Results

Student's Name
Institution of Learning

Results

Introduction

This chapter represents the result of the measurements of LAS in the wastewater. However, Methylene Blue Active Substances (MBAS) are those that are chosen to evaluate LAS in the Pittsburgh's Wastewater Treatment Plant. Linear Alkylbenzene Sulphonate is a surface-active compound that is widely utilized in the domestic usage within the washing process. It is considered to be predominant to soap due to the fact that soap is not durable and sturdy in rigid or acid water. Therefore, domestically released water is a crucial source of LAS in wastewater. Furthermore, LAS is also discharged in the industrial effluent. Industries that are infamous for discharging such effluent incorporate paper-elaboration plants and abstergent manufacturing industries. Contrary to other surface-active compounds, LAS is considered to be biodegradable and is less hazardous as it is less virulence. Nevertheless, it is still able to interfere with a number of metabolic operations in aqueous flora and fauna (Cirelli et al., 2010). Therefore, there is a requirement to control the ratios in wastewater before and after procedure in order to assure that they are not venomous to both hydrous existence and, wildlife animal subjects and human beings. There is no enough information concerning the ratios of LAS in wastewater in Pittsburg, and this formulates the fundament of such a research proposal. Cognition of the quantity of LAS in wastewater in Pittsburg before and after elaboration would be affluent for a number of reasons. Firstly, this cognition would assist while monitoring the levels of LAS discharged into rivers and other water objects by introducing legislation that will monitor the scope of LAS to be discharged to wastewaters. Secondly, it would introduce assessors select the best method of LAS passage from wastewater. Furthermore, it would soothe post-procedure canvass of the quality of

wastewater. Moreover, it is also, it would be beneficial for agricultural objectives, due to the fact that it will cause a lot of processing in agrarian fields (Cirelli et al., 2010).

Therefore, the object of this study is to monitor the levels of wastewater before and after treatment in order to ensure that are preserved at a level that could not cause toxicity to not only aquatic life and wildlife animals and humans. The major purpose of the research is to determine the amount of Linear Alkyl Benzene Sulfonate (LAS0 in Pittsburgh's wastewater before and after treatment.

Results

The study analyses influent and effluent wastewater, which means that the study analyses the wastewater flowing into treatment plant and water, which received primary, secondary, or advanced treatment in order to reduce LAS. The study evicts that LAS was found to increase with increasing sonification in time. The research was conducted during the eight-week period. The shape of the LAS profiles has been obtained from the MBAS measurements on the samples taken from the Pittsburgh Wastewater Treatment Plant. The effectiveness of utilizing a sonochemical reactor for the degradation from effluent of wastewater treatment plant and influent of wastewater treatment plant has been investigated. The Methylene Blue Active Substances (MBAS) analysis was incorporated in order to assess the actual concentration of the LAS parent compound at the end of the test period (Moldovan et al., 2011). The results demonstrate that 85% of the parent LAS was no longer available in the solution. From this, it may be concluded that the remaining total organic carbon concentration probably was produced by co-products from degradation reactions, which could not be utilized as a carbon source by the microorganism presented (Prats et al., 2006).

The efficiency of a sonochemical reactor for LAS levels in evaluated with an emphasis on the effect of sonification time and initial LAS concentration. Experiment was carried out at initial concentrations of 3.555 of influent LAS and 0.23 effluent LAS. The profile provides a significant difference between the influent and effluent water. The study took into account LAS influent and effluent differences within the time period, LAS differences within the days period, while proving the differences of the temperature differences. The LAS has been analyzed for the three period of the day, starting from the morning (10:00 AM), afternoon (2:30 PM) and evening (7:00 PM). The research showed that the influent LAS has been increasing before the afternoon and slightly decreasing before the evening measurements. The same tendency has been detected by the effluent LAS, while increasing before 2:30 PM and decreasing the LAS present in the water by 7:00 PM. The figures presented by the research were highly different for the majority of the study analysis expect the last four days, when the figures remained at the same level, including the levels of influent and effluent temperatures, and the ratios of influent LAS and effluent LAS.

