnetic Waste Water Treatment solutions: A Noble Environmental Technology

For many of our clients Saham Global act as advisor and provider of Smart Green Engineering Solutions. Our Holistic Approch aims at increasing Water & Energy Efficiency of the client's daily operations.

In July 1996 the MagneLogic scientists in partnership with the laboratory of the Sewage Treatment Plant of Dubai Municipality conducted demonstration tests on the MagneLogic equipment developed by Magnetic Technologies L.L.C. The intentions was to accelerate technological process and reduce the cost-in-operation. This trial resulted in partial installation of magnetic systems at some points of sludge making facility at the sewage plant in April 1997. The devices were fixed on a waste water pipe at the inlet of the consolidation tank (before the digesters), a water pipe for flocculent solution of the consolidation tank and two pipes for flocculent solution of the consolidation tank.

The waste water pipe of the consolidation tank was equipped with forced air injection through a magnetic system.

The magnetic equipment was also mounted after the digesters on three water pipes for flocculent solution, three pipes for magnetic field treatment of flocculent solution, and three pipes directly before the centrifugal unit.

I. THEORETICAL GROUNDS FOR EXPEDIENT INSTALLATION OF MAGNETIC SYSTEMS AT SLUDGE EXTRACTION SECTION

1. The waste water treated by magnetic field of certain parameters alters its structure due to changes in the force of molecular interaction as well as in the bonding with gas molecules and particles of different nature that may be found in the effluent water. This considerably slows molecular chaotic movement and, therefore, facilitates the surfacing of hydrogen sulphide molecules from the depth of the water. Thus, the extraction of hydrogen sulphide from the consolidation tank is significantly increased.

2. As is known the coagulant is used to neutralize colloidal polluted particles and the sludge, in particular. Hence, it is important that the reagent be spread as quickly as possible. The coagulation time is extremely short (less than a second) and the best results can be assured on condition that the colloidal particles be completely neutralized before a part of the coagulant starts to form sediments.

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

This can be achieved by the method of magnetic and hydrodynamic resonance treatment of water and coagulant solution combined with aeration of the water flow. When the flow passes through an active zone of the magnetic system the associates of both water molecules and impurities are crushed into smaller particles. This expands their surface area that reacts with the coagulant and, consequently, shortens the coagulation time and reduces the quantity of required coagulant. Furthermore, the structure of sediments becomes more solidified with subsequent additional extraction of hydrogen sulphide.

However, it should be noted that tiny sludge particles would move with air bubbles to the top layers. So it is important to opt for sufficient aeration degree of the water flow.

The magnetic systems will further enhance adhesive properties of sludge particles which is likely to save the flocculent and increase the sludge extraction.

3. As is known the sludge digestion implies chemical reactions conducted by versatile microorganisms including bacteria, which play a pivotal role in the process. The bacteria affect impurities that serve as nutrition. Catalysts in the form of synthesized bacteria, which support reactions, accelerate all chemical reactions, i.e. fermentation process is based on bacterial culture development. When conditions turn unfavourable, the growth rate of bacteria declines. Accumulations of toxic products of metabolism or environmental changes are the key reasons for growth impediment or suspension. Hydrogen sulphide is a toxic product and, therefore, its drop in the digester will reduce digestion and enhance the quality of sludge.

It is noteworthy that one of negative indicators of the hydrogen sulphide high content in the water is a wild and rapid development of sulphuric bacteria sustained by hydrogen sulphide. These bacteria actively destroy any concrete and metal structures that the effluent water passes through as well as all other units at your plant. In this respect it is advisable that special magnetic hydrogen sulphide neutralizers be installed both at the beginning of the wastewater pipeline (pump houses, etc.) and at different sections of your facility. Another explicit benefit that these systems could have brought would be a drastic drop of toxic gas emission into the air. Apart from being destructive and hazardous to the environment, these gases also cause inconvenience for the people because of its off-putting smell.

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

II. ANALYSIS OF WORKING RESULTS OF MAGNETIC SYSTEMS

1. There has been a change in the sludge content percentage inside the consolidation tank before and after installation of the technological equipment designed by Magnetic Technologies L.L.C.:

April 1997	-	7.5%
May 1997	-	7.94%
June 1997 (three weeks)	-	8.04%

As is seen, the increase of sludge extraction made up 5.86% and 7.2% in May and June, respectively, which is different from April (before installation). It is noteworthy that the flocculent consumption in the consolidation tank was positively cut in May.

2. Below follow changes in the flocculent consumption before and after installation of the technological equipment designed by Magnetic Technologies L.L.C.:

April 1997	-	381 bags
May 1997	-	333 bags
June 1997	-	324 bags

To sum up, the flocculent consumption went down by 48-57 bags or 12.6-14.0 % in May and June against April, i.e. prior to installation of devices.

3. The diagram of H_2S extracted from the consolidation tank prior and following installation of the technological equipment designed by Magnetic Technologies L.L.C. looks as follows:

January 1997	-	72,034 ppm
February 1997	-	42,887 ppm
March 1997	-	74,633 ppm
April 1997	-	63,401 ppm
May 1997	-	99,063 ppm
June 1997	-	64,155 ppm
July 1997	-	54,287 ppm

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

Therefore, an increase in the H_2S extraction for May is attributive to installation of the device which feeds the air treated by magnetic field in a forced manner as well as the system for magnetization of the effluent water and flocculent solution alike. May saw a raise in the H_2S extraction by 56.2% versus April and by 56.6% against the average value for January-April. This has curtailed the fermentation time in the digesters.

