

# EFFECT OF THE RETENTION TIME AND THE PHENOL CONCENTRATION ON THE STABILIZATION POND EFFICIENCY IN THE TREATMENT OF OIL REFINERY WASTEWATER

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## ABSTRACT

Phenols are among the most common organic pollutants because of their toxicity even at low concentrations. The effects of the retention time and the phenol concentration on the stabilization pond efficiency in the treatment of oil refinery wastewater were the purpose of this study, and hence the input of a pilot unit was varied in terms of phenol concentrations and retention time. The following parameters have been examined,  $\text{NH}_4^+$ ,  $\text{PO}_4^{3-}$ , phenol, TCOD, SCOD, TBOD, SBOD and pH. The results showed that the average efficiency in the stabilization ponds varied in the ranges 71.9 – 91.2%, 76.4 – 93.3%, 68.4 – 91.7%, 75.9 – 93.7% and 77.6 – 98.0% for the removal of SCOD, TCOD, SBOD, TBOD and phenol, respectively. These results indicated that the phenol concentration and the retention time affected dramatically the anaerobic and facultative ponds performance, so that the system performance was significantly increased by decreasing the phenol concentration and increasing the retention time. It can be concluded that stabilization ponds show favorable performance in removing organic compounds at various phenol concentrations and high retention times; this system can be therefore used to replace rather expensive and complex systems such as active sludge.

**KEYWORDS:** anaerobic and facultative stabilization pond, phenol removal, oil refinery wastewater, retention time

## 1. INTRODUCTION

Phenol ( $\text{C}_6\text{H}_5\text{OH}$ ) is a toxic aromatic hydrocarbon. Solid phenol is white but is mostly colored due to the presence of impurities [1]. At room temperature, phenol is a translucent, colorless, crystalline, white powder or syrupy

liquid on mixing with water. Phenol has a sweet tar like odor and is soluble in alcohol, glycerol, petroleum and also but to a lesser extent in water [2]. Phenol and its derivatives are among the most common organic pollutants because of their toxicity even at low concentrations [1, 3]; they can be found in wastewater of many chemical plants such as paper and pulp, pesticides, dyes, and chemical manufacturing industries. Besides, wastewater originating from other industries such as resin manufacturing, gas and coke manufacturing, tanning, textile, plastic, rubber, pharmaceutical, oil refineries, ceramic, steel, coal conversion processes, phenolic resin industries and petroleum also contains various types of phenols [3-5]. Phenols are also present in domestic effluents and vegetation decay [5]. Therefore, wastewaters containing phenolic compounds present a serious discharge problem due to their poor biodegradability, high toxicity and ecological aspects [3].

Phenol shows also significant health effects for humans. The manufacture and transportation of phenol as well as its many uses may lead workers to a high exposure to this substance through inhalation, ingestion, eye or skin contact, and absorption through the skin. Phenol is rapidly absorbed through the skin and can cause skin and eye burns upon contact. Comas, convulsions, protein degeneration, tissue erosion, paralysis of the central nervous system, cyanosis and death can result from an overexposure. Internally, phenol affects the liver, kidneys, lungs, and vascular system. The ingestion of 1 g of phenol is deadly for human [1, 6]. Therefore, they are considered as priority pollutants since they are harmful to organisms even at low concentrations and many of them have been classified as hazardous pollutants because of their potential harm to human health [6]. According to the World Health Organization regulation, 0.002 mg/l is the permissible limit for phenol concentration in potable water and the regulation by the Environmental Protection Agency (EPA), call for lowering phenol content in wastewater less than 1 mg/l [3]. Consequently, wastewater containing phenols and other toxic compounds must be treated before discharge into the aquatic

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