

Direct horizontal-flow roughing filtration. Part I: optimisation of process parameters

T. Ahsan, G. J. Alsaerts* and J. P. Buiteman, *International Institute for Infrastructural, Hydraulic and Environmental Engineering (IHE)*, PO Box 3015, 2601 DA Delft, the Netherlands

ABSTRACT: Roughing filters are used prior to slow or rapid rate filters for the pretreatment of turbid water. In order to improve the performance of horizontal-flow roughing filtration this process has been modified by applying a constant coagulant dose prior to filtration (direct horizontal-flow roughing filtration or DHRF). In this paper the main process parameters of DHRF were optimised with a lab-scale pilot-plant. For high turbidity water (≈ 200 NTU), the optimum coagulant dose was about 1 mg Al(III)/L , which was effective over a wide pH range (6.5–8.5). Optimum rapid mix G was $200\text{--}300 \text{ s}^{-1}$ with a 1 min detention time. For a DHRF with a 4–5 m long first compartment (grain size 20 mm), and a 3–4 m long second compartment, with comparatively large grains (8–13 mm), a filtration rate of 5–7 m/h appeared to be suitable to ensure low effluent turbidity (2–3 NTU), low headloss (12–18 cm) and acceptable filter run time (3–5 days). Part II of this paper will investigate the DHRF performance in handling fluctuations in raw water turbidity and in colour removal.

Filtration rudimentaire directe à écoulement horizontal: Première partie: optimisation des paramètres de cette technique

RÉSUMÉ: La filtration rudimentaire est utilisée avant la filtration lente ou rapide pour le prétraitement des eaux turbides. A fin d'améliorer la performance de la filtration rudimentaire directe à écoulement horizontal, on a antérieurement modifié ce procédé par l'application d'une dose constante de coagulant avant la filtration (filtration rudimentaire directe à écoulement horizontal ou FRDH). Dans cette communication, les principaux paramètres de cette technique ont été optimisés grâce à une installation pilote à l'échelle du laboratoire. Pour des eaux à forte turbidité (≈ 200 UNT) la dose optimale de coagulant était d'environ 1 mg Al(III)/L , s'avérant efficace pour un large éventail de pH (6,5–8,5). Le mélange rapide optimal G était de $200\text{--}300 \text{ s}^{-1}$ avec un temps de séjour de 1 min. Pour une installation comportant un premier compartiment de 4–5 m de long (granularité 20 mm) et un second compartiment de 3–4 m de long avec une granularité comparativement élevée (8–13 mm), un débit de filtration de 5–7 m/h semblait adéquat pour garantir une faible turbidité de l'effluent (2–3 UNT), une faible perte de charge (12–18 cm) et une durée de service du filtre acceptable (3–5 jours). Dans la seconde partie de la communication, on examinera les performances de la FRDH par rapport aux fluctuations dans la turbidité des eaux brutes et à l'élimination de la couleur.

INTRODUCTION

Horizontal-flow roughing filtration (HRF) has been proposed as a viable pretreatment process to go before sand filters in developing countries [1–3]. The filters are typically 8–12 m long and divided into three or four compartments, with the first containing coarse grains (15–25 mm dia.) followed by compartments with increasingly finer grains (down to 3–5 mm dia.). The design guideline for HRF based on laboratory tests suggests that for influent turbidity up to 200–400 NTU and a filtration

rate of 0.5–1 m/h, the filtrate quality is 3–5 NTU [4]. However, field experience has shown that the removal efficiency is 70–90%. For a high turbidity influent (200 NTU) the effluent typically remains as high as 50 NTU [5–7]. The small grains bed in the last compartment is prone to clogging and is difficult to clean. A major limitation of HRF is its low filtration rate and the consequent need for a large filter volume leading to a high construction cost. Particle removal efficiency would also be low when the influent water contains organic substances and colloidal particles of high stability (see Part II, to be published in *J. Water SRT—Aqua*, Vol. 45, No. 6). The proposed manual filter cleaning is also a major constraint. This makes HRF

*Corresponding author.

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B. M. Simarmata



Process Analysis And Optimization Of Direct Horizontal-flow Roughing Filtration:

Process Analysis and Optimization of Direct Horizontal-flow Roughing Filtration Tanveer Ahsan, 1995-12-31 This study developed a pretreatment technology for highly turbid river water called direct horizontal flow roughing filtration by combining the principles of direct with roughing filtration process. It is intended to help with appropriate water treatment technology in developing countries. 12th International Symposium on Process Systems Engineering and 25th European Symposium on Computer Aided Process Engineering, 2015-07-14 25th European Symposium on Computer Aided Process Engineering contains the papers presented at the 12th Process Systems Engineering PSE and 25th European Society of Computer Aided Process Engineering ESCAPE Joint Event held in Copenhagen Denmark 31 May 4 June 2015 The purpose of these series is to bring together the international community of researchers and engineers who are interested in computing based methods in process engineering This conference highlights the contributions of the PSE CAPE community towards the sustainability of modern society Contributors from academia and industry establish the core products of PSE CAPE define the new and changing scope of our results and future challenges Plenary and keynote lectures discuss real world challenges globalization energy environment and health and contribute to discussions on the widening scope of PSE CAPE versus the consolidation of the core topics of PSE CAPE Highlights how the Process Systems Engineering Computer Aided Process Engineering community contributes to the sustainability of modern society Presents findings and discussions from both the 12th Process Systems Engineering PSE and 25th European Society of Computer Aided Process Engineering ESCAPE Events Establishes the core products of Process Systems Engineering Computer Aided Process Engineering Defines the future challenges of the Process Systems Engineering Computer Aided Process Engineering community **Recent Progress in Slow Sand and Alternative Biofiltration Processes** Rolf Gimbel, Nigel Graham, M. Robin Collins, 2006-03-31 Slow sand filtration is typically cited as being the first engineered process in drinking water treatment Proven modifications to the conventional slow sand filtration process the awareness of induced biological activity in riverbank filtration systems and the growth of oxidant induced biological removals in more rapid rate filters e.g biological activated carbon demonstrate the renaissance of biofiltration as a treatment process that remains viable for both small rural communities and major cities Biofiltration is expected to become even more common in the future as efforts intensify to decrease the presence of disease causing microorganisms and disinfection by products in drinking water to minimize microbial regrowth potential in distribution systems and where operator skill levels are emphasized Recent Progress in Slow Sand and Alternative Biofiltration Processes provides a state of the art assessment on a variety of biofiltration systems from studies conducted around the world The authors collectively represent a perspective from 23 countries and include academics biofiltration system users designers and manufacturers It provides an up to date perspective on the physical chemical biological and operational factors affecting the performance of slow sand filtration SSF riverbank filtration RBF soil aquifer treatment SAT

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