A comparative breakdown of H_2S extraction in June and July 1997 as opposed to June and July 1996 is shown in Table No. 1.

Note: The air system of the consolidation tank operated discreetly from April 25 to May 5, on May 10-11, 14-15 as well as from May 16 to May 18 owing to some technical faults. During these periods, the percentage of H_2S extraction accounted for 90.6% of the average value for January-April 1997.

Table 1.

Comparative Analysis of H_2S Extraction from the Consolidation Tank prior to Installation of the MagneLogic Systems (1996) and After the Installation (1997) with Identical Climatic Conditions

Month	*1996, ppm*	*1997, ppm*	*Difference, ppm*	*% of Change*
June	47,989	64,155	16,166	33,7
July	30,712	54,287	23,575	76,7

Changing of the Percentage Containing of Gas in Digesters per one ton of sludge before and after installation of the equipment manufactured by Magnetic Technologies L.L.C. (1997)

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

Table 2.

4. Percentage changes of gas production in the digesters per one ton of sludge.

Month	*Week*	*Sludge Qty. cub.m/week*	*Gas Quantity cub.m/week*	*Gas Quantity per 1 t of sludge, cub.m/t*	*Average gas quantity per 1 t of sludge, cub.m/t*
1	2	3	4	5	6
April	1	5,850	158,267	27,054	Before installation of magnetic systems 28,203
	2	5,843	153,637	26,294	
	3	5,250	161,068	30,676	
	4	4,830	143,241	29,656	
May	1	5,408	148,279	27,418	
	2	5,492	154,442	28,121	
	3	4,943	161,428	32,657	After installation of equipment 32,674
	4	4,792	157,122	33,788	
June	1	4,643	150,333	32,418	
	2	4,439	146,811	33,072	
	3	4,656	146,382	31,439	

Gas production per 1 t of sludge has gone up by 15.85%.

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

Table 3.

5. Quantity changes in sludge extraction after digestion before and after installation of the MagneLogic equipment, designed by Magnetic Technologies L.L.C.

Month	*Week*	*Sludge qty. before digestion cub.m/week*	*Sludge qty. after digestion cub.m/week*	*Changes %*	*Qty. changes in sludge extraction after digestion,%*
April	1	5,850	4,978	-14.9	Before installation of technological magnetic equipment to accelerate digestion -21.3%
	2	5,843	4,408	-24.5	
	3	5,250	4,568	-12.3	
	4	4,830	3,458	-28.4	
May	1	5,408	4,269	-21.0	
	2	5,492	4,285	-21.9	
	3	4,945	3,671	-25.7	
	4	4,792	3,752	-21.7	
June	1	4,643	4,095	-11.8	30 days after installation sludge extraction has increased by 9.5%
	2	4,439	4,008	-9.7	37 days after installation sludge extraction has increased by 11.6%
	3	4,656	5,220	+12.1	44 days after installation sludge extraction has increased by 33.4%

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

As is seen from the table, following installation of magnetic systems the quantity of extracted sludge has grown 9.5% after 30 days, 11.6% after 37 days and 33.4% after 44 days.

So a conclusion can be drawn that the fermentation time has shrunk from 40-45 days down to 26-30 days regardless of incomplete installation of the technological magnetic equipment required for this process.

III. CONCLUSION

Partial installation of MagneLogic systems has allowed the convenience of achieving the following effects:

1. *An increase in the percentage of sludge extracted from the consolidation tank to the digesters by 6-7%.*
2. *Flocculent consumption has fallen by 12.6%.*
3. *The rate of H_2S extraction from the digesters has gone up by 56-90%.*
4. *Gas production per 1 t of sludge in the digesters has been enhanced by 15.8%.*
5. *Having pushed up the quantity of sludge extracted from the digesters by 33.4% as of the 44th day it is possible to assume that the fermentation period has dropped from 40-45 days down to 26-30 days.*
6. *A slight reduction in the pH value of the inside the consolidation tank has been observed (1.8-2.7%).*
7. *The consumption of NaOH (caustic soda) has increased due to a bigger extraction of hydrogen sulphide from the consolidation tank.*

SAHAM GLOBAL - Group Coordination Center
PO Box 282385, Dubai
United Arab Emirates
Phone +971 (4) 3807855
Email: info@saham-international.com
Internet: www.SahamGlobal.com

IV. ADVICE FOR FURTHER OPTIMIZATION

1. To boost the extraction of hydrogen sulphide from the consolidation tank it is necessary to solve a technical problem caused by forced air feed which, therefore, requires a compressor. Its power shall be calculated depending on a number of consolidation tanks to be equipped with our systems.

2. To increase the extraction of the sludge from the consolidation tank and, additionally, reduce the consumption of flocculent it would be necessary to fix additional magnetic systems specially on the rakes inside the tank.

3. Implementation of the first two steps makes it possible to further reduce the fermentation period.

4. Extraction of the sludge after the centrifugal unit may be increased provided the rakes of the consolidation tank after the digesters are equipped with magnetic devices.

V. SUMMARY

Fulfillment of the above-mentioned recommendations has enabled Dubai Municipality to additionally enhance the efficiency of the sludge making section at your plant by no less than 30%.