Influent LAS and Effluent LAS vs. Day

The significant disparity of the levels observed in the LAS influent and LAS effluent are analyzed from the viewpoint of day variation. The general quantity of wastewater, which comes to the Wastewater Treatment Plant, differs in accordance to the time of the day, due to the fact that the current reaches the climax in the morning and noted the same tendency in the evening. Various industry activities also provoke disparity to both the amount and the virtue of the wastewater. The figure 1 demonstrates the increase of the LAS influent for Monday, with minor fluctuations observed during Tuesday, Wednesday, and Thursday, reaching its climax on Friday and decreasing during Saturday, reaching the lowest point on Sunday. The ratios constituent

2.48mg/l of influent LAS on Sunday, significantly growing to the point of 3.38 mg/l on Monday, ranging between 3.38 mg/l and 3.58 mg/l during Tuesday, Wednesday and Thursday, having the lowest point of 3.18 mg/l on 2:30 PM on Wednesday, evicting the highest measurement of 3.58 mg/l on Friday. The results depicted the smooth decrease to the point of 3.28 mg/l on Saturday, which was further decreasing by Sunday. On the other hand, the level of effluent LAS provided relatively stable degree within the whole week, flaunting between 0.28 mg/l and 0.38 mg/l, reaching the highest level on Wednesday and Thursday.

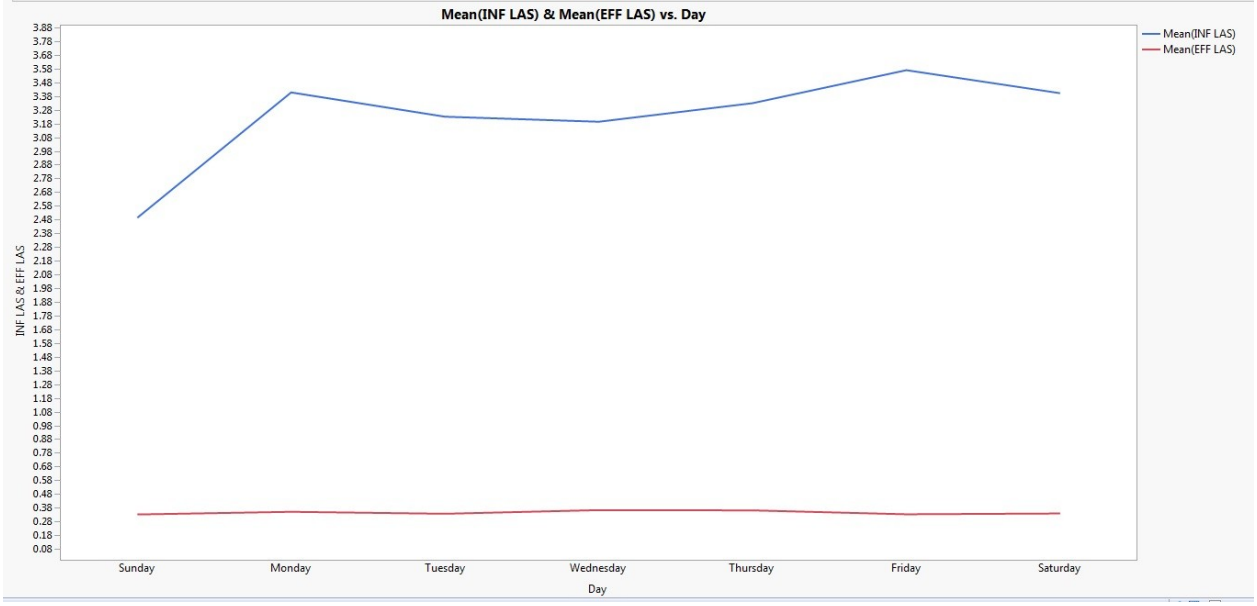

Figure 1. Influent LAS and effluent LAS vs. day.

The graph depicts a significant difference between Influent and Effluent LAS. It is clear that influent LAS is significantly higher on Sunday, reaching its climax on Friday, while effluent LAS is stable within the same period. Furthermore, the initial difference evaluated between the level of influent LAS and effluent LAS on Sunday makes 3.1 mg/l. The ratio reaches its higher difference on Friday, which amounts to 3.2 mg/l.

Therefore, it is possible to indicate the LAS difference within the day measurement evaluation. The graph defining the LAS difference resembles the upper curve of the above-mentioned graph (figure 1).

