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Reduction of COD and BOD of synthetic water by Using Advance Oxidation Process (UV/H_2O_2)

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ABSTRACT

In present study, reduction of phenol by advanced oxidation process such as UV/H_2O_2. Many factors influence the oxidation process such as the pH value, contact time and the amount of hydrogen peroxide. The maximum chemical oxygen demand (COD) and biological oxygen demand (BOD) range from 80~533 mg/l and 15~50mg/l were achieved after treatment at phenol concentration 20, 30, 40 and 50 mg/l with 2, 4, 6 and 7 ml of H_2O_2 dosage and contact time 10, 20, 30, 40, and 50 min. The Maximum reduction in COD and BOD were 79.1% and 68%, respectively was achieved by UV/H_2O_2 process.

Keywords— Advance Oxidation Process, UV/ H_2O_2, phenol, H_2O_2, COD and BOD

I. INTRODUCTION

For all living beings, the environment is important. Each and everybody is affected by environmental issues like global warming, depletion of the ozone layer, dwindling forest, energy resources, loss of global biodiversity, etc. Environment study deals with the analysis of the degradation process in water, air, land, soil and organisms which leads to pollution.

Advanced oxidation processes (AOPs), involving various phase systems, are under active investigations. These processes make use of visible light or ultraviolet, different catalysts (TiO_2) and oxidants (oxygen, hydrogen peroxide and ozone) are used to prepare highly reactive radicals (HO·) for the degradation of aqueous pollutants into innocuous mixture [1]. Various pollutants, and dyestuff used in industries such as textile, paper or even food products poses a threat to the environment. During their processing, some are discharged in textile effluents, causing problems to the aquatic environment (absorption and reflection of sunlight, toxicity) [2], [3], [4]. Advanced oxidation processes, although making use of different reacting systems. These attributes to same chemical aspects, i.e. production of OH radicals. They are also characterized by a limited selectivity of being attack which is a useful attribute for an oxidant used in wastewater treatment and for solving decomposition problems. The AOP effect is also increased by the fact that they offer different possible ways for OH radicals' production, thus allowing a better compliance with the specific treatment required [5]. Most of the studies have focused on decolonization, degradation mechanisms, and mineralization reactions in dye- ozone reactions, and few have reported the relationship between ozone-substrate and the stoichiometry of the degradation reaction during ozonation process. Advanced oxidation processes (AOPs) are alternative methods for decolorizing and reducing recalcitrant wastewater loads from textile companies. AOPs are based on the generation of hydroxyl radicals in water, which are highly reactive and non- selective oxidants that can oxidize organic compounds. Accordingly, the ozone-based systems are feasible for decolorizing azo dyes [6]. The advantages of this process are, among others, that no additional disposal problems are involved after treatment because the organic contaminants in the water are almost completely destroyed while removing the color. On the other hand, the use of ultraviolet (UV) light to degrade and destroy organic pollutants within textile wastewater could be a source of toxic dioxin and dioxin-like compound [7] In 1987 the Advance oxidation process was established by Glage and co-worker. After reviewing several research papers, I have concluded that advanced oxidation process is basically not a very new treatment method. Advanced Oxidation Process is general chemical processes which are used for treatment of water and wastewater by oxidation of hydroxyl radical ($OH^{\cdot}$) in sufficient quantity for the

treatment of water. These hydroxyls radical react very rapidly with most organic compound because this hydroxyl radical is powerful and non selective chemical oxidant [8, 9]. The Advance oxidation process may achieve the overall efficiency of compound in some cases. The Advance Oxidation Process may be used as pre/ post treatment for the biological system [10]. After pre treatment of the biological contaminate residue left can be removed from the post treatment process [11]. This technique is used for the treatment of effluent and other waste material released from the industry. Photo catalysis is one of the techniques for the water and wastewater treatment which are called the "Advance oxidation process". The advance oxidation processes mainly work with the UV lamp or solar radiation [12].

Biological Oxygen Demand (BOD) is a measure of the oxygen used by microorganisms to decompose this waste. Chemical Oxygen Demand (COD) is the amount of oxygen consumed by the organic compounds and inorganic matter which were oxidized in water [13].

The word "phenol" which is the part of water pollution and in which include the phenol, C_6H_5OH, and all derivative and it is released from the industry. Phenol is a weak acid, which is rapidly soluble in water and it is also called the carbolic acid, is an aromatic organic compound [14].

