An Experimental Study on the Simultaneous Phenol and Chromium Removal From Water Using Titanium Dioxide Photocatalyst

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Abstract

Organic pollutants along with heavy metals and organic metal compounds may cause abnormal changes in physical and chemical parameters (acidity, alkalinity, salinity, color, smell and taste) of aquatic ecosystems and are among the serious threats of environmental health, especially the water resources. In this study, the effect of titanium dioxide photocatalyst with different concentrations (50, 100, 200, 500 and 1000 mg/l) on the simultaneous removal of phenol and heavy metal (chromium) from aqueous solution of the closed system was investigated. In order to determine the optimal concentrations of photocatalyst, all the tests were conducted in pH =7, using ultraviolet light with 100 watt power. The highest rate of phenol and chromium removal was observed at concentration of 100 mg/ml which was equal to 72.3% and 67.2%, respectively. Study of the reaction kinetics showed that the reactions of phenol and chromium removal were zero and first-order, respectively.

Keywords: Photocatalyst; Ultraviolet Radiation; Phenol; Chromium; Titanium Dioxide.

1. Introduction

As Iran is located in a dry and semi-arid region, exploitation of unconventional water resources can be one of the suitable methods to compensate for water deficiency. Pollutants such as heavy metals are stable in these water sources and may cause environmental pollution and alteration of the physical and chemical parameters of the water. Due to their availability for living organisms, these pollutants may endanger the health of aquatic ecosystems, hence, purification these pollutants sounds essential [1].

Heavy metals such as lead, cadmium, mercury, nickel and zinc in various types of bread and lead, cadmium, mercury, aluminum, arsenic, copper and iron in various kinds of salts are among the environmental pollutants; and human exposure to some of them through water and food can result in chronic and sometimes dangerous acute toxicities. Large quantities of natural and human-made heavy metals enter the environment, and the rate of their entry through synthetic ways goes far beyond their harvest by natural processes. Aquatic systems are naturally the final destination of these metals. The source of these pollutants in water includes household wastewater, chemical discharge, pesticides, insecticides and herbivores, industrial discharges, radioactive wastewater, petroleum hydrocarbons and dyes. These pollutants are divided into two types: degradable and non-degradable. Non-degradable pollutants include heavy metal compounds and salts, long-chain phenolic compounds and pesticides accumulated in the environment; they can affect the food chain and biological organisms in water. The increased concentration of these substances has adverse effects on fish, other aquatic organisms and even aquatic plants. The first factor indicating the effects of metals pollutants in an

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