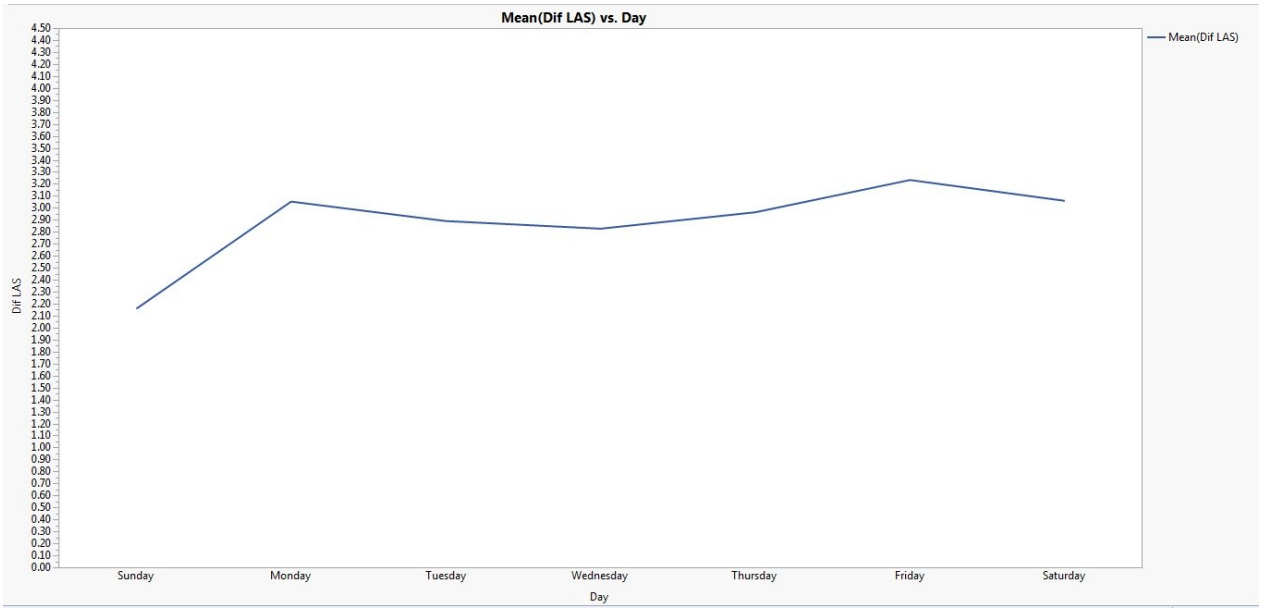

Figure 2. LAS difference vs. day.

The LAS difference ratio reaches the lowest position 2.15 mg/l (average) on Sunday. Afterwards, it significantly increases to 3.00 mg/l on Monday. The ratio of the LAS difference ranges from 3.00 mg/l (average) to its climax of 3.30 mg/l (average) during Tuesday, Wednesday, and Thursday. The graph shows that that the LAS difference reaches the climax of 3.30 mg/l (average) on Friday and smoothly drops to 3.1 mg/l by Saturday. The essential decrease may be explained by the fact that the level of industrial activity lowers and is suspended on the weekends with the ratio reaching the lowest position on Sunday. Moreover, it s explained due to the circumstance of the everyday water influents presence, which continue during Saturday and Sunday, while no additional operations are performed. The ratio reaches the climax on Friday as the industrial activity is accumulated during the week, presenting the highest mark on the final day of the business week (OECD SIDS, 2005).

Influent LAS and Effluent LAS vs. Time

Secondly, a significant difference was observed between the levels of influent LAS and effluent LAS within the measurement of time. As a matter of fact, the level of influent LAS constituent 2.78 mg/l (average) in the morning (10:00 PM), increasing to its climax of 3.78 mg/l in the afternoon (2:30 PM) and decreasing to the ration of 3.08 mg/l in the evening (7:00 PM). This fact may be explained by the rise of temperature during the afternoon and the activity of the Wastewater Treatment Plant (OECD SIDS, 2005). On the other hand, the level of the effluent LAS demonstrated stability, as the level constituent 0.38 mg/l (average) during the whole day, incorporating the morning (10:00 AM), afternoon (2:30 PM) and evening (7:00 PM). It practically evicts that upon changes in LAS concentration, the procentral LAS removal remained constant. Hence, an increase in LAS influent levels became apparent. LAS effluent concentrations already proved the stability within the analysis of the influent LAS and effluent LAS concerning the daily measurement (Figure 1). It is likely that influent LAS and effluent LAS concentration could be further reduced by increasing the hydraulic retention time (HRT). This was, however, not tested.

