

PC10) Phosphate and Heavy Metals Removal in Seawater Using Porous Activated Red mud Pellet (PolluFree)

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1. Introduction

This study is to examine the chemical and mineralogical characteristics of the multi-contaminants removal porous pellet(PolluFree) manufactured by modified bauxite refinery residues, verify the removal efficiency as well as mechanisms of the PolluFree™ in relation to phosphate and heavy metals(Cu, Cd, Pb) in closure bay, aquaculture farm, and ocean aquarium water environment, and assess the water quality safety of PolluFree by government-sponsored institute lab (KORAS).

2. materials and methods

Table 1. Mineral composition of PolluFree as determined by X-ray diffraction

Hematite	Fe_2O_3
Quartz	SiO_2
Gibbsite	$Al(OH)_3$
Boehmite	$\gamma-AlOOH$
Calcite	$Ca(CO_3)$
Sodalite	$Na_4Al_3Si_3O_{12}Cl$
Anatase	TiO_2
Whewellite	$CaC_2O_4 \cdot H_2O$
Cancrinite	$(Na, Ca, K)_8(Al, Si)_{12}O_{24}(SO_4CO_3)3H_2O$
Anhydrite/gypsum	$CaSO_4 / CaSO_4 \cdot 2H_2O$
Hydrotalcite	$Mg_6Al_2CO_3(OH)_{16} \cdot 4H_2O$
Hydrocalumite	$Ca_2Al(OH)_7 \cdot 3H_2O$
p-aluminohydrocalcite	$CaAl_2(CO_3)_2(OH)_4 \cdot 3H_2O$
Brucite	$Mg_3(OH)_6$
Portlandite	$Ca(OH)_2$



The chemical composition and mineralogy of the major components in the PolluFree are shown in Tables 1. The XRD pattern obtained for PolluFree showed that hematite and calcite are the major components present. Other compounds such as boehmite, quartz, sodalite, cancrinite, anatase, anhydrite/gypsum, whewellite, hydrotalcite, and portlandite are also identified. It can be seen that PolluFree™ is a complex mixture composed primarily of Ca, Fe, Al, Si, and Mg.

3. Results and discussion

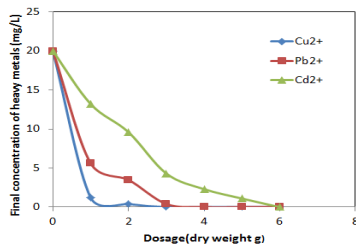


Fig. 1. Phosphate removal efficiency as a function of PolluFree™ dosage rate.

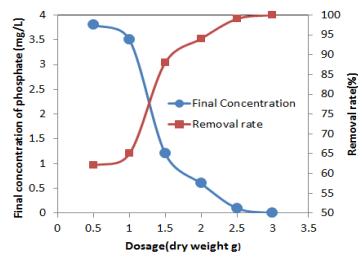


Fig. 2. Heavy metals removal efficiency as a function of PolluFree™ dosage rate.

PolluFree can dramatically remove Cu concentration in seawater with small amount of dosing rate and thus prevent Cu concentration accumulation caused by adding copper sulfate($CuSO_4 \cdot 5H_2O$). And PolluFree can simultaneously remove phosphate and heavy metals in seawater.

4. Reference

Laure, M., Despland, Malcom W. Clark, Tony Vancov, Dirk Erler, Michel Aragno, 2011, Nutrient and trace-metal removal by bauxsol pellets in wastewater treatment, Environmental Science and Technology, 45, 5746-5753.