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Use of Coagulation for Post Treatment of UASB Effluent

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ABSTRACT

Exploratory experiments were performed to test the feasibility of coagulation and flocculation as a post treatment process for the effluent of an Upflow Anaerobic Sludge Blanket (UASB) reactor treating domestic sewage. Commonly used coagulants [Alum, Polyaluminium Chloride (PAC)] were utilized in a series of jar tests to determine the optimum coagulant dose. The optimum chemical dosage was 500 mg/L to 600mg/L for [Alum, Polyaluminium Chloride (PAC)] respectively.It was found that all the tested coagulants were effective in reducing the effluent BOD ,COD and SS Coagulation treatment is also efficient in reduction of nutrient from wastewater because by coagulation we can reduce Phosphorous and Nitrogen up to 85-92 % and 75-85% respectively. It was found Coagulation give better results than aeration for post treatment of UASB effluent.

Keywords : UASB, Coagulation, Alum, PACL, Post treatment, Aeration

I. INTRODUCTION

Anaerobic treatment is regarded as the core technology for energy and nutrient recovery from source separated black water because it converts organic matter to methane, which can be used to produce electricity and heat, while at the same time anaerobic treatment yields low amounts of excess sludge. The nutrients are largely conserved in the liquid phase and can be subsequently recovered with physical-chemical processes such as precipitation and ion-exchange or removed biologically.(Kujawa K.; and Zeeman G.(2006)) Depending on the distance to agricultural fields, direct reuse of nutrient rich anaerobic effluent is possible if it is treated to remove pathogens and micro-pollutants.

Environmental preservation efforts and developments in the technology have resulted in stringent discharge standards. With environmental regulations becoming more stringent, regulatory compliance has also become a matter of increasing concern to the poultry industries. Therefore, there is a need to install effective post-treatment technologies, after undergoing anaerobic processes treating heavily contaminated waste streams, such as poultry manure wastewater. To meet strict laws on environmental protec- tion, pollutant loads discharged from the poultry industries should be first reduced to a significant extent, and a proper post-treatment (polishing) step should be further applied to improve the quality of the final discharge in terms of residual pollutant contents (Kaan Y., Fatih I., Zehra S., Suleyman S.,Talha M. (2008))

In warm climate countries, the high rate anaerobic process presents satisfactory treatment performance, even for diluted domestic wastewater, with many advantages, including reduction of green house gas emissions, energy gains, reduced excess sludge

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productions, stabilised sludge, and low space requirements (van Lier and Huibers, 2004). In particular, the upflow anaerobic sludge blanket (UASB) reactor is a reliable and simple technology for domestic sewage treatment (van Haandel and Lettinga, 1994).

Despite all those advantages, anaerobic processing cannot be considered as an unitary (one-step) treatment system, since its effluent requires further stages to improve water quality enough to reach discharge or reuse standards required by the Brazilian environmental standards (Chenicharo and Machado, 1998). Anaerobic systems effluents may still contain residual organic matter, nutrients and pathogens, which must be removed in a post-treatment stage (van der Steen et al., 1999).

II. MATERIALS AND METHODOLOGY

The study was carried out at UASB Plant, Bamroli, is situated in Surat. The sample was collected from inlet, just after UASB and final effluent. The collected sample was stowed in plastic cans. Then, they were stored in deepfreeze at 4 °C to minimize substrate decomposition and also odor from sample.

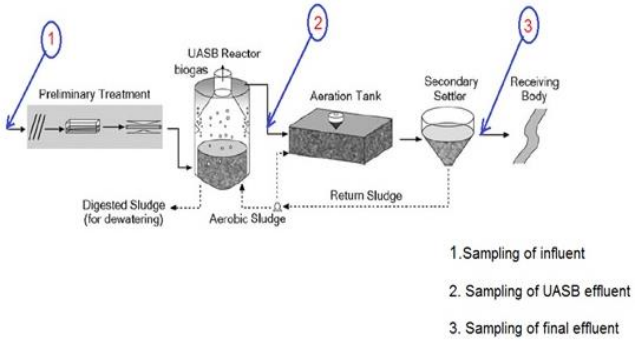

Fig. 1. Sampling point of study

The samples were analyzed for pH, Solids, BOD, COD, Nitrogen, Phosphorous, and Coliform in the laboratory. This study is about the post treatment of UASB effluent using coagulation so Jar tests was carried out to determine optimum coagulant dose for post treatment of UASB effluent.The coagulants used in this study were Alum and Poly Aluminium chloride (PACl). Turbidity was measured of each sample after allow to settle for enough time. Then from the reading of the turbidity the optimum dose of the Alum and Poly Aluminium chloride (PACl) were decided. The remaining treated samples were then analyzed for pH, Solids, BOD, COD, Nitrogen, Phosphorous, and Coliform in the laboratory.

III. RESULT AND DISCUSSION

Jar test was performed to determine the optimum dose of coagulant.