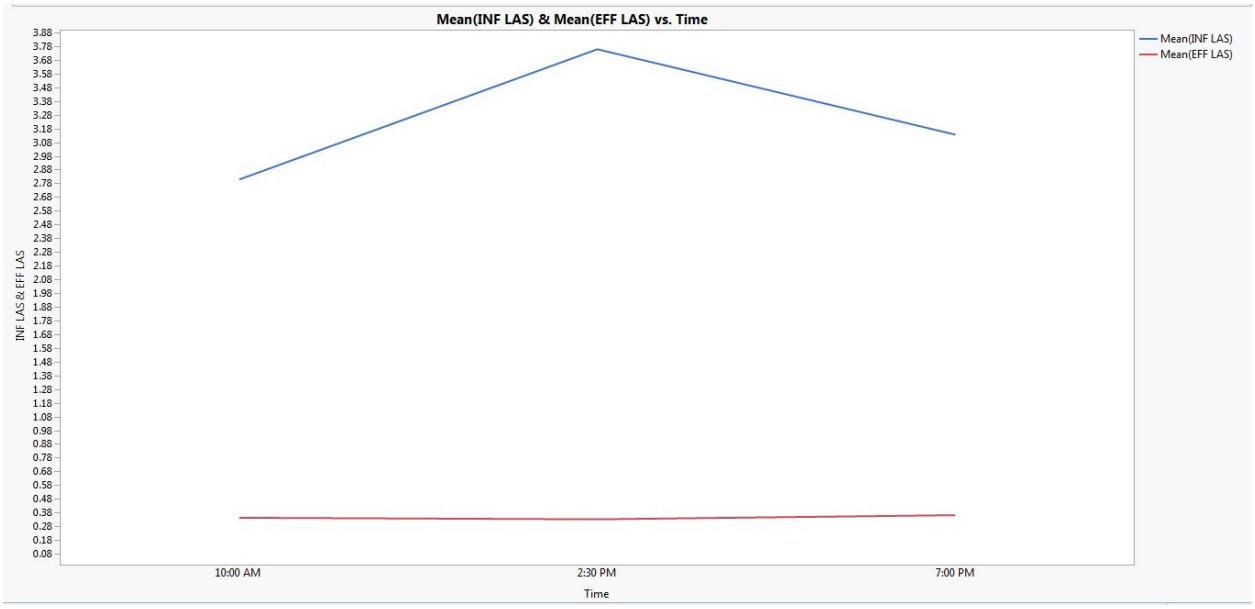

Figure 3. Influent LAS and effluent LAS vs. time.

The graph demonstrates the significant initial difference between the levels of influent LAS and effluent LAS constituting 2.4 mg/l (average) during the morning (10:00 AM), with influent LAS constituting 2.78 mg/l and effluent LAS making 038 mg/l. The climax difference is reached during the afternoon, with effluent LAS being stable and influent LAS rising to its highest point of 3.78 mg/l. The difference constituents 3.4 mg/l during the afternoon (2:30 PM). Nevertheless, the disparity decreases by evening, with the effluent LAS being stable and influent LAS lowering to the point of 3.08 mg/l. The difference makes 2.7 mg/l during the evening (7:00 PM). This may be explained by the fact that the flow of water increases during the morning and evening, thus the level of influent LAS is lower. However, during the day, when the industrial activity occurs, the level is significantly increasing in the case of influent LAS. Thus, the fluctuations within an operation cycle show that the maximum concentrations can be found in the effluent.

It is also important to investigate the LAS difference in accordance to the time of measurement. The graph of LAS difference resembles the previous graph (Figure 3).

