CASE STUDY

Phosphate removal from Water

Location: Spain & Mexico

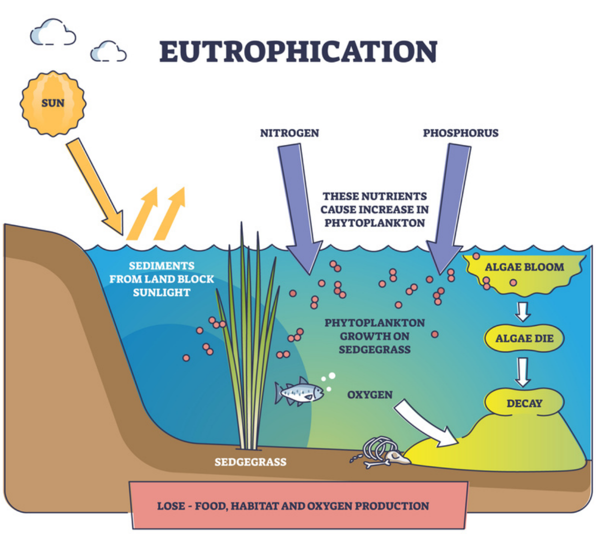
Technology: Ferrolox

BACKGROUND

This case study summarizes a research article published in the Journal of Molecular Liquids in 2018. A group of researchers performed adsorption studies on 8 commercial sorbents. Three of your widely popular adsorbents, namely **FERROLOX**, Katalyst Light and Catalytic Carbon were selected for the same. The study was based on the phosphate removal capacity of these sorbents.

PROBLEM FORMULTION

All living things require phosphorus, one of the essential macronutrients [2]. Although phosphorus occurs naturally in the environment, excessive levels of phosphorus (often in the form of phosphate) is constantly introduced to water bodies through the discharge of untreated industrial effluent and agricultural runoff. The excessive concentration of phosphates has been linked to eutrophication [2, 3, 4].
Eutrophication, the primary cause of water quality deterioration, is the main reason for he excessive growth of algae that reduces



water transparency and whose decomposition when dying consumes the dissolved oxygen in the water, producing an unpleasant odor and the decline of aquatic life [2, 3, 4].
There are several treatment options, including physical, biological, and physicochemical ones [2, 4, 6]. Physical techniques for phosphate removal are either seen as being costly or unsuccessful [4, 7], whilst biological methods are unstable because of their susceptibility to operational factors including changes in pH and phosphate content [6, 7].
The physio-chemical approaches, on the other hand, are more appealing, particularly the adsorption method, which combines the ability to recover phosphorus with high efficacy and simplicity of use. Adsorption does not produce the enormous volumes of sludge that other processes like chemical precipitation do [4, 5, 7, 8].

METHODOLOGY

Coconut Shell Activated Carbon, Bituminous Coal Carbon, Bone Char, Natural Zeolite, Silica, Ferrolox (Watch Water), Catalytic Carbon (Watch Water), and Katalyst Light (Watch Water) were among the eight commercial sorbents that were examined in this study. The following table lists the general characteristics and specifications of these sorbents:

SORBENT	CODE	PROPERTY			
		Origen or Nature	Particle size (mm)	Surface area (m2/g)	pH
1. Coconut Shell activated carbon	CC	Vegetal. Thermal activation	2.38-0.595	1050	7-8
2. Bituminous coal activated carbon	B	Mineral. Thermal activation.	2.38-0.595	1000	8
3. Bone char	BC	Animal: bovine bones	2.38-0.595	104	8 - 9.5
4. Zeolite	Z	Natural Zeolite	1,18	25	8.91
5. Silica	S	Natural Silica	3.175-1.58	-	8.69
6. Ferrolox	F	Patented granular Iron hydroxide (70-85%)	1.5-4.0	270	7.71
7. Catalytic Carbon	CtC	Coconut shell activated carbon (85%) with iron catalytic coating (FeO(OH) 15%)	2.4-0.6	2000-2500	9.5
8. Katalyst Light	KL	ZEOSORB (clinoptilolite [85%]) with a MnO2 coating (10%) and Ca(OH)2 (5%)	1.4-0.6	-	11.13

Table: Specifications of the commercial sorbents used for the removal of phosphate from water [1].