Table No.1 : Determination of optimum dose of coagulant

	Turbidity in NTU (Alum)		Turbidity in NTU (PACl)	
Dose (mg/lit)	**Test-1**	**Test-2**	**Test-1**	**Test-2**
0	148	498	150	458
10	90	452	101	370
20	50	436	63	239
50	19	324	29	167
100	10	235	17	124
250	9	102	5	89
350	6	57	4	10
500	**5**	**6**	**4**	7
650	5	8	2	**5**
800	4	7	3	6
1000	-	6	-	3
1200	-	5	-	2

Turbidity readings which are highlighted indicating maximum dose require for post treatment. Then these treated samples were analyzed for Solids, BOD, COD, Nitrogen, Phosphorous, and Coliform in the laboratory.

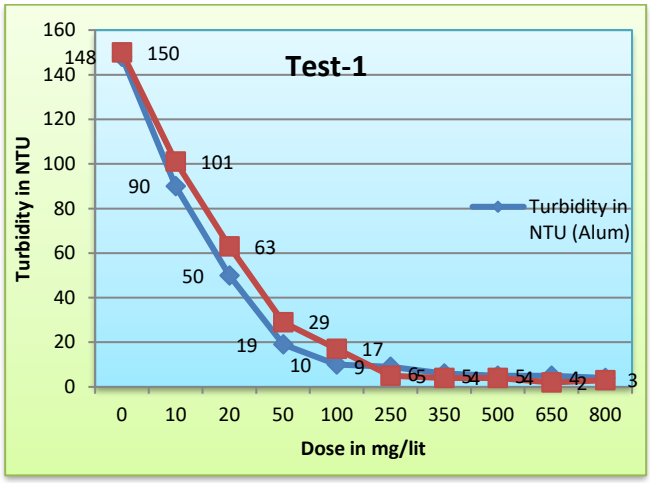

Fig. 2. Reduction of turbidity in test

TABLE.2. REDUCTION BY PACL OF UASB EFFLUENT

Parameters		UASB Outlet	PACl		Effluent of SST	
				% removal		% removal
TSS	Test -1	585	242	58.63	480	17.95
(mg/lit)	Test -2	700	149	78.71	600	14.29
TDS	Test -1	560	217	61.25	510	8.93
(mg/lit)	Test -2	630	234	62.86	490	22.22
TS	Test -1	1145	459	59.91	990	13.54
(mg/lit)	Test -2	1330	383	71.2	1090	18.05
COD	Test -1	210	89	57.619	176	16.19
(mg/lit)	Test -2	340	80	76.47	168	50.588
BOD (mg/lit)	Test -1	108	76	29.629	94	12.962
	Test -2	138	74	46.376	114	17.391
PO_4^{-3}	Test -1	2.9	0.21	92.76	1.46	49.66
(mg/lit)	Test -2	4	0.52	87	2	50
Nitrogen	Test -1	26.6	3.36	87.37	12.6	52.63
(mg/lit)	Test -2	37	5.74	84.49	16.8	54.59
Coliform	Test -1	93000	28	99.97	-	
	Test -2	360000	38	99.99	-	

TABLE.3. REDUCTION BY ALUM OF UASB EFFLUENT

Parameters		UASB Outlet	Alum		Effluent of SST	
				% removal		% removal
TSS	Test -1	585	142	75.73	480	17.95
(mg/lit)	Test -2	700	190	72.86	600	14.29
TDS	Test -1	560	258	53.93	510	8.93
(mg/lit)	Test -2	630	297	52.86	490	22.22
TS	Test -1	1145	400	65.07	990	13.54
(mg/lit)	Test -2	1330	487	63.38	1090	18.05
COD	Test -1	210	106	49.52	176	16.19
(mg/lit)	Test -2	340	120	64.705	168	50.588
BOD (mg/lit)	Test -1	108	82	24.074	94	12.962
	Test -2	138	92	33.333	114	17.391
PO_4^{-3}	Test -1	2.9	0.38	86.9	1.46	49.66
(mg/lit)	Test -2	4	0.41	89.75	2	50
Nitrogen	Test -1	26.6	4.06	84.74	12.6	52.63
(mg/lit)	Test -2	37	7.98	78.43	16.8	54.59
Coliform	Test -1	93000	43	99.95	-	
	Test -2	360000	93	99.97	-	-

Table No.2 and 3 showing summery of whole results and comparison between quality of effluent of aeration tank and sample which was treated with coagulation. It is observed that by coagulation (Alum and PACL) we can reduce TS, TDS and TSS up to 75%, 50-55% and 65-63% respectively. But in case of aeration followed by SST we can achieve reduction up to 15-20% only.

It is observed that by coagulation Phosphorous and Nitrogen can be reduced up to 85-92 % and 75-85% respectively and it is far better than 55% reduction achieved by Aeration. we can reduce COD and BOD

up to 75 % and 45 % respectively, But by using aeration only 20 to 50 % reduction in COD and BOD.