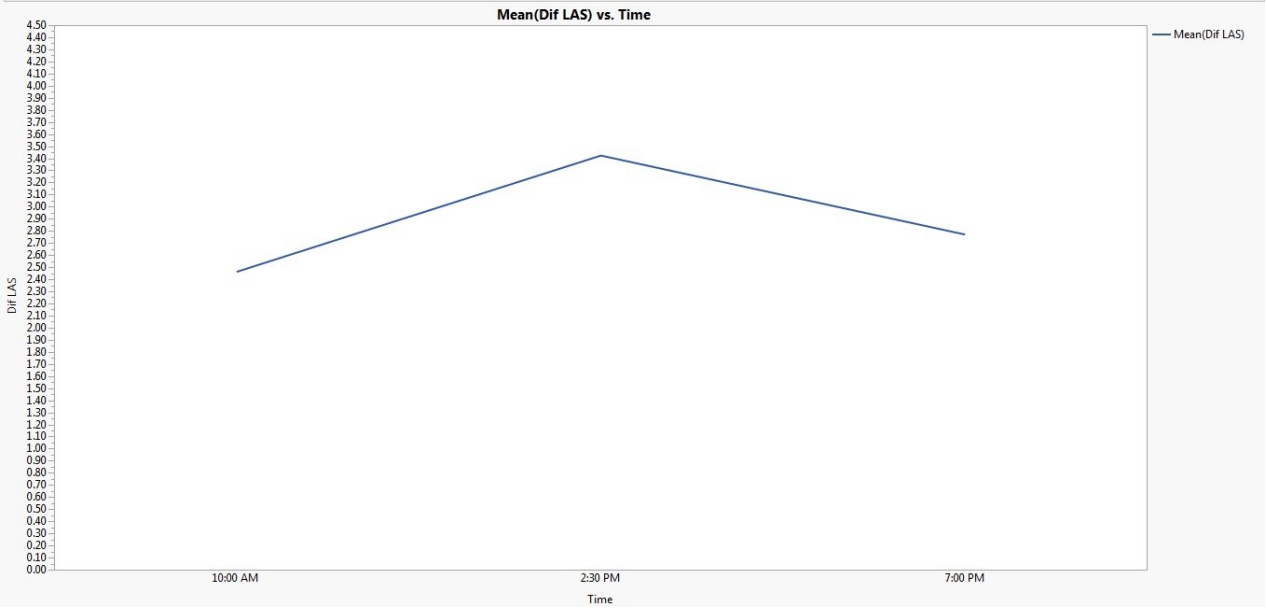

Figure 4. LAS difference vs. time.

Therefore, the LAS difference in the morning (10:00 AM) constituent 2.40 mg/l. The difference reaches the climax in the afternoon (2:30 PM), making 3.50 mg/l. The ratio of the LAS difference in the evening (7:00PM) drops making 2.80 mg/l. Therefore, it is obvious that the difference reaches the lowest level before the morning due to the fact that there is a morning influent of the water. The level of LAS difference reaches the climax due to the fact of the industrial activity presence of the Wastewater Treatment Plant (OECD SIDS, 2005). The LAS difference drops in the evening due to the presence of the evening influent of water.

Influent LAS and Effluent LAS vs. Temperature

Thirdly, influent LAS and effluent LAS have been analyzed from the viewpoint of temperature changes. As a matter of fact, both influent LAS and effluent LAS levels illustrated a serious variability of graphs, with the results of the influent LAS being more stable in comparison to effluent LAS. The lowest temperature researched 50ºF, while the highest temperature is 62ºF.

