

Effects of Water Chemistry on in-situ Deposition of Mineral Phases at Kandy South Water Treatment Plant

N.G.R. Saumyarathna
Uva Wellassa University, Badulla, Sri Lanka

and

S.K. Weragoda, M. Makehelwala
Greater Kandy Water Treatment Plant, Katugastota, Sri Lanka

Introduction

The Kandy South Water Treatment Plant (KSWTP) was commissioned on 29th January 2010. The main function of this plant is to treat raw water abstracted from the Mahaweli Ganga (River). This plant is designed to produce 35,000 m³/day of drinking water. The water treatment facilities comprise: 1) Intake section, 2) Treatment processes, including aerator, lime and alum feeding, pulsators, sand filters, backwashing system, post chlorination and neutralization system; 3) Storage; 4) Sludge Treatment; and 5) Other accessories, including supervisory control and data acquisition (SCADA), programmable logic controls (PLCs). The possible effect of water chemistry on in-situ deposition of mineral phases at KSWTP has been analyzed in this study. Brownish black color depositions are found inside the casing, impellers and on the surface of the moving parts of the Non Return Valves (NRV's) at KSWTP. Water in the channel at the service outlet of instrument is black color. It is also noticed that black-brown color deposition on walls of clear water reservoir. Dissolved elements such as Mn, Si, Al, Ca, and Mg in natural water form mineral deposition with different temperature and pressure. Thus, these elements may be causative factors. Deposition results when dissolved ions in the water exceed the solubility of a given mineral (Sly et al, 1990).

Methodology

Deposit samples were analyzed using Energy Dispersive X-ray Fluorescence (EDX) method which can directly determine the metal content in the solid material. Wet samples were analyzed to determine the bacteriological effect of manganese deposition. Water quality of different treatment processes was measured each week during the month period. Chemical water quality parameters were analyzed using various analytical methods. Major and minor ions were measured using titrimetric and spectroscopic methods using Varian SpectrAA 240 AAS available at the UvaWellassa University and as Atomic Hach DR 5000 as UV/Vis spectrophotometer. Other physical properties were measured with standard methods. Possible mineral phases of different ion concentration with different pressure and temperature were simulated using Visual Minteq software.

Results and Discussion

Table 1. Metal content of dry deposit sample.

wt %	Mahakandha pump	Non-return valve
Fe	3.4	78.9
Mn	57.4	17
Cu	31.1	0.4
Pb	4.1	
Ni	1.1	1
Zn	1	0.6
Ca	0.4	0.9
Ce	0.2	
Ba	0.2	1
S	1	
Cr		0.1
Sum	99.9	99.9

Conclusions

There is no any bacteriological manganese oxidation process in this water treatment process. Low level of manganese and iron in the water has formed iron and manganese deposit. Source of Iron and manganese of the water is raw water. There is no copper in raw water and copper in the treatment process form Cuprospinel (CuFe_2O_4). Ferrihydrite, Ferrihydrite (aged), Gibbsite (C), Goethite, Hematite, Lepidocrocite, Stengite, $\text{Fe}(\text{OH})_2 \cdot 7\text{Cl}_3(\text{s})$, Maghemite and Magnetite are the main possible Fe-bearing mineral phases. $\text{MnHPO}_4(\text{s})$ is the only Mn-bearing mineral phase.

References

Sly, L.I., Hodgkinson, M.C., Arunpairojana, V., 1990. Deposition of Manganese in a Drinking Water Distribution System. *Applied and Environmental Microbiology*, 56, 628-639.