

Photodegradation of Halogen Derivatives of Aliphatic Hydrocarbon in Aqueous Solution Photocatalytic Suspensions.

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The rates of photodegradation, reactivities, and mechanisms of photooxidation for the aqueous solution containing with halogen derivatives of aliphatic hydrocarbons have been discussed with kinds of photocatalysts, concentration of photocatalytic suspensions, strength of radiant power, time of illumination, changes of pH of substrate solution, wavelength of radiation, and pressure of oxygen gas saturated in the solution.

These aqueous solution suspended with 0.5 gL^{-1} TiO_2 powder have been photodecomposed in the range of 100 and 93.8 % per 1 hour if it is illuminated with wavelength ($\lambda \geq 300\text{nm}$) produced from Xe-lamp(450W).

The photocatalytic abilities have been increased in the order of $\text{Fe}_2\text{O}_3 < \text{CdS} < \text{CeO}_2 < \text{Y}_2\text{O}_3 < \text{TiO}_2$, and rates of photodegradation for the solution have maximum values in the condition of pH 6 ~ 8 and 3 psi- O_2 /L. These rates for the photooxidation per 1 hour were dependent on the size of molecular weight and chemical bonding for organic halogen

compounds, and the rates of photodegradation were increased in the order of $C_2H_{11}Br < CH_2Br_2 < C_5H_4Cl < C_2H_4Cl_2 < trans-C_2H_2Cl_2 < cis-C_2H_2Cl_2$. The $t_{1/2}$ and $t_{99\%}$ for these solutions were 5~21 and 40~90 minutes, respectively and these values were concided with initial reaction kinetics(r_0)(table 1.).

It was found that reaction of photodegradation have the pseudo first -order kinetics controlled by the amount of h^+_{VB} diffused from a surface of photocatalysts.

Table 1. Initial rates of photocatalytic degradation(r_0), illumination-times required to decompose to 50%($t_{1/2}$) or 99%($t_{99\%}$) and removal percentage of aqueous organic pollutants as a function of illuminate-times in condition of the aerobic processes (TiO₂:0.5g/ℓ, X-lamp:450W ≥ 300nm).

Pollutants	Time of illumination (min)	TOC (mg/L)	Removal (%)	r_o (mmol h ⁻¹)	$t_{1/2}$ (min)	$t_{99.9\%}$ (min)
<i>cis</i> - DCE	0	50.00	0	0.774	5	40
	10	14.01	72.9			
	20	04.50	91.0			
	30	01.68	96.6			
	40	0.000	100.0			
<i>trans</i> - DCE	0	50.00	0	0.506	5	50
	10	11.00	78.7			
	20	3.350	93.3			
	30	1.551	96.9			
	40	1.102	97.8			
	50	1.055	97.7			
60	0.954	98.1				
1,2-Dichloroethane	0	50.00	0	0.49	10	55
	10	24.27	48.4			
	20	14.92	70.2			
	30	8.253	83.5			
	40	4.808	90.4			
	50	2.811	94.4			
60	1.610	96.8				
1-Chloropentane	0	50.00	0	0.46	18	78
	10	37.20	25.6			
	20	22.75	54.5			
	30	11.90	76.2			
	40	3.70	92.6			
	50	3.20	93.6			
60	0.85	93.8				
Dibromomethane	0	50.00	0	0.28	15	90
	10	22.50	42.5			
	20	18.80	65.2			
	30	11.00	78.0			
	40	6.40	87.2			
	50	3.65	92.7			
60	2.45	95.1				
1-Bromopentane	0	50.00	0	0.30	21	95
	10	9.90	80.2			
	20	4.80	90.4			
	30	3.50	93.3			
	40	2.80	94.4			
	50	3.65	92.7			
60	2.75	94.5				