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The Effect of Basic Parameters on the Quality of Effluent Waste Water

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Abstract

The effect of the shape of impellers on the wastewater treatment process is investigated in this research. Wastewater from the desalination unit of petrochemical industry is used in treatment tanks. Experiments are held with three different types of impellers in the treatment tanks and the amounts of chemical oxygen demands, biological oxygen demands.

Keywords: wastewater; type; biological; oxygen demand.

Introduction

One of the famous treatment methods to reduce suspended solids and turbidity is the coagulation and flocculation. Coagulation uses salts such as aluminum sulfate (alum) or ferrous of ferric (iron) salts, which bond to the suspended particles, making them less stable in suspension, i.e., more likely to settle out. Flocculation is the binding or physical enmeshment of these destabilized particles, and results in flocs that is heavier than water, which settles out in a clarifier [1].

Scientifics stated that removal of very small particles by gravity sedimentation requires excessively long retention periods [2]. Typically these solids are bacteria, viruses, colloidal organic and fine mineral. Chemical treatment of wastewater containing these solids results in the precipitation of chemical agents which cause flocculation and rapid settling [3].

In addition to solids removal, chemical treatment can help the reduction of organic pollution [4]. A study was made to determine the effectiveness of various mixers on the removal of organic pollutants [5].

Scientifics studied mixing, coagulation and flocculation process with a standard jar test procedure with rapid and slow mixing of a kaolin suspension (aluminum silicate), at 150 rotate per minute and 30 rpm, respectively, in which a cation Al (3+), acts as a coagulant and pectin acts as the flocculent and found that maximum flocculating activity and turbidity reduction are in the region of pH greater than 3, cation concentration greater than 0.5 mM, and pectin dosage greater than 20 mg/L, using synthetic turbid wastewater within the range [6]. The flocculating activity for pectin and turbidity reduction in wastewater is at 99% [7].

Researchers investigated the feasibility of mixing rate and ferric coagulant recovery from chemical sludge and its recycle in chemically enhanced primary treatment (CEPT) and found that the efficiency of coagulant recovery had a linear relationship with sludge reduction [8]. Experiments verify that it would be a sustainable and cost-effective way to recover ferric coagulant from coagulation sludge in water treatment and chemical wastewater treatment and then recycle it to CEPT, as well as reduce sludge volume [9 and 10].

Materials and Methods

In the field of water treatment, mixing and contacting are important unit operations having a fundamental influence on the performance of individual process stages or even on the results of the complete process itself. The ever increasing demands on water quality call for continuous improvement of the cleansing processes. This has led to a marked increase in the general use of mixers for mixing and contacting operations in the treatment units.

Two reactors were used in the laboratory experiment. The procedures included two minutes for rapid mixing, followed by eight minutes of slow mixing and half minutes settling, approximately. Supernatant was taken for determination of turbidity test. Turbidity was measured by turbidity meter. Raw samples, chemically precipitated samples and aerated samples have been analyzed for transmittance (turbidity) and COD. COD was measured using Velp instrument and according to the Standard Method for the Examination of Water and Wastewater, 1992 using the closed reflux, titrimetric method. Table 1 shows analysis for samples from MED of Mobin petrochemical complex.

Table 1.

Composition	Unit	Brine outlet line
Ca++	ppm as CaCO3	14616.3
Mg++	ppm as CaCO3	36080
Fe++	ppm	Trace
Ba++	ppm	Trace
SO_4 --	g/l	5.25
HCO_3 -	g/l	0.185
Total hardness	ppm as CaCO3	453
Salinity	Percent	20
Conductivity	ms/cm	58666
Silica	ppm	0.1
Specific Gravity at 15 c		1.25
pH		10.11
Viscosity (Kinematic)	mm2/s	1.2
TSS	g/l	Trace

Results and Discussion

A submersible mixer is a mechanical device that is used to mix sludge tanks and other liquid volumes. Submersible mixers are often used in sewage treatment plants to keep solids in suspension in the various process tanks and/or sludge holding tanks. The submersible mixer is operated by an electric motor, which is coupled to the mixer's propeller, either direct-coupled or via a planetary gear-reducer. The propeller rotates and creates liquid flow in the tank, which in turn keeps the solids in suspension. The submersible mixer is typically installed on a guide rail system, which enables the mixer to be retrieved for periodic inspection and preventive maintenance.

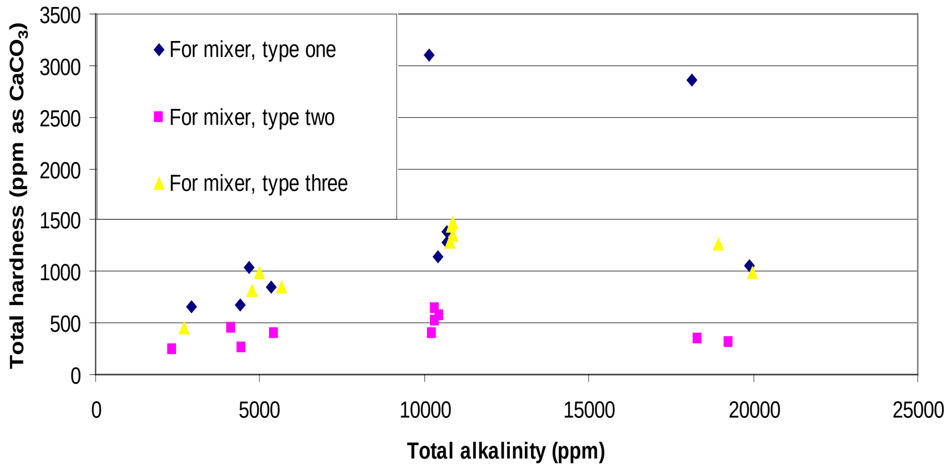

Figure 1. Total hardness versus total alkalinity.

