Discussion Paper

Impact of alum pretreatment on biosand filter performance: a commentary on Curry *et al.* (2020)

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ABSTRACT

In a recent contribution by Curry and colleagues, a field-derived assessment of a reportedly common pretreatment technique to reduce turbidities of biosand filter (BSF) feed water was reported. Their results demonstrated that despite alum pretreatment achieving lower settled turbidity values relative to control filters, such intervention led to significantly lower flow rates in the alum-dosed BSFs. However, their study stopped short of providing a more meaningful interpretation to what may initially seem like a counterintuitive finding, which is presented here.

Key words | aluminium sulphate, biosand filter, headloss, pretreatment, slow sand filtration

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HIGHLIGHTS

- A complementary interpretation to the results is provided with reference to the study by Curry and colleagues on a field-derived assessment of a reportedly common pretreatment technique to reduce turbidities of biosand filter feed water.

Dear Editor,

Recently, Curry *et al.* (2020) addressed the impact of rock alum pretreatment on biosand filter (BSF) performance. They provided a field-derived assessment of a reportedly common pretreatment technique to reduce turbidities of BSF filter feed water (i.e. use of rock alum to enhance pre-settling of surface waters) in Cambodia. Their results demonstrated that despite alum pretreatment achieving lower settled turbidity values relative to control filters, such intervention led to significantly lower flow rates in the alum-dosed BSFs. However, their Short Communication stopped short of providing a more meaningful interpretation to what may initially seem like a counterintuitive finding.

BSFs are a household-scale modification of slow sand filters (SSFs) that operate intermittently to serve domestic drinking water needs. Given the similarities between the two filters, BSF design and performance are many times described, studied, and interpreted in an analogous manner to SSFs. As such, previous work on SSF pretreatment with alum provides some insights to the results reported by Curry *et al.* (2020). Dorea & Clarke (2006a) showed that an alum-pretreated SSF had shorter filtration runs (due to higher headloss development) in comparison to a control (i.e. no pretreatment) filter run in parallel. This occurred despite lower influent turbidities in the alum-pretreated SSF. The explanation for this lies in the fact that the nature of the turbidity-causing particles being compared is very different to the non-alum-dosed influent (Dorea & Clarke 2006b; Dorea 2013). Based on the total aluminium content, the influent particles in the alum-dosed filters consisted of aluminium hydroxide precipitates, which had a higher headloss-inducing effect than particulates present in the influent of control runs. Given the similarities between the recent study by Curry *et al.* (2020) and previous studies, it is likely that a change in the speciation of the turbidity-inducing particles is a plausible explanation for their observations.

This interpretation is corroborated by the relatively high aluminium (assumed total fraction) they (Curry *et al.* 2020)

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measured. However, one caveat that was not acknowledged in their study was with respect to the limitations of the spectrophotometric technique they used to quantify aluminium. Their method of choice, while perhaps appropriate for the type of fieldwork conducted, can suffer from interference from substances such as phosphates (Dorea 2009). The fact that one of the source waters used came from an eutrophic (i.e. richness of nutrients) pond, it may be that filtered aluminium levels are underestimated.

Experience from work cited above on alum pretreatment of SSF-type filters (arguably relevant to BSFs) requires careful control of coagulation process with regard to dosing (i.e. quantity) and mixing conditions to minimise headloss-inducing aluminium-laden particulates in the influent. The type of rock alum dosing described in the study under discussion (i.e. swirling rock alum 10 times 'just under the surface') is beautifully simple for household water treatment but may not offer the desired control required to negate the adverse effects on the operation of BSFs (i.e. reduced flow rates).

I hope this Commentary will offer a complementary and useful interpretation to the results of the study on BSF pretreatment by Curry and colleagues.

Sincerely,

Caetano Dorea

DATA AVAILABILITY STATEMENT

All relevant data are included in the paper or its Supplementary Information.

REFERENCES

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