RESULTS

With a maximal adsorption capacity of 193.75 mg/g at pH 7, **FERROLOX** (patented granular form of Iron III Hydroxide) was shown to be the best sorbent. Studies using molecular simulation software revealed that aqueous phosphates formed a complex (FePO4H2) on iron(III) hydroxide, enabling phosphate recovery and reuse. Both synthetic solutions and industrial wastewater had comparable amounts of phosphates adsorbed on iron(III) hydroxide, indicating iron(III) hydroxide is a selective sorbent for phosphate removal. The adsorption study's outcomes followed the following pattern: iron (III) hydroxide > manganese (II) oxide composite > bone char > activate carbon > silica > zeolite. Although our other product Katalyst Light was the second best sorbent out of the selected eight, **FERROLOX** outperformed all the others by a huge margin. At low pH, **FERROLOX** showed even higher adsorption capacity (300mg/g) for phosphates. [1]

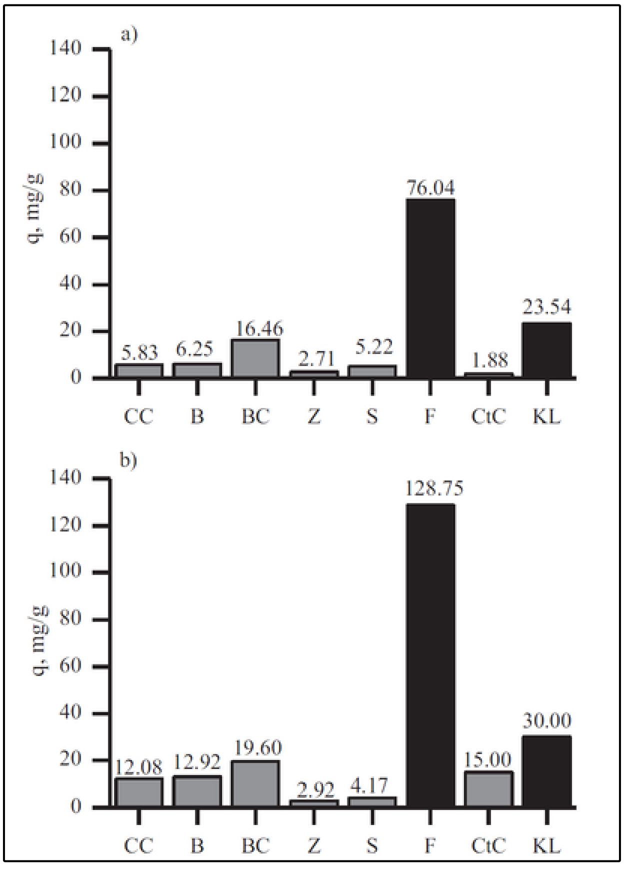


Figure: Sorption results of the eight commercial sorbents using phosphate solutions of (a) 500 mg/L and (b) 1500 mg/L at pH 7, 30 °C and mass to volume ratio of 2 g/L. [1].

FERROLOX

WATCH WATER
a Water Company

CONCLUSION

The results of the adsorption experiments highlight **FERROLOX as an exceptional sorbent for phosphate removal**, especially at low pH levels It exhibited a maximum adsorption capacity of 194 mg/g at pH 7 and 323 mg/g at pH 2. While Katalox Light also demonstrated phosphate removal capabilities, it had a lower adsorption capacity than Ferrolox. Based on the research paper and our own evaluation, Ferrolox emerges as a highly effective and selective sorbent for phosphate removal from both synthetic solutions and real wastewater. We highly recommend Ferrolox as a primary choice for phosphate removal in wastewater treatment processes, particularly in industries with high phosphate concentrations. We would like to thank the authors of the research paper for their valuable insights and findings, which have contributed to our understanding of phosphate removal technologies.

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