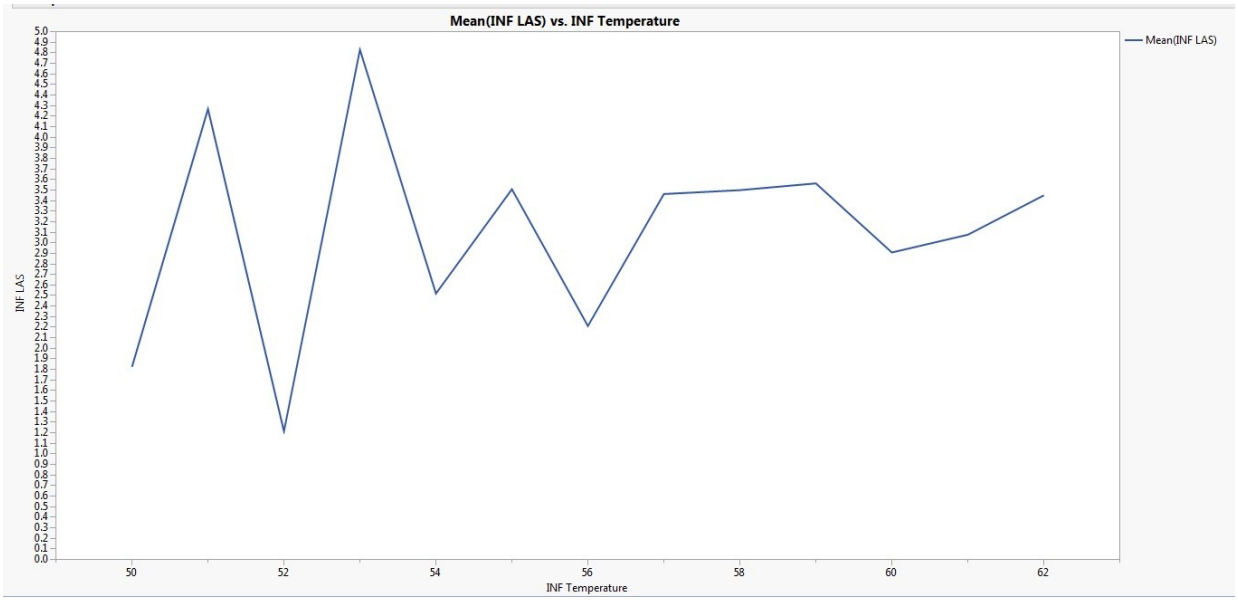

Figure 5. Influent LAS and influent temperature.

The graph depicts that the level of influent LAS was highly different in accordance to the temperature recorded with the lowest temperature recorded (50ºF) at the level of 1.8 mg/l. This level seriously increased to 4.3 mg/l with the temperature rising to the mark of 51ºF. Moreover, this level considerably drops with the temperature rising by 1ºF and amounted 1.2 mg/l. With the further increasing by 1 ºF, the ratio changed to 4.9 mg/l and dropped to 2.7 mg/l with the temperature constituting 54 ºF. There was noted a smooth rising to the point of 3.4 m/l when the temperature scale reached 55 ºF and insignificant drop, when the indicator changed b 1 ºF to 2.1 mg/l.. Afterwards, the graph illustrated that influent LAS increased to 35 mg/l with the temperature indicator showing 57 ºF and was comparatively stable with the temperature rising to 59 ºF. However, it decreased with 60 ºF to the level of 3.0m/l constantly growing while the temperature reached the point of 62 ºF. The influent LAS depicted 3.3 mg/l as the final ratio. In fact, such a graph depicts that fluctuations are more evident at a lower temperature, tending to become more stable at higher temperature. Actually, the changes of the influent LAS are very volatile. Therefore, it is highly important to analyze them comparing to the results noted by the comparisons of ratios with the days and days' period as it is practically impossible to find the tendency of the ratio alterations.

The graph, which illustrates the effluent LAS in comparison to the temperature indicators, presents highly different results.

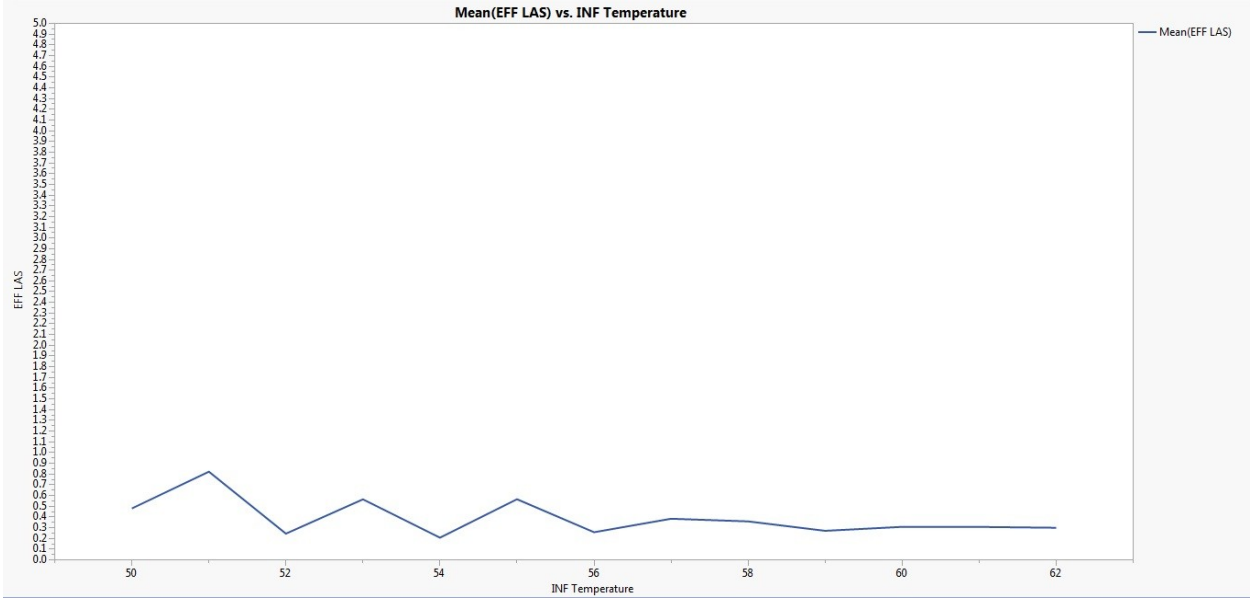

Figure 6. Effluent LAS vs. influent temperature.

