Catalytic ozonation of benzothiazole contaminated waters promoted by volcanic sand

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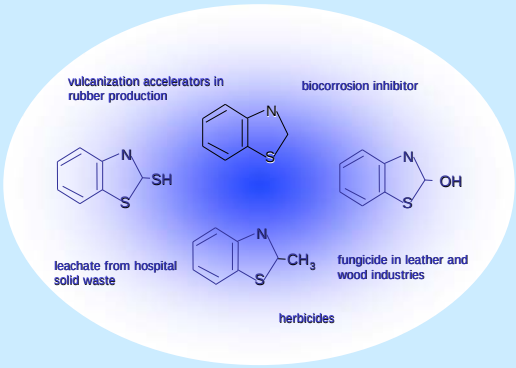
INTRODUCTION

Environmental source emission of BTs

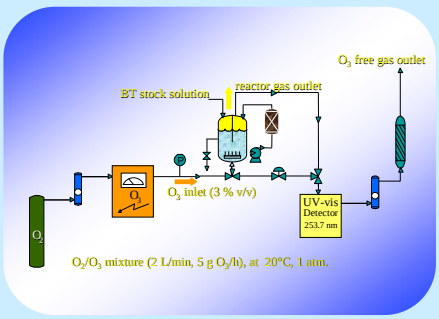


OBJECTIVES

This work evaluates benzothiazole (BT) degradation using single ozonation (O_3) and catalytic ozonation promoted by volcanic sand (O_3/VS). The effect of pH (2-7), and the presence of radical scavengers on process rates and removal efficiencies are assessed at laboratory scale.

This work is a preliminary report of a wider on-going innovative project that focuses on a new process development that combines the use of ozone and natural heterogeneous materials for toxic organic pollutant removal from contaminated waters.

EXPERIMENTAL

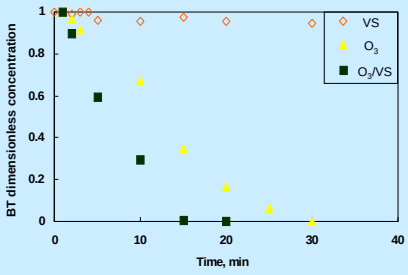


Experimental system

RESULTS AND DISCUSSION

1.- BT AQUEOUS REMOVAL USING O_3 AND O_3/VS PROCESSES

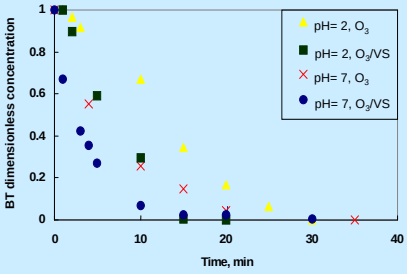
T= 20 °C, pH= 2, C_{BTo}= 222 µM, 10 g/L VS



Simultaneous O_3/VS process increased BT removal rate, as compared with single O_3 treatment. BT removal rate by adsorption process on VS was not significant under the exposure time used here.

2.- EFFECT OF pH ON BT REMOVAL RATE

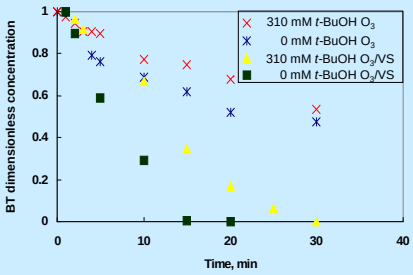
T= 20 °C, pH= 2, C_{BTo}= 222 µM, 10 g/L VS



The fast oxidation reaction of BT in presence of volcanic sand suggests the presence of surface sites that enhance ozone decomposition into free radicals.

3.- EFFECT OF THE PRESENCE OF RADICAL SCAVENGERS

T= 20 °C, pH= 2, C_{BTo}= 222 µM, 10 g/L VS



The reduction on BT removal rate by the presence of *t*-BuOH could be related with the inhibition of radical chain reactions taking place in the solution bulk.

Ozone and radical reaction contributions to BT oxidation using O_3 and O_3/VS processes.

Processes	pH 2		pH 7	
	% Ozone reaction	% Radical reaction	% Ozone reaction	% Radical reaction
O_3	23	77	15	85
O_3/VS	15	85	8	92

In the O_3 and O_3/VS processes, the contribution of the radical indirect reaction increases when pH raised. Moreover, this effect is much greater in the case of O3/VS process.

CONCLUSIONS

This study shows that O_3/VS combined treatment increase benzothiazole removal rate with respect to single ozonation.

In the combined treatment, the effects of radical inhibitors are reduced due to the presence of volcanic sand, suggesting that volcanic sand surface plays a fundamental role in the reaction mechanism.

Benzothiazole oxidation seemed to occur both via ozone direct reaction and by radical species generated by catalytic ozone decomposition on metallic surface sites of the volcanic sand.

ACKNOWLEDGEMENTS. **The authors wish to thank FONDECYT (Grant N° 1060304) for their financial support.**

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