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Drinking Water Engineering and Science Discussions

Interactive comment on "Optimization of coagulation-flocculation parameters using a photometric dispersion analyser" *by* S. Ramphal and M. Sibiya

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Dear Referee 2,

Thank you for the comments made with regard to our article. The comments received and the time invested on your part is greatly appreciated. We would like to respond to your specific comments as follows:

1. a) In response to why such a high dosage was used:

Preliminary experiments were performed to identify the approximate optimal coagulant dosage (by maintaining coagulation pH constant and varying the coagulant dosage).

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The results of this experiment revealed that the optimal was approximately 10 mg/l as Al3+; hence, this coagulant dosage was used for pH optimization. The sample water used in this study obtained from a surface water impoundment. The raw water characteristics of this impoundment can differ markedly, especially during the rainfall season (the period during which this study was performed) when the turbidity can be as great as 140 NTU. Amongst others, Baghvand et al. (2010), Dalton (2008) and Cepeda and Cepeda (2005) have reported higher aluminium sulphate dosage requirements in response to high raw water turbidity. In saying so, the physical and chemical characteristics of source waters are different, hence, dosage requirements differ.

References:

Baghvand, A. Daryabeigi, Z., Mehrdadi, N., and Karbassi, A.: Optimizing coagulation process for low to high turbidity waters using aluminium and iron salts, American Journal of Environmental Science, 6(5), 442 – 448, 2010

Cepeda, Z., and Cepeda, E.: Application of generalized linear models to data analysis in drinking water treatment, Revista Colombiana de Estad′Äśstica, 28(2), 233 – 242, 2005

Dalton, M.: Potable water coagulant trials utilizing polyaluminium chlorhydrate, 33rd Annual Qld Water Industry Operations Workshop, Carrara – Gold Coast, 3 - 5 June, 2008

1. b) The concept of coagulation pH:

This comment is extremely valid. The sample pH was initially adjusted to the relevant pH in accordance to Bratby, (2006). As per our article, when 10 mg/l as Al3+ was dosed to an initial sample pH of 8, the coagulation pH, or pH after coagulant dosage and rapid mixing, was measured as 6.29. During the dosage optimization, when the optimal dosage of 6 mg/l as added to an initial sample pH of 8, the coagulation pH was measured as 6.69. These optimal coagulation pH values are well within those

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reported by Pernitsky and Edzwald, (2006). With reference to an over dosage of alum, we anticipate that the paragraph above ('in response to why such a high dosage was used'), as well as response number 4 will allay these reservations.

References:

Bratby, J.: Coagulation and flocculation in water and wastewater treatment, 2nd Edition, IWA Publishing, London, United Kingdom, 2006.

Pernitsky, D.J. and Edzwald, J.K.: Selection of alum and polyaluminium coagulants: principles and applications, Journal of Water Supply Research and Technology, 55, 121 – 141, 2006.

2. Suggestion that results has little practical relevance to the treatment plant:

We understand that this comment probably arises from the notion that there was an over dosage of alum. We hope that the response given in response number 1 removes these doubts.

3. Further reading suggestions:

We acknowledge your comment on there being an adequate amount of relevant reading done. However, we are unsure how to respond to comments referring to our understanding of coagulation.

4. Comments regarding the minimum solubility:

Although reference to a published minimum solubility was made, experiments determining residual aluminium concentration were performed. These tests showed that under the optimal coagulation conditions, there was no aluminium carryover which indicates that the coagulation pH may have coincided with the minimum solubility of alum. The results of these experiments were not included as we felt it did not fall within the scope of this article. The temperature at which the experiments were performed will be incorporated into the article.

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5. Comments on pH range investigated:

The investigated pH range was extended as we attempted to assess the floc size, aggregation rate and floc size variance trends over a wider pH range.

6. Raw water quality:

Comment is noted. The raw water characteristics will be incorporated into the article. We understand that it is due to this lack of information that has led to concerns regarding over dosage.

7. Determining calcium carbonate precipitation potential (CCPP):

We are assuming that you are referring to CCPP calculations performed in Section 3.5. If this is so, we can explain as follows. Coagulation pH (as per definition used in response number 1, paragraph 2) was optimized. It is just that we have chosen to refer to initial sample pH as opposed to the coagulation pH for simplicity. However, at the optimal pH and dosage values we have quoted the corresponding coagulation pH values. As such, CCPP calculations are valid.

8. Selection of wavelength:

Comment is noted and will be incorporated into article.

9. Number of measurements:

Comment is noted and will be incorporated into article.

We would like to respond to your technical comments as follows:

1. Comments on figures:

Comment is noted and relevant changes will be incorporated into article.

2. Use of significant/significantly:

Comment is noted and changes incorporated into article.

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We hope that these responses prove adequate in addressing the key shortcomings raised. We would like to reiterate that the core focus of this article was to optimise coagulation conditions while monitoring floc size, the rate of aggregation and floc size variability to expand on the current knowledge base and identify additional performance parameters which may be used in future studies.

Sincerely, S. Ramphal M. Sibiya

Interactive comment on Drink. Water Eng. Sci. Discuss., 7, 95, 2014.