The graph is comparatively milder than the one that evicted the dependence between the influent LAS ratio and temperature. The influent LAS ratio constituted 0.4 mg/l at the lowest temperature recorded (50ºF). The figure rose to 0.8 mg/l with the temperature rising to 51 ºF. With the next 1ºF, the ratio of effluent LAS decreased to 0.3 mg/l. Effluent LAS ratio increased to 0.6 mg/l at the temperature indicator of 53 ºF and returned to the previous ratio of 0.3 mg/l with the following rising of the temperature. The ratio constituted 0.5 mg/l at the temperature level of 55 ºF and lowered to 0.4 mg/l. As a matter of fact, the ratio ranged between 0.3 mg/l and 0.4 mg/l during the following increasing of the temperature. Therefore, it may be concluded that effluent LAS ratio may be considered as much more stable in comparison to influent LAS. The primary difference between influent LAS and effluent LAS constitutes 1.4 mg/l at the lowest temperature of 50 ºF. The disparity between influent LAS and effluent LAS constitutes 3 mg/l at the highest temperature measured of 62 ºF. Nevertheless, the differences between the influent LAS and effluent LAS are extremely high and unstable in the measurements between the lowest and the highest temperature recorded within the period of eight weeks. In practice, it is extremely

important to research and analyze the differences between overall LAS levels and influent temperature.

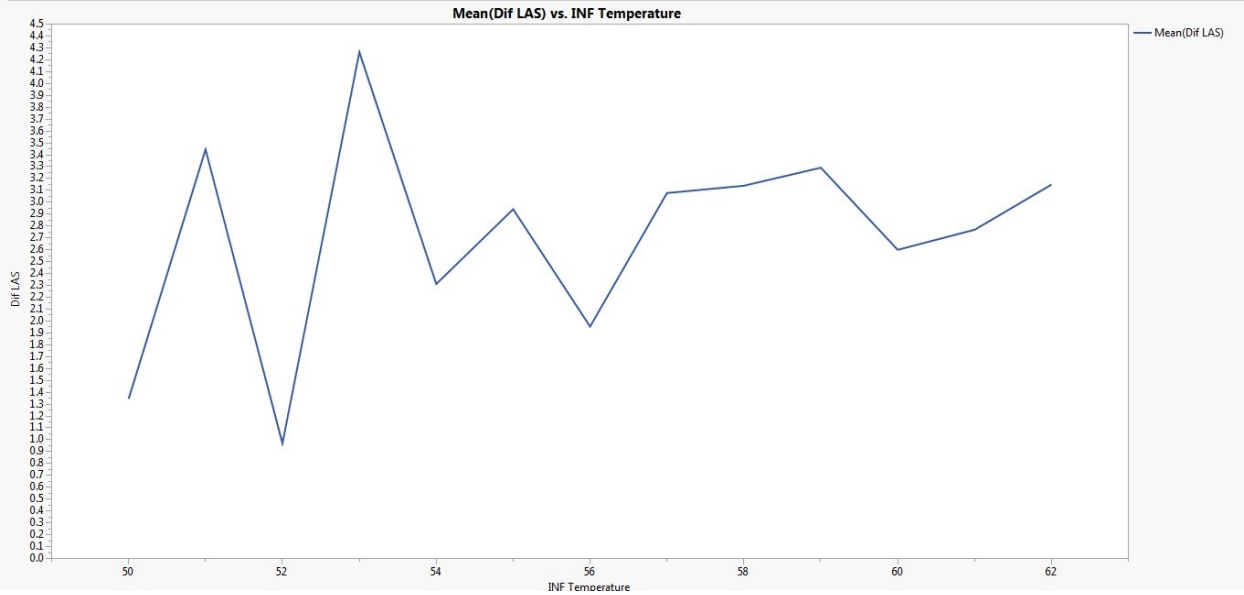

Figure 7. LAS difference vs. influent temperature.

