Degradation for Organic Compounds Using Ecofriendly Methods

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ABSTRACT

The aim of this study was to investigate the removal of the model surfactant sodium dodecylbenzene sulfonate (SDBS) from water using various reactions that create radicals. Fenton's reagent has demonstrated significant effectiveness in degrading surfactants. Direct photooxidation is not very efficient for removing SDBS from aqueous solutions. The introduction of H_2O_2 and K_2S2O_8 during irradiation produces highly reactive radicals that accelerate the SDBS degradation rate.the $UV/K_2S_2O_8$ approach stands out as the most efficient approach. In particular, iron salts like $FeSO_4$ are often used in oxidative degradation processes because they help in the generation of hydroxyl radicals when they react with hydrogen peroxide,leading to the efficient breakdown of organic pollutants like SDBS. It enhance the efficiency of the degradation processes through the generation of reactive radicals that accelerates the breakdown of SDBS.

INTRODUCTION

In order to effectively degrade the commonly used anionic surfactant sodium dodecyl benzene sulfonate (SDBS). It has a strong foaming ability and detergency. Surfactant are commonly used in industrial processes and consumer products to stabilize emulsions, form foams. It is a non-persistant organic pollutant that is difficult to volatilized and biodegrade. It has toxic effects on living organisms in the environment. Hydrogen peroxide, potassium per sulphate and iron salts found to be effective in breaking down stubborn surfactants. In typical studies, SDBS degradation under sunlight can lead to the breakdown of surfactant into smaller organic molecules it can still function effectively without being affected by light exposure as it is not particularly sensitive to sunlight (Borah *et al*. 2020) (Kumari and Aditya, 2023) (Laccourreye and Hervé, 2019) (Xiu *et al*. 2024).

OBJECTIVE

The aim of this study was to look at how different treatments that create free radicals can remove a type of detergent called surfactant sodium dodecylbenzene sulfonate (SDBS), considered as a model surfactant. Process combinations for the generation of HO radical site radicals ($Fe(II)/H_2O_2$, UV/H_2O_2) and SO_4 radical site radicals ($UV/K_2S_2O_8$) were investigated.

METHODOLOGY

Prepare a stock of 100ppm (SDBS) in distilled water. Dissolved $K_2S_2O_8$ in distilled water to a desired concentration of 0.01M. Prepare H_2O_2 solution typically around 30% concentration, then dilute to the desired concentration for the reaction iron solution were also used in small amount. Testing was done using concentration of 10, 20 and 50-mg/l anionic surfactant and 5,10 and 25-mg/l hydrogen peroxide and potassium per sulphate testing was performed with different concentrations and volumes. Mix the SDBS solution with $K_2S_2O_8$, add H_2O_2 to initiate the oxidation reaction and few drops of iron were also added in a mixture.

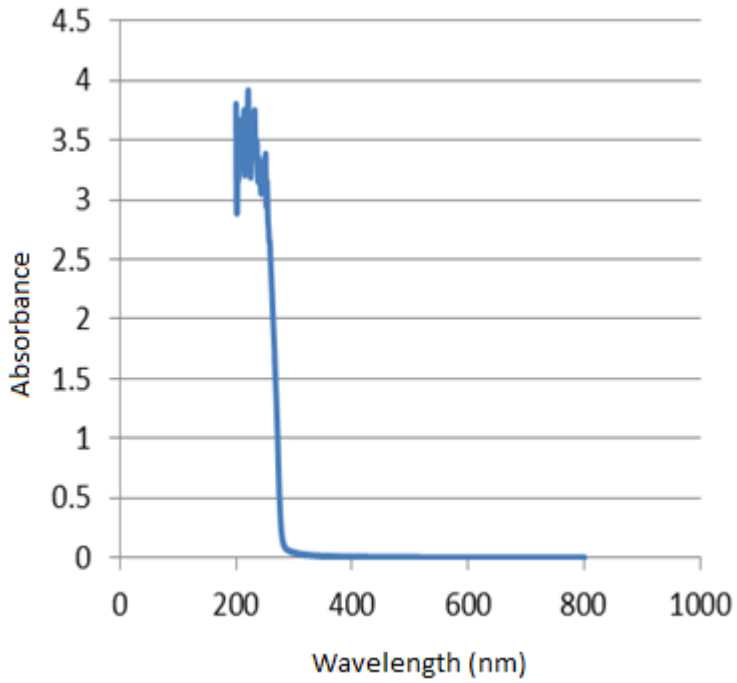
Different Concentration with Constant Volume

Add 2ml-9ml of (SDBS) stock solution in a 0.5ml of 0.01M $K_2S_2O_8$ solution with iron.

Constant Concentration with Different Volume

Add 5ml of (SDBS) stock solution in a range of 0.1-0.9ml of $K_2S_2O_8$ solution with iron.

RESULT



The spectra indicate removal of the pollutant as its peak diasppered from the initial position.

CONCLUSION

In conclude, the degradation of SDBS using KPS and H_2O_2 provides a promising advanced oxidation approach to reduce the environmental hazards both of these chemicals are strong oxidants that under suitable conditions can produce sulfate and hydroxyl radicals. These radicals attack the molecular structure of SDBS breaking it down into smaller less toxic compounds. The higher the SDBS concentration, the slower the degradation rate because the surfactant itself absorbs UV light which reduces the penetration depth of UV radiation.

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