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Full Length Article

Effect of settling time, velocity gradient, and camp number on turbidity removal for oilfield produced water ☆

Thamer J. Mohammed [a], Eman Shakir [b,*]

[a] Chemical Engineering Department, University of Technology, Iraq
[b] Environmental Research Center, University of Technology, Iraq

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ABSTRACT

This paper studies the effect of settling time, velocity gradient, and camp number on turbidity removal for oilfield produced water from Degasing station1 (DS1)/North Rumaila oilfield/Southern Oil Company in Basrah Province/Iraq during 2013. Physico-chemical tests were carried out on sample with the different dosage of three types of coagulants and flocculants; poly-aluminum chloride, ferric chloride, and cationic polyelectrolyte individually and in combination. From experiments, it was found the removal of residual turbidity increases as the settling time increases. The rotation speed of 45–55 rpm, (G of 54.5–78.5 s^{-1}) was the most favourable speed of mixing of flocculation. The effect of camp number on the residual turbidity was done at time range of (10–30 min) and velocity gradient (G) of 50 s^{-1}. The residual turbidity initially decreases with increasing camp number; it reaches a minimum value, and then starts increasing again with further increases in camp number. The experimental results of this study are used to develop an empirical correlation for turbidity removal efficiency as a function of multi variables poly-aluminum chloride dosage; polyelectrolyte dosage; and Ferric chloride dosage.

1. Introduction

Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, planktons and other micro and macroscopic organisms [1]. Turbidity particles range from about 0.01 to 100 μm in size. The larger fraction is relatively easy to settle or filter. The smaller, colloidal fraction, (from 0.01 to 5 μm), presents the real challenge. Their settling times are intolerably slow and they easily escape filtration [2,3]. The removal of turbidity in water would be extremely beneficial as it would alleviate the majority of problems associated with turbidity [4,5]. Turbidity can be used to measure the performance of individual treatment processes as well as the performance of an overall water treatment system. Common water treatment processes like screening, Pre-sedimentation, Coagulation- Flocculation and Filtration intended to remove suspended solids and reduce turbidity [6]. One of the most commonly used methods for the removal of turbidity in the form of suspended and colloidal material in water is the addition of coagulants and flocculants, such as alum, ferric chloride, and long-chain polymers [7]. Coagulation technology is one of the important ways and the most popular process to deal with water and wastewater treatment [8,9]. It is effective in removing particles as well as organic matter [10]. The separation of particulate matter from the liquid phase is one of the important steps in most wastewater treatment processes. All waters contain both dissolved and suspended particles. Coagulation and flocculation processes are used to separate the suspended solids portion from the water [11,12]. it is an advanced method and may be categorically defined as treatment for the removal of pollutants include suspended solids, BOD, nutrients, nitrogen and phosphors, heavy metals and colors [13]. This paper studies the effect of settling time, Velocity Gradient, and Camp Number on turbidity removal for oilfield produced water using coagulation-flocculation with different dosages of poly-aluminum chloride, ferric chloride, and poly-electrolyte.

2. Experimental work

2.1. Produced water characteristics

Oilfield produced water used in the present study was from Degasing station1(DS1)/North Rumaila oilfield/Southern Oil Company which is situated at coordinates: 30°34′40.88″N, 47°20′18.78″E in Basrah Province/Iraq during 2013. The characteristics

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* Corresponding author.
E-mail address: eman.erc@gmail.com (E. Shakir).

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