Treatment of Produced Water using Chemical Coagulation + Flotation and Electro-Oxidation

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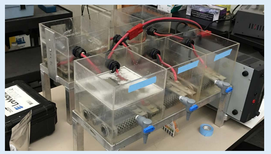
Introduction

In Kern County, oil is a major industry. A significant byproduct of oil production is water. Unfortunately, this produced water is futile due to its contaminants. With todays water crisis, new technologies are being developed to treat this water.

Objective

To clean produced water using OriginClear's Electro Water Seperation System. The main goal is create an efficient protocol to alleviate the suspended oil particles and lower the COD in the water.



EWS System

COD Ranges of Treated Water Over Time

Materials

- EWS System
- Hach Turbidity Meter
- Hach Colorimeter
- pH Meter
- Jar Mixers

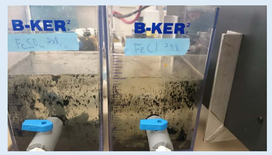
Coagulants:

- $FeSO_4$
- $FeCl_2$
- $AlCl_3$
- $Al_2(SO_4)_3$

Procedures

The general procedure consisted of exposing water to varying parameters. The parameters used were current, coagulant, and time. Various trials were conducted using different combinations such as increasing the current and reducing time.

Aluminum Coagulants



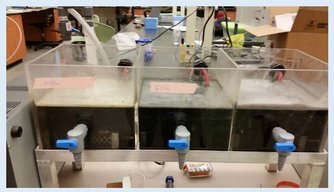
Iron Coagulants

Chemical Coagulation + Floatation Data

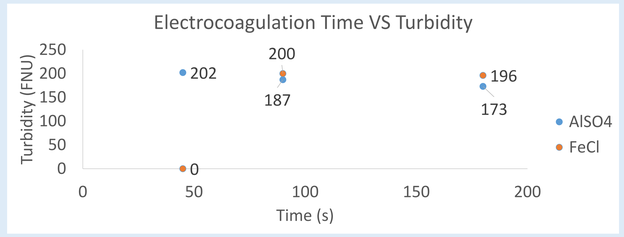
Water (3 L)	pH	Coagulant Type	Coug Amount (mg/L)	Amp	Time (s)	Turbidity
Raw	6.6	AlSO4	600	10A	45	202
	6.6		600	10A	90	187
	6.6		600	10A	180	173
	6.6	FeSO4	600	10A	45	high
	6.6		600	10A	90	high
	6.6		600	10A	180	high
	6.6	FeCl	600	10A	45	high
	6.6		600	10A	90	200
	6.6		600	10A	180	196

Results of Electrocoagulation

Treated Water in Turbidity Vials 1

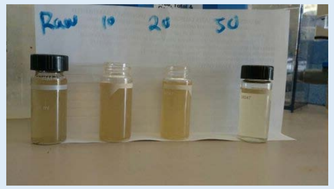


Chemical Coagulation + Flotation in Process

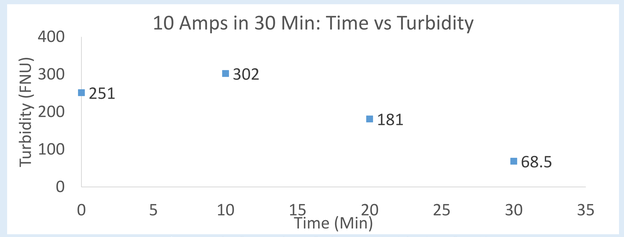


Turbidity Graph of different Coagulants

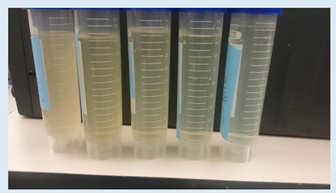
Electro-Oxidation Data 1



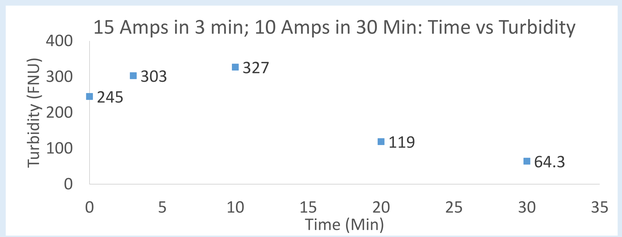
Treated Water in Turbidity Vials 2
1st Round



1st Round of Results of Electro-Oxidation for Site 1



Treated Water in Turbidity Vials
2nd Round



2nd Round of Results of Electro-Oxidation for Site 1

Electro-Oxidation Data 2

	Raw Water	Treatment Results
Turbidity (FNU)	188	66
Conductivity (µS)	20.06	20.19
COD (mg/L)	>15,000	1228
pH	9.1	9.1
ORP[i] (mV)	372	812

Conclusion

From our experiments we concluded that chemical coagulation + flotation was not cleaning produced water efficiently. The best turbidity reading achieved during CCF was 173 FNU. We determined that electro-oxidation (no coagulants) was successful in treating produced water since we achieved a turbidity of 68.5 from 251 which is a 73% drop. We also noticed that higher pH runs more effectively in terms of reducing COD and turbidity. The higher pH yielded a turbidity and COD reading of 66 FNU and 1228 mg/L compared to the lower pH of readings of 74.2 FNU and 1276 mg/L.

Future Plans

Going forward we will start to upscale our protocols in order to verify the feasibility of our results in a large scale environment. We will implement a post treatment of water using reverse osmosis. Lastly, we will incorporate an active oxidation process to our protocol.

Active Oxidation Machine

Reverse Osmosis Machine

Acknowledgments

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