CHAPTER I

INTRODUCTION

The textile industry has traditionally been one of the most important industries in Thailand, creating more 1 million of employment. Its status can be seen from the statistical figures of the year period 1989-1995 which show that the textile industry accounted for the largest export earnings.[1, 2]

However, it is also a potential source of pollution which could have disastrous effects on the ecology of the region. The pollution problem of the textile industry of most concern is the problem associating with water pollution, almost caused by textile finishing industry. Wastewater from textile finishing industry contain large amounts of dyes and chemicals, some of which are highly toxic and undegradable. Treatment of these effluents place heavy burdens on the industry as the costs are relatively high and this inevitably add to their overall costs and undermines their competitiveness.[3]

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[1] Industrial Promotion, Department. Textile Industry ,Division, Process improvement and pollution control management in the textile industries (n.p., 1992), p.1.

[2] Bank of Thailand. Monthly Bulletin 36 (September 1996): 60-63.

[3] Industrial Promotion, Department. Textile Industry ,Division, Process improvement and pollution control management in the textile industries, pp.1-4.

One of the pollution control parameters of concern to this industry is color.[4, 5] Textile dyes are of environmental interest because of their widespread use, their potential for formation of to toxic aromatic amines and their low removal rate during aerobic waste water treatment.[6] In general, dye wastewater can be treated by adsorption onto activated carbon or by coagulant. Those treatment methods mainly transfer the contaminant from wastewater to solid waste. Therefore, further disposal of sludge is needed for adsorption and coagulation processes.[7] There is still no cheap solution to the problem and the law does require that the color of the discharge must not be offensive. The problem is also aggravated by the fact that most of the factories owner regard waste water treatment as something that best be avoided.[8]

Synthetic textile dyes and other industrial dyestuffs constitute the largest group of chemical produced in the world.[9] Azo dyes are broadly used in

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[4] Industrial Promotion, Department. Textile Industry ,Division, Process improvement and pollution control management in the textile industries, (n.p., 1992), pp.1 - 4.

[5] Hung-Yee, S., Ching-Rong, H., "Degradation of commercial azo dyes in water using ozonation and UV enhanced ozonation process", Chemosphere 31 (1995): 3813 - 3825.

[6] Baughman, G.L., and Weber, E.J., "Transformation of dyes and related compounds in anoxic sediment: kinetics and products", Environ. Sci. Technol. 28 (1994): 267 - 276.

[7] Hung-Yee, S., Ching-Rong, H., "Degradation of commercial azo dyes in water using ozonation and UV enhanced ozonation process", Chemosphere 31.

[8] Industrial Promotion, Department. Textile Industry ,Division., Process improvement and pollution control management in the textile industries, p.4.

[9] Vinodgopal, K., Wynkoop, D.E., and Kamat, P.V., "Environmental photochemistry on semiconductor surface: photosensitized degradation of a textile azo dye, acid orange 7 on TiO_2 particle using visible light", Environ. Sci. Technol. 30 (1996): 1660 - 1666.

the textile industry, and also widely employed to color solvents, inks, paints, varnishes, paper, plastic, rubber, foods, drugs, and cosmetics.[10] Some azo dyes have been shown to be or are suspected to be human carcinogens or environmental toxicity. The activated sludge process does not decompose most azo dyes causing a potentially serious disposal problem.[11, 12, 13] The azo dyes in particular can undergo natural anaerobic degradation to potentially carcinogenic amines or toxic substants.[14, 15]

Photocatalytic degradation of water organic pollutants appears to be a promising method, in particular when using Titanium dioxide (TiO_2) as a stable and inexpensive photosensitive material.[16, 17, 18]

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[10] Hung-Yee, S., Ching-Rong, H., "Degradation of commercial azo dyes in water using ozonation and UV enhanced ozonation process", Chemosphere ,31

[11] Ibid.

[12] Weber, E.J., and Adams, R.L., "Chemical- and sediment- mediated reduction of the azo dye disperse blue 79", Environ. Sci. Technol. 29 (1995): 1163 - 1170.

[13] Freeman, H.S., Hinks, D., and Esaney, J., Physico-chemical principles of color chemistry : Genotoxicity of azo dyes: bases and implications (London : An imprint of Chapmand & Hall, 1996), p. 254.

[14] Vinodgopal, K., Wynkoop, D.E., and Kamat, P.V., "Environmental photochemistry on semiconductor surface: photosensitized degradation of a textile azo dye, acid orange 7 on TiO_2 particle using visible light", Environ. Sci. Technol. 30 (1996) :1660 - 1666.

[15] Vinodgopal, K., and Kamat, P.V., "Enhanced rates of photocatalytic degradation of an azo dye using SnO_2/ TiO_2 coupled semiconductor thin films", Environ. Sci. Technol. 29 (1995) ; 841 - 845.

[16] D'oliveira, J.C., Al-Sayyed, G., and Pichat, P., "Photodegradation of 2- and 3- chlorophenol in TiO_2 aqueous suspensions", Environ Sci. Technol. 24 (1990) : 990 - 996.

[17] Tanaka, K., Hisanaga, T., and Harada, K., "Photocatalytic degradation of organohalide compounds in semiconductor suspension with add hydrogen peroxide", New. J. Chem. 13 (1989) : 5 - 7.

[18] Dong, H.K., and Marc, A.A., "Photoelectrocatalytic degradation of formic acid using a porous TiO2 thin-film electrode", Environ. Sci. Technol. 28 (1994) :479 - 483.

The semiconductor particles are irradiated with light and produce photoexcited electrons (e^-) and holes (h^+). These can migrate to the oxide surface and participated in half cell reaction that are part of the closed catalytic cycle. In the aqueous phase, the illuminated surface is widely regard as a producer of hydroxyl radicals and these and other highly oxidizing initial products of this indirect photochemistry go on to attack oxidizable contaminants.[19, 20]

For trying to look for a better system to color elimination which non aromatic amine produced from azo dyes degradation, this study demonstrates dye eliminable treatment process using photocatalytic degradation in TiO_2 aqueous suspension at $\lambda > 310$ nm.

[19] Davi, E., Palmisano, L., and Sclafani, A., "Photocatalytic degradation of phenol by TiO_2 aqueous dispersions: rutile and anatase activity", New J. Chem. 14 (1990) : 265 - 268.

[20] Ollis, D.F., Pelizzetti, E., and Serpone, N., "Destruction of water contaminants", Environ. Sci. Technol. 25 (1991): 1523 - 1529.