Application of nano particles in removal of microbial pollutants

n.kazemian, A Harzandi

ABSTRACT
seudomonas aeruginosa is a microorganism resistant to chlorine and UV-C irradiation. TiO2 photo catalytic technology can destroy bacteria, which are resistant to oxidative destruction of cell membrane caused by sole UV irradiation. This study aims to investigate the total mineralization of the bacterium (aeruginosa) to the extent of death and cell-mass destruction using TiO2 photo catalytic oxidation process. In this work the effects of parameters such as amount of TiO2, irradiation time, initial concentration of bacterium, presence of ascorbic acid and effect of cell wall on removal of aeruginosa were studied. The data, which were obtained in this study, showed that the optimum concentration of TiO2 was 325 ppm. Also at the initial concentration of TiO_2 equal to 325 ppm and initial microorganism MPN / 100 ml equal to 300 and after 75 min UV irradiation time, P. aeruginosa removal efficiency was 94.3 %. Removal efficiency of aeruginosa in the absence of TiO2 or UV irradiation was very low. Decreasing the concentration of microorganisms increased its removal efficiency. Removal efficiency of spheroplast cells was more than intact cells of aeruginosa, which shows the important role of cell wall on cell resistance against chemical agents. Ascorbic acid had inhibitory effect on this process.

KEYWORDS: AOP, Disinfect, photo catalytic, seudomonas aeruginosa

1. INTRODUCTION

Chemical oxidizing agents such as chlorine and its compounds, ozone, hydrogen peroxide and potassium permanganate are used to treat microbial pollution of waters, but they are not completely efficient on some of resistant microorganisms. Therefore, it is necessary to use more advanced and efficient methods to disinfect waters and wastewaters. Some of the methods that are recently studied for this purpose are advanced oxidation processes (AOPs), which use UV-C irradiation along with a photo catalyst such as TiO2 to destroy the microorganism. When irradiated TiO2 particles are in direct contact with or close to microbes, the microbial surface becomes the primary target of the initial oxidative attack [1]. The wavelength range of UV-C irradiation is from 100 nm to 290 nm (UV-C) [2].

Some metallic oxides and sulfides are used as environmental photo catalysts. They have a completed valence band and an empty conduction band. When the energy of irradiated photons are being equal or more than the split between these two bands, an electron is excited from valence to conduction band and in this way the photo catalytic property is appeared [3].
The most studies in this field have been done on bacteria, especially e. coli, while viruses and yeasts have been least studied. Matsunaga and Tomodo published first report about photo catalytic disinfection on 1985 [4]. They found that in the presence of high concentrations of microorganisms, disinfection process follows the second order rate equation. Saito *et al.* (1992)