Abstract

This diploma thesis is aimed at the evaluation of water treatment technology in Písty waterworks which treats raw water with high concentration of iron and manganese. The most common method of iron and manganese removal from raw water is based on oxidation to insoluble hydrated oxides followed by separation of formed aggregates. The plant technology consists of aeration, oxidation agent $KMnO_4$ dosing and mixing, sedimentation, filtration and hygienic protection.

Chemical analysis of treated water, evaluation of the aeration efficiency of iron and manganese oxidation, evaluation of the separation efficiency of the sedimentation tank and filters, assessment of distribution of iron and manganese in the filter, assessment of dirt holding capacity and optimization of $KMnO_4$ dose were determined.

Raw water pH fluctuated around 7,3 during measurements, whereas iron and manganese concentrations in raw water were 6,00 and 0,82 $mg.l^{-1}$, respectively. Oxidation of 97,2 % of dissolved iron and of 14,3 % of dissolved manganese was achieved after the aeration. The separation efficiency of the sedimentation tank was 82,9 % for iron and 46,5 % for manganese, however the separation efficiency of the second half of the sedimentation tank was low. Thus, the perforated baffles in the second half of the sedimentation tank do not contribute to the aggregation. The observed degree of aggregation of iron and manganese was 0,99 and 0,76, respectively. The highest portions of iron (87 %) and manganese (65,5 %) were contained in macro-aggregates which are readily separable by sedimentation.

The filtration efficiency was 82,6 % for iron and 98,6 % for manganese. The increased manganese removal is attributed to the adsorption of Mn^{2+} onto filter bed coated by MnO_2. It was found that the distribution of manganese in the filter bed was relatively homogenous contrary to the distribution of iron which was retained predominantly in the upper layer of the filter bed. It is probably due to the tendency of iron to form macro-aggregates during aggregation process at the plant. Optimization of $KMnO_4$ dose and reaction pH enables the significant decrease in $KMnO_4$ consumption compared to the current reaction conditions at the plant which would lead to the reduction of treatment costs. Optimized $KMnO_4$ dose was 1,68 mg per 1 mg of dissolved manganese at pH value 8,5.

Key words: water treatment, manganese and iron removal, permanganate oxidation, jar test, process optimization.