The LAS levels are developing according to the same scheme as influent LAS ratios. The LAS difference ratio constituents 1.3 mg/l at the lowest temperature of 50 ºF. It increases to 3.6 mg/l at the temperature of 51 ºF and significantly drops to 0.9 mg/l at the temperature 52 ºF. The ratio of LAS difference increased to the climax of 4.3 mg/l at the temperature indicator of 53 ºF and afterwards dropped to 2.4 mg/l at the indicator of 54 ºF. There was a slight increase of LAS difference mean to 3.0 mg/l at the temperature of 55 ºF and decreased to 2.0 mg/l with the temperature of 56 ºF. Afterwards was a serious rise to 3.1 mg/l with the following increasing of the temperature, marking the position of 3.4 mg/l at the temperature indicator increasing from 56ºF up to 59 ºF. The graph depicts the decrease of the LAS difference indicator to 2.6 mg/l at the temperature of 60 ºF, with a smooth increase following this position. The LAS difference ratio increased to 3.1 mg/l at the highest temperature indicator of 62 ºF. The LAS difference ratio is highly unstable in accordance to influent temperature. It resembles the graph of influent LAS

ratio (figure 6). In the case when temperature is lower, the graph is instable and rattling. The relative stability may be observed with the higher indicator of temperature, when fluctuations are more comparatively smooth.

It is highly important to compare the differences between influent LAS and effluent LAS together with the LAS difference in accordance to the influent and effluent temperature, paying significant attention to the day type.

Table 1.

Day	Time	IINF Temp	INF LAS	EFF Temp	EFF LAS	Dif Temp	Dif LAS	Day type
Friday	10:00AM	55	5,19	50	0.51	5	4.68	Weekday
Friday	2:30PM	58	6.295	53	0.52	5	5.975	Weekday
Friday	7:00PM	55	2.205	40	0.405	15	1.8	Weekday
Sunday	10:00AM	50	2.58	40	0.445	15	2.135	Weekend
Sunday	2:30PM	50	1.41	40	0.375	10	1.035	Weekend
Sunday	7:00PM	50	1.485	35	0.62	10	0.865	Weekend

The table provides the differences measured during the last day of the working week (Friday) comparing to the last day of the weekend period. As a matter of fact, it is obvious that the influent ratio differs significantly within the day period, reaching the highest position in the afternoon (2:30 PM). The ratio is quite high in the morning (10:00AM) reaching 5.19 mg/l, it increases to 6.295 mg/l, which is the climax in the afternoon (2:30PM) and significantly drops to 2.205 mg/l in the evening (7:00 PM). If we compare these figures to the same ratio on Sunday, we will see significant differences. The level of influent LAS constituents 2.58 mg in the morning, drops to 1.41 mg/l in the afternoon and slightly increases to 1.485 mg/l in the evening. The difference can be easily explained by the absence of the industrial activity in the Wastewater Treatment Plant on the last day of the weekend, when the ratio of the influent LAS detects the lowest measurements. On the other hand, the levels of influent LAS do not illustrate such a significant difference. These ratios make 0.51 mg/l in the morning, 0.52 mg/l in the afternoon

and a slight increase to 0.405 in the evening of Friday. The effluent LAS constituents 0.445 mg/l in the morning, a slight decrease to 0.375 mg/l and significant lowering to 0.62 mg/l on Sunday evening. The highest ratio is revealed during the afternoon of the last of the working week, when the industrial activity is present. The lowest ratio is projected in the evening of the last day of the weekend, with the absence of a working industrial activity (OECD SIDS, 2005). Therefore, the highest LAS difference may be noted on the evening of the last working day (Friday), which constituents 5, 975 mg/l, while the lowest LAS difference is observed on the Sunday evening, making 0.865 mg/l.

References

Cirelli, A. F., Ojeda, C., Castro, M. J., & Salgot, M. (2010). Surfactants in sludge-amended agricultural soils: A review. In *Organic Farming, Pest Control and Remediation of Soil Pollutants* (pp. 227-251). Springer Netherlands.

Moldovan, Z., Avram, V., Marincas, O., Petrov, P., & Ternes, T. (2011). The determination of the linear alkylbenzene sulfonate isomers in water samples by gas-chromatography/mass spectrometry. *Journal of Chromatography A*, *1218*(2), 343-349.

OECD SIDS. (2005). 'Linear alkylbenzene sulfonate', SIDS Initial Assessment Report, 1-357.

Prats, D., Lopez, C., Vallejo, D., Varo, P., & Leon, V. (2006). Effect of temperature on the biodegradation of LAS and alcohol ethoxylates. *Journal of Surfactants and Detergents*, *9*(1), 69-75.