II. MATERIAL AND METHOD

- ***Material:***

S.No.	Material used	Specification
01	Phenol	99.9 % purity
02	UV Bulb	9 Watt
03	H_2O_2	1.132 Specific gravity
04	Double distilled water	Chem. Lab India, Gwalior
05	Dosing pump	165-230Volt/50Hz
06	Digital balance	AC-1-ph-Wire Static Meter

- ***Preparation of solution:***

In our experimental study with advance oxidation process (UV/H_2O_2). The solutions were prepared by dissolving the phenol in distilled water with appropriate volume of phenol. It was used 3 liter distilled water, previously homogenized and conditioned to room temperature. Then it was added the phenol compound 60 mg during the first 10 min of the beginning of the reaction and the volume of H_2O_2 6 ml were added after 10 min.

- ***Experimental setup and method:***

All experiments were performed in the batch reactor with UV/ H_2O_2 process at ambient temperature. In this study experimental setup used is shown in fig.1. In an annular glass photo reactor, photoreactions were carried out. The reactor was cylindrical, made of quartz glass which was available for the transfer of reaction. A low pressure UV lamp with monochromatic radiation at 254 nm and a nominal power of 9 W which was immersed in the glass reactor was used. The Outside wall of the reactor was covered with aluminum foil which improves the filtration efficiency of reaction mixture. The reaction mixture was filled into the reaction chamber. The reaction mixture located between the UV lamp and the reactor walls. The feed solution of phenol mixed by needed volume of H_2O_2 is continuously re-circulated through the reactor by using a dosing pump. The samples were withdrawn at different time intervals for estimations of phenol.

Fig.1 Top view of the experimental setup

III. RESULT AND DISCUSSION

From our experiment we collect the sample of water after reduction of phenol for determinig the COD and BOD range after treatment.

Effect on COD of phenol reduction:

From the fig.2 the COD of sample continuously decrease with irradiation time at different levels of phenol concentration by UV/H_2O_2 process. The total reduction of COD was achieved during the process at 20 to 50 mg/l phenol concentration ranging from 80~533 mg/l. The result of this study, the organic and the inorganic presence in water is low because the COD is continuously decreasing.

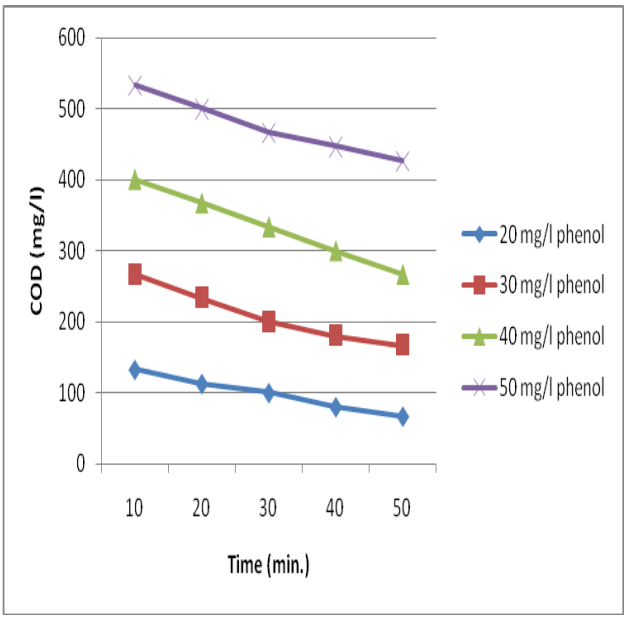

Fig. 2 COD reduction at different concentration of phenol with time

Effect on BOD of phenol reduction:

From the fig.3 the BOD of sample continuously decreases with irradiation time at different levels of phenol concentration by UV/H_2O_2 process. The maximum reduction of BOD was achieved during the process at 20 mg/l phenol concentration ranging from 50~15 mg/l. The result of the study that oxygen demands is also decreased with continuously decreasing the BOD in water.