TABLE 4. COMPARISON PERCENTAGE REDUCTION OF COAGULANTS

	ALUM	PACL	Post treatment of plant
Phosphurous %	88.33	89.78	49.83
Nitrogen %	81.58	85.93	53.61
COD %	57.11	67.04	50.389
BOD %	28.7	38	15.17
E-Coli %	99.96	96.13	0
TS %	62.41	64.13	13.38
TDS %	53.39	62.05	18.75
TSS %	71.42	66.36	16.12

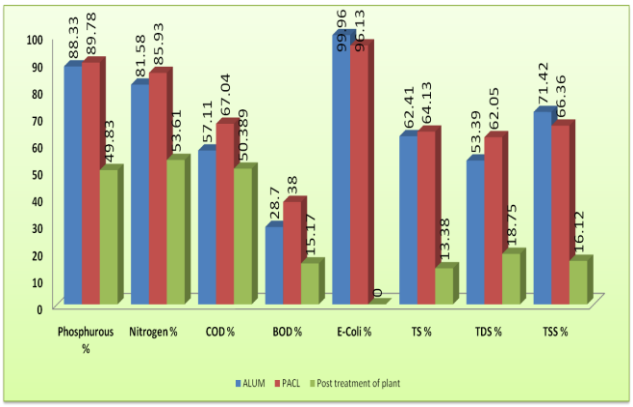

Fig. 3. Comparison in reduction efficiency of Alum and PACL.

From fig.3 It is clear that coagulation is better option for post treatment of UASB effluent camper to Aeration because average percentage reduction by aeration is less in all of the parameters

IV. CONCLUSIONS

The optimum chemical dosage was 500 mg/L to 600Mg/L for [alum, polyaluminium chloride (PAC)] respectively. It was found that both tested coagulants were effective in reducing the effluent BOD, COD, TS, TDS, TSS.

Coagulation treatment is also efficient in reduction of nutrient from wastewater because by coagulation we can reduce Phosphorous and Nitrogen up to 85-92 % and 75-85% respectively. There was excellent removal of bacteria by coagulation Alum and PACl and it was almost 99%.

Overall, the combination of anaerobic digestion and coagulation has proven to be a very efficient method for wastewater treatment achieving final COD concentrations lower than 100 mg/L. so coagulation is a good option for post treatment of UASB effluent.

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VI. REFERENCES

[1]. Aiyukabc S.,Odonkor P., Nkoebe T., Adrianus V and Verstraete W. 2010. Technical Problems Ensuing From UASB Reactor Application in Domestic Wastewater Treatment without Pre-Treatment. International Journal of Environmental Science and Development, Vol.1, No.5, 392-398.

[2]. Chernicharo L. 2006. Post-treatment options

for the anaerobic treatment of domestic wastewater. Environmental Science and Bio/Technology 5, 73–92.

[3]. Choo S. Tai, Kripa S. Singh and Shannon R. Grant. 2006. Post-Treatment of Anaerobic Bioreactor Effluent Using Jet Loop Reactor (JLR). Water Qual. Res. J. Canada, Volume 41, No. 3,pp 316–324.

[4]. Georgiou M., Gizgis N.,Diamadopoulos E. Sept. 2001. Anaerobic treatment of primary domestic wastewater by means of a UASB reactor followed by coagulation. 7th International Conference on Environmental Science and Technology Ermoupolis, Syros island, Greece. 235-242.

[5]. Kaan Y., Fatih I., Zehra S., Suleyman S.,Talha M. (2008)"Decolorization and COD reduction of UASB pretreated poultry manure wastewater by electrocoagulation process: A post-treatment study" Journal of Hazardous Materials 162 (2009) 120–132

[6]. Klimiuk, U. Filipkowska, B. Libecki. 1999. Coagulation of Wastewater Containing Reactive Dyes with the Use of Polyaluminium Chloride (PAC). Polish Journal of Environmental Studies Vol. 8, No. 2, 81-88.

[7]. Kujawa K.; and Zeeman G.(2006) "Anaerobic treatment in decentralised and source-separationbased sanitation concepts". Rev. Environ. Sci. Bio/Technol. , Vol. 5, pp 115-139.

[8]. Lew, S. Tarre, M. Belavski and M. Green. 2004. UASB reactor for domestic wastewater treatment at low temperatures: a comparison between a classical UASB and hybrid UASB-filter reactor. Water Science and Technology, Vol. 49 No 11–12, 295–301

[9]. Marthe S., Hardy T , Grietje Z and Cees J.N.(2010)"Anaerobic Treatment of Concentrated Black Water in a UASB Reactor at a Short HRT" ISSN, Water, Vol. 2,pp 101-119.

[10]. Miranda L., Henriques J.,andMonteggia L.October - December, 2005. A full-scale UASB reactor for treatment of pig and cattle slaughter house wastewater with a high oil and grease content. Brazilian Journal of Chemical Engineering. Vol. 22, No. 04, 601 – 610.

[11]. Tawfik, M. Sobhey, M. Badawy. 2008. Treatment of a combined dairy and domestic wastewater in an up-flow anaerobic sludge blanket (UASB) reactor followed by activated sludge (AS system). Desalination 227, 167–177.

[12]. Tandukar M., Uemura S., I. Machdar, A. Ohashi and H. Harada. 20.05. low-cost municipal sewage treatment system with a combination of UASB and the "fourth-generation" down flow hanging sponge reactors. Water Science & Technology Vol. 52 No 1-2, 323–329.