Comment on article

"Performance of multistage filtration using different filter media against conventional water treatment systems" (Ochieng et al., *Water SA*, July 2004, Vol. 30 (3) 361-367)

Ochieng et al. (2004) compared the performance of multi-stage (gravel + slow-sand) filtration (MSF) systems with conventional water treatment systems based on rapid sand filtration (RSF). Their hypothesis is that an MSF system can perform better than an RSF system. This line of research is particularly important in the scope of appropriate technologies for developing countries. Multi-stage filtration has many advantages over conventional treatment systems, especially considering low-income settings. However, some aspects of their investigation did not sustain their conclusions, mainly due to a lack of basic experimental description or supporting data, namely:

1) Their objective was to compare two kinds of systems (MSF and RSF), but details of the conventional RSF system used are omitted from the experimental descriptions. That is, all that is stated is that this type of system relies on coagulation, flocculation, sedimentation, and rapid-sand filtration. No reference to the coagulant used (type and quantity), process residence times, and loading rates is made. An unbiased comparison certainly merits a detailed and equal level of description of both systems. Without such information it is not possible to assess how and if the RSF system was performing to its full potential.
2) The percentage difference in terms of suspended solids and turbidity removal, for example, was "small" and as low as 1 % (based on averages given). The lack of detail in the data presented does not support any level of statistical significance to be attributed to their comparison. Moreover, datasets were selected from periods in which the slow-sand filters where "at their best performance" after maturation. This is not representative of a whole filtration run. Particularly, bearing in mind that slow-sand filters, in most MSF applications, typically do not run to waste during maturation of slow sand filters. Besides, it is not known if RSF datasets were also selectively analysed.
3) They conclude that the effluents of the MSF system's chlorine dose requirement "would be greatly reduced." This assertion is based on coliform removal data. However, there is no evidence to back this conclusion. Furthermore, chlorine doses are typically determined by residual chlorine demand tests for practical reasons. Bacterial concentrations are not preferred because they may require incubation times of up to 24 hours to determine and give no indication of the residual disinfectant level. Moreover, chlorine demand is influenced by the concentration of organics in the water. Coagulants (e.g. metallic salts) used in conventional treatment systems are able to remove some of these organics, thereby reducing required chlorine doses. Galvis (1993) reported the capacity of MSF systems to significantly remove organics measured by true colour and chemical oxygen demand. Hence a valuable opportunity to compare both systems with regards to chlorine requirements and their implication has been missed.

In light of the exposed, hopefully this will provide an opportunity for a constructive discussion in which the authors are able to offer lacking explanations to support their conclusions. This would validate their findings and certainly contribute to the knowledge in MSF technology.

References

GALVIS G (1993) Innovative technology for reduction in biological contaminants and trihalomethane precursors. In: GF Craun (ed.) *Safety of Water Disinfection: Balancing Chemical and Microbial Risks.* ILSI Press, Washington D.C., USA. 415-428.

OCHIENG GMM, OTIENO FAO, OGADA TPM, SHITOTE SM and MENZWA DM (2004) Performance of multistage filtration using different filter media against conventional water treatment systems. *Water SA* **30** (3) 361-367.

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Response to Comments

We have read through the comments forwarded to us in regard to our published article "Performance of multistage filtration using different filter media against conventional water treatment systems*"* (Ochieng et al., *Water SA*, July 2004, Vol. **30** (3) 361-367). Following is our response on the same.

Concern No. 1 (Detailed description of RSF)

- We acknowledge the fact that for an unbiased comparison between the two systems in question (i.e. MSF and RSF), detailed and equal level of the description of both systems is necessary. However, the authors would like to make the following observation on the same.
- In dealing with any "Standard procedure and or standard methods" used in any experiment, it is always thought that a brief mention of such would be sufficient to convey the message. As with RSF being considered "conventional", the same argument was extended and especially motivated by the suggestions made by the reviewers that the article be shortened by tightening up the text, this was thought of as one way of achieving this. It is worth mentioning too that in the original manuscript submitted for review, a mention of the daily output from the RSF was made.

Concern No. 2 (Representation of statistical analysis)

- In the original manuscript (available from the authors on request), the data for both the turbidity and suspended solids were presented in graphical form for the whole study period. This was done to aid the reader in having a visual impression of the situation under study. Further, a summary of the performance information was also given in periods i.e. commissioning to maturity; low peak; high peak; and average (all periods) with discussions on the perceived possible rea-

sons attributed to the observations made. Once again, due to the suggestion that the article be tightened up, some of the said information was omitted in the revised script. It is also worth noting that the authors registered their concern in line with the shortening/tightening the text vs. loss of content/ scope of the article. These concerns were made in writing to the editor in response to the reviewers' comments (available from the authors on request).

Concern No. 3 Conclusion (lack of supporting data for 'reduced chlorine dosage' and use of coliform levels as a measure for chlorine dosage)

- Again, the data to back this conclusion was provided in the original manuscript.
- The use of coliform levels as a basis for suggested possible chlorine dosage was based on the fact that bacteriological quality of the end water from any drinking water treatment plant is of prime concern with regard to its potability. Furthermore, the tests done to characterize both systems were based on selected (basic) quality parameters used by many water quality control bodies e.g. Kenya Bureau of Standards (KEBS, 1996) and also on recommendations by Galvis et al. (1993) on key parameters that are useful in the study of performance of an MSF system.
- Further, as documented in the results, after the maturation period, the *E. coli* levels of MSF effluents were in the range (0 – 1). In this case, application of chlorine was suggested as a buffer measure in incidences of non zero levels of *E. coli*. In some instances, MSF has been used entirely without chlorination especially in rural areas where the costs inhibit such actions. This again acts as a motivation factor for applying MSF due to its cost advantages in comparison with conventional RSF systems.
- Given also the financial implications of such tests as COD and True colour, *E. coli* and turbidity levels were thus considered reasonable estimates to base such conclusions. Additional tests (e.g. COD and true colour) were not done to further substantiate this conclusion. However, these could be suggested as a basis for further investigations provided sufficient funds are made available as this was also a major drawback in this study.

We trust that this bit of information will provide reason enough for the state of the article.

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