The effect of three types of mixers on the total alkalinity and total hardness is illustrated in Figure 1. All types present relatively poor elimination of total hardness at amount of 10000 of alkalinity. Type two shows the effective elimination in the amount of total hardness in the range of different alkalinity.

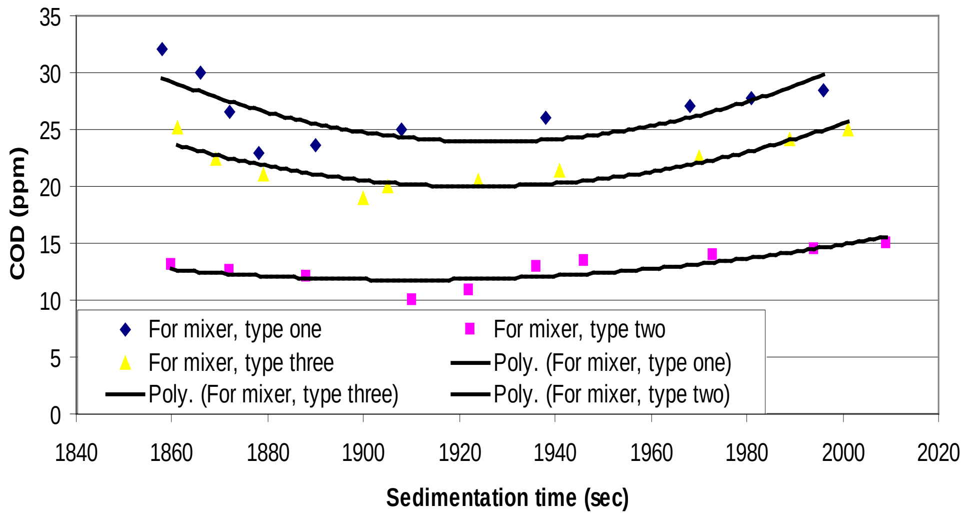

Figure 2. The effect of sedimentation time on the COD.

The mixer type 2 shows the lowest amounts of chemical oxygen demands (in the range of 10 ppm to 15 ppm) in all related sedimentation times. This may be since of the best effect of mixer blades in flocculation mechanism. So, the organic compounds which react with oxygen are trapped between flocs and sediments.

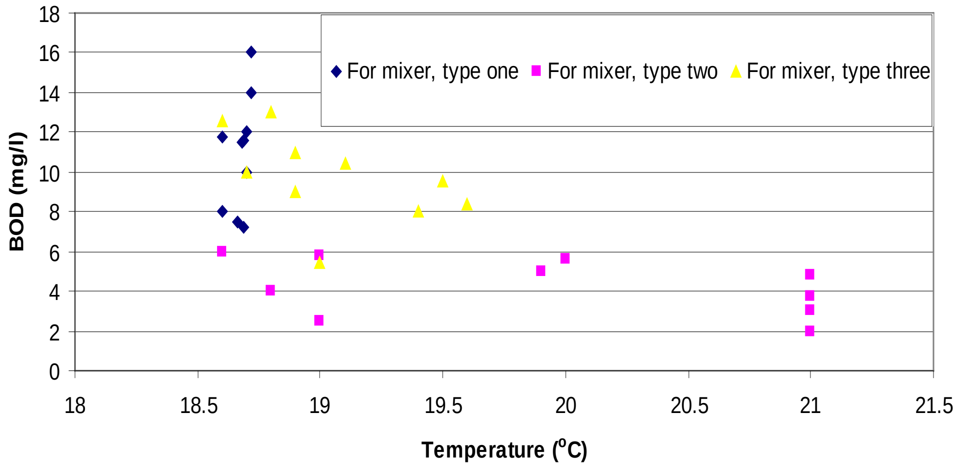

Figure 3. The effect of temperature and mixer shapes on the amount of BOD.

The effect of temperature and mixer shapes on the amount of BOD is investigated in Figure 3. Biological oxygen demand is the major criteria in wastewater treatment. The mixing phenomenon by mixer type 2 increases the temperature of reactor to 21C. the range of BOD values between 18.5 C to 21C are changed between 2 mg/l to 6.2 mg/l, respectively. Temperature distribution is not considerable with mixer type 1, however mixer type 3 and type 2 shows wide temperature distribution, comparably. According to the results in Figure3, the mixer type 2 removes BOD effectively. So, at the adjusted temperature, the smaller amount of BOD is obtained, after using type 2. This may relates to the best effect of blades in mixer type 2 on the coagulation and flocculation of organic compounds. Temperature of environment doesn't show any clear effect in the BOD elimination.

Conclusion

In this study, the effect of mixer blades and the number of blades on the amount of major parameters of treatment process are investigated. Drainage of petrochemical desalination plant makes environmental emissions and treatment of effluent wastewater is considered in this research. The relations between important parameters such as turbidity, total hardness, alkalinity, chemical oxygen demands and biochemical oxygen demands are presented based upon the results of experiments.

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