EVALUATION OF THE PERFORMANCE OF MULTI-STAGE FILTERS FOR TREATMENT OF DRINKING WATER: A PILOT PLANT STUDY AT MOI UNIVERSITY WATER TREATMENT WORKS-ELDORET, KENYA.

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ABSTRACT

Only 35% of over 70% Kenyans living in the rural and suburban areas have access to treated water as opposed to 75% of those in urban areas. A major reason for this low accessibility to potable water in Kenya stems in the government's over dependence on complex and expensive conventional treatment systems at the expense of more appropriate treatment technologies such as Multi - Stage Filtration (MSF). Among others, MSF are capable of increasing access of the rural communities to potable water at the lowest operation and maintenance costs. Multi - Stage Filtration (MSF) is a combination of Slow Sand Filters (SSF) and Pre - treatment systems. This research was undertaken in order to facilitate the ultimate introduction of MSF treatment system as a means of alleviating the problem of inaccessibility of treated water. The general objective was evaluation of performance of MSFs in removing selected parameters guiding drinking water quality such as Faecal and Total coliforms, turbidity, suspended solids, and iron in comparison to the conventional treatment systems. Performance of gravel, burnt (charcoal) maize cobs, and broken burnt bricks as suitable pre - treatment filter materials were compared. Verification of Wegelin design criteria for Horizontal flow Roughing Filters (HRF) recommended in literature, monitoring SSF filter bed resistance as an indicator of filter run length, and comparison of performance of MSF against conventional filters were also done. Database for the performance of MSF with respect to Moi University was also obtained. Use was made of pilot plant study, laboratory tests, and secondary data to accomplish the study. The results showed that all the three pre - treatment filter materials could satisfactorily serve as filter material. Both burnt bricks and maize cobs performed slightly better than gravel. It was also observed that HRFs could reduce the SSF influent impurity loads such as iron and bacteria by about 40%. SSFs

were also found to eliminate faecal coliforms by very high percentages of over 97% hence reducing the chlorination expense tremendously. The predicted suspended solids removal efficiency by the HRFs using Wegelin design criteria compared closely with field results in the high peak periods. Generally, MSF technology was observed to perform better than the conventional system. With regard to bacteriological quality improvement, MSF gave removal efficiency in the range of 90% against 49% for conventional system before chlorination. For suspended solids and turbidity, MSFs were slightly better than the conventional system with MSF giving removal of 95% for both parameters against 91% and 93% for conventional system respectively. Despite the low filtration rates of MSFs compared to conventional system, the capacity compensation by additional filter area for SSFs results in a slightly higher initial cost in terms of land and sand volume.