Abstract

The hydrogen sulphide produced in wastewater is a major cause of corrosion in concrete sewer lines, manholes, sewage pumping wells and treatment tanks. The sulphide corrosion also occurs in electrical and mechanical parts of sewage pumping stations. The presence of sewage hydrogen sulphide is a public nuisance because it has highly disagreeable odor at a level as low as 0.01 ppm or less in the atmosphere. This research was initiated upon the request of the Baghdad Sewage Board to evaluate and control such problems.

Laboratory and field experiments involve simultaneous measurements of dissolved sulphide concentration and sewage characteristics such as BOD_5, COD, sulphates, suspended solids, pH and sewage temperature which were carried out from April to September 2002 at two sewage pumping stations in Al-Kerkh sewerage system. The pumping stations include Al-Bayaa and Al-Doura sewage pumping stations.

The corrosion problem was investigated in three main concrete sewer lines in Al-Kerkh side. The inspected lines were West Trunk Sewer (W.T.S), N-line and Al-Tamim line. Through this work, eight manholes along W.T.S, six manholes along N-Line and six manholes along Al-Tamim line were inspected. The sewage samples were taken to determine sewage characteristics and the depth of flow was measured for five runs at each inspected manhole.

Results reveal that the degree of dissolved sulphide concentrations reported through this study for all sampling points are (0.36-9.416 mg/L) with 53% of the reported values more than 2 mg/L. The reported dissolved sulphide concentrations are higher than those reported in the

international studies because of high temperature of sewage (39.2 ^{o}C) in Baghdad.

Analysis of data reported in this work shows that the sulphide concentrations could be correlated with BOD5, COD, sulphate concentrations, suspended solids and sewage temperature. The results also indicate that sulphide concentration is affected by the depth of flow in sewer lines and the velocity of flow.

Pomeroy Z-value also was used to evaluate the problem under study. The results indicate that the inspected lines suffer from serious attack and high odor nuisance. An analysis of data shows that the hydraulic side has the first effect on the problem.

Nine regression models were developed to predict sulphide concentration in the studied locations in terms of some independent variables concerning the physical, chemical and hydraulic characteristics of the sewage in addition to six regression models to estimate sulphide flux in terms of BOD_5.

The capability of three different chemicals ($CuSO_4$, $ZnSO_4$, $Ca(OCl)_2$), to control sulphide formation was tested. The tests show that the dissolved sulphide percentage removal is directly proportional to the applied dose, which in turn depends on the initial sulphide concentration in sewage samples.

Three design nomograms were prepared in this study presenting an easy method to determine the required doses from each chemical to achieve certain degree of sulphide removal when the sulphide concentration in the sewage is known. From the dissolved sulphide percentage removal, zinc sulphate is the most efficient chemical and from the change in sewage characteristics, calcium hypochlorite is the best chemical.

The cleaning and flushing method also is applied in this work. A reduction of about 85% in dissolved sulphide concentration was achieved therefore, sewer maintenance to remove slime and silt using periodic flushing of the sewers is needed to prevent the septicity of the sludge deposits. The study reveals that there are some uncontrolled industrial discharges to the municipal sewer system therefore, the sewage board should monitor and control of these effluents to be within the allowable limits.

The ability of two materials, sodium silicate and potassium silicate to protect concrete sewers from sulphide attack was tested. The work includes two manners of surface treatment. The first is by submerging the concrete specimens in the treatment solutions and the second by brushing the surface of concrete specimens with these materials. The results show that the first manner is not an effective method whereas brushing the concrete surface with several thin coats of sodium silicate and potassium silicate decreases the deterioration by about 80.6% and 56.7% respectively. The combined action of rice husk ash and high range water reducing agent to produce concrete pipe with a high resistance to sulphide attack was investigated. The results show a significant improvement of the resistance to the corrosion problem.