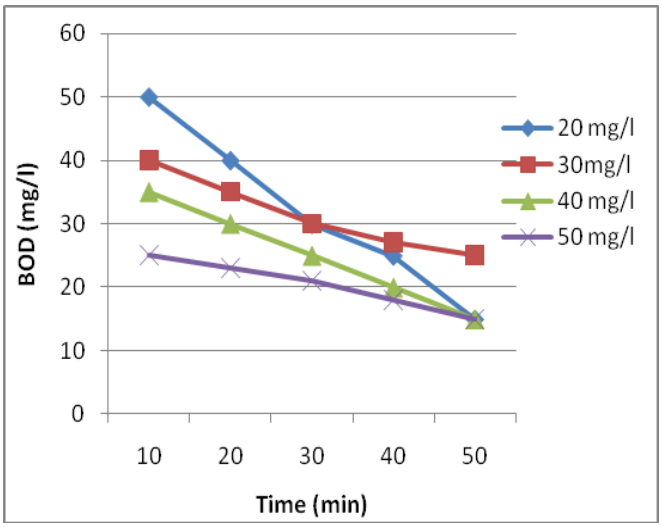

Fig. 3 BOD reduction at different concentration of phenol with time

IV. CONCLUSION

We conclude from the study that the BOD and COD of water continuously decrease with irradiation time and different level of phenol concentration by UV/H_2O_2 process. In the present work, we can see that that is decrease in BOD with time at different concentration of phenol from which we can also conclude that oxygen demand in water also decreases. The COD reduction concluded the organic and inorganic demand in water is also reduced.

REFERENCES

[1] M. LOMORA, "Intermediary Compounds In Advance Oxidation Processes for Waste Water Treatment" Engineering Science. 2011, Vol.4 (53) No. 1-2

[2] Erdemoglu, S., Aksub, s.k. "Photo catalytic degradation of Congo Red by Hydrothermally Synthesized Nanocrystalline tio_2 and Iidentification of Degradation Products by LC-MS." In: Journal of Hazardous Materials 2008, 155, p. 469-476.

[3] Fan, H-J., Lu, C-S., et. al.: Mechanistic Pathways Differences between P25-TiO_2 and Pt-TiO_2 Mediated CV Photodegradation. In: journal of Hazardous materials 2011, 185, p. 227-235.

[4] Hoffmann, et. al., "Environmental Application of Semiconductor Photocatalysis", In: Chem. Rev. 1995, 95, p. 69-96.

[5] Sandip Sharma, et, al, " A general review on Advanced Oxidation Processes for waste water treatment" 2011, 382481, 08-10

[6] Sandip Sharmaa, et, al, "Studies on Degradation of Reactive Red 135 Dye in Wastewater using Ozone" Procedia Engineering 2013, 51, 451 – 455.

[7] Volmajer Valh,et.al, "The applicability of an Advaance Oxidation Process for Textile Finishing Waste streams and fate of persistent organic pollutants" 2012, 6(4), 863-874

[8] Marina Trapido "Ozone based Advance Oxidation Process" Department of chemical engineering, Tallinm University of Technology, Ehitajate tee, 5, 19086

[9] Fagbenro Oluwakemi Kehinde, hamidi Abdul Aziz "Textile waste water and the advanced oxidative treatment process, an overview" 2014, 3, 2319-875

[10] Alessandra Cesaro, Vincenzo Naddeo and Vincenzo Belgiorno "Waste water treatment by combination of Adavnced Oxidation process and conventional Biological system" J. Bioremed Bideg 2013, 4, 8-10000208

[11] John Bergendhl and James O'Shaughnessy "Application of advance oxidation for waste water treatment" 508-831-5772
[12] Carla C.A. Loures, Marco A.K. Alcantra, Helcio J. Izario Filho, Antonio C.S.C. Teixeira, Flavio T. silva, Teresa C.B. Paiva, Gisella R.L. Samanamud "Advance oxidative degradation process: Fundamentals and applications" 2013, 5, 2035-1755
[13] Qiong YANG, Zhenyao , Jidong YANG "Simultaneous Determination of Chemical Oxygen Demand (COD) and Biological Oxygen Demand (BOD5) in Wastewater by Near-Infrared Spectrometry" J. Water Resource and Protection, 2009, 4, 286-289
[14] Ana Paula Barbosa Rodrigues de Freitas Leandro Valim de Freitas Hélcio José Izário Filho, Messias Borges Silva, "Phenol removal via advanced oxidative processes (O3/photo-Fenton) and chemometrics American Journal of Theoretical and Applied Statistics
2013; 2(6): 243-247