CHAPTER (1)

1. INTRODUCTION

Most pollutants in the waste water effluents from industrial or domestic sources comprise of organic chemicals and pathogens which must be removed or destroyed before discharge into the water bodies. Such pollutants prevailing in the ground and surface waters pose irreversible hazards to human and aquatic life. The uncontrolled and heavy discharge of chemicals from industries comprises the major source of water and air pollution. Like any other chemical industry, textile industry is the main source of coloured organic reagents which are called dyes. Dyes are extensively used in the textile industry during dyeing process and in some medical applications, and then the excess dyes are released into the effluent streams as waste after the process. The released wastes are nevertheless in highly concentrated and complex state causing difficulty in handling for further treatment. Most modern synthetic dyes are fairly stable even to the sunlight, with some of them being carcinogenic. Thus the waste water from a textile industry essentially needs an efficient treatment technology which can destroy all pollutants giving ultimately clean water for safe disposal. Several methods have been developed for the removal of dyes from effluents including (1) physical methods employing precipitation, adsorption, and reverse osmosis; (2) chemical methods via oxidation (using air oxygen; ozone, NaOC1, and H_2O_2 as oxidants) and reduction (e.g., Na_2SO_3); and (3) biological methods including aerobic and anaerobic treatment. The disadvantages of these conventional methods are sludge formation, waste disposal and high operation cost, time consuming and ineffectiveness in cases where complicated aromatic compounds are presented[1]

Advanced oxidation processes (AOPs) have been proved to be sufficiently effective alternative method in treating wastewaters containing dyes. Among these processes, heterogeneous photocatalysis techniques using semiconductor material such as TiO_2 could be considered to be the most efficient. This technique involve the use of semiconductor as catalyst which upon illumination by a light that has energy higher than the band gap energy of the catalyst used can form electron-hole pair. This electron-hole pair is the responsible for the formation of oxidized species such as $OH^{\bullet}$ and $O_2^{-\bullet}$ which play an important role in destroying the pollutants. TiO_2/UV system has been used widely, due to its non-toxic, inexpensive, and high reactive nature.[2]

The present work is aimed to the decolourisation and degradation of methylene blue (MB) as organic dye using nano-particles of TiO_2 under illumination of UV light in slurry type reactor sparged by air under different conditions such as, time of operation, initial dye concentration, initial solution pH, catalyst loading and air superficial velocity. Also, the immobilization of TiO_2 on squared glass chips is performed using dip coating technique then the performance of these coated chips is evaluated under the best conditions obtained from slurry reactor. Finally, the order of the reaction was determined by Lagergren's model.