"Municipal Wastewater Treatment by a "Prototype Nano Sewerage Treatment Plant(STP)"

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Introduction

Despite the importance of water as a valuable life supporting resource, it is under continuous threat as a consequence of climate change, booming population, industrial activities, and generation of huge amount of waste (Jhansi and Mishra 2013; Ouyang 2005; Battaglin et al., 2007). Due to the drastic improvement of living standards, generation of emerging pollutants has also increased from many activities (Trépanier et al. 2002). On the other hand, water resource is becoming scarce day by day (Esteban and Miguel 2008). Therefore, it has become essential to treat the wastewater and reuse it as much as possible. Though wastewater reuse was initially preferred for agricultural use (Angelakis et al. 1999; Fatta-Kassino et al. 2011; Pedrero et al. 2009), the reuse of wastewater for urban and industrial purposes has now become paramount in several countries. However, feasibility of reclaimed water for municipal and industrial applications is dependent upon the level of wastewater treatment (Kellis et al. 2013).

Methodology

Figure 1: Image of the Pilot Plant Setup

The pilot study was conducted to test its performance to meet the local wastewater quality specification as set by the (Suruhanjaya Perkhidmatan Air Negara, SPAN). The system was designed to meet the effluent quality specifications stipulated in Standard A of the Environmental Quality Act of Malaysia (Table 1). The wastewater was tested against the 5 parameters as listed in Table 1, where the mean influent quality is also given.

Pollutant	Concentration (mg/L)	
	Mean Influent	Standard - A
Biochemical Oxygen Demand (BOD)	220	20
Chemical Oxygen Demand (COD)	412	120
Total Suspended Solids (TSS)	117	50
Ammoniacal Nitrogen (AN)	34.6	10
Oil and Grease (O&G)	18.7	5

Table 1:Wastewater Characteristics and Allowable

Results & Discussion

The plant was locally fabricated and installed at the commercial premise close to EcoClean Technology Sdn. Bhd. Then the system was partially filled with active sludge from biological wastewater treatment plants of similar nature. The pilot plant was batch fed with the raw wastewater. The water samples from the influent and effluent locations of the plant were collected and sent to the lab for testing. The pollutant reduction stabilized after 3 months (Table 2), when the start-up period was considered completed. After the start-up period, the BOD concentrations was reduced by 98%, COD by 94% Ammoniacal nitrogen by 90%, oil and grease, and TSS by 99%. These results prove that Class A water quality can be achieved.

Figure 2 : Physical camparison of water samples from different locations of the treatment system

Parameter	Sample from					Reduction (%)
	Influent	Anaerobic	FICCO 1	FICCO 2	Effluent	
pH (Unit)	7.08	6.53	7.50	7.22	7.12	-
Turbidity (NTU)	106	55	14	8	3	97.2
TDS (mg/L)	245	274	209	152	138	43.7
TSS (mg/L)	147	53	21	9	2	98.6
BOD (mg/L)	35	22	7	4	2	94.3
COD (mg/L)	267	198	83	37	6	97.8
AN (mg/L)	23.8	31.0	17.2	11.4	2.1	91.2
O&G (mg/L)	31	7.4	0.3	<0.1	<0.1	99.0

Table2 : Pollutant Reduction Performance of at Various Unit Processes

Conclusion

Chemo-autotrophic Activated Carbon Oxidation System (CAACO), presented in this report used to improve activated carbon technology patented to solve some problems posed by conventional sewage treatment plants (STPs) in Malaysia. High surface area (218 m^2/g) of the actiaved carbon allowed high bacterial density per gram of the media. This, in turn, enabled the design of small STPs to handle sewage loading comparable to that of conventional STPs. The Chemo-autotrophic Activated Carbon Oxidation System required less energy and mechanical equipment compared to conventional STPs. It used closed system which reduced odour, and can be scaled to any size to meet specific requirements. The setup time for this pilot plant was very short and it took about 3 months to complete the start-up period and to deliver satisfactory performance. This results of the pilot plant indicated that this technology is indeed capable of treating wastewater to produce high quality effluents. There is also a potential to reuse the effluent with some additional treatment depending on the usage and desired quality of recycled water. One of the main benefits of this technology is the modular nature of the system, where many small reactors can be used together for treatment instead of one big reactor. Such modules can also be added to the existing treatment plants to handle the increased load due to increased population serving the sewerage catchment.