COMPARATIVE STUDIES REGARDING THE HEAVY METALS IONS AND CONDUCTIBILITY, IN WASTE WATERS FROM SMITHFIELD –PERIAM SWINE FARM, TIMIS COUNTY

STUDII COMPARATIVE PRIVIND INCARCATURA CU DIFERIȚI IONI DE METALE GRELE, A APELOR REZIDUALE DE LA FERMA DE CRETERE A PORCILOR SMITHFIELD – PERIAM, JUDETUL TIMIS

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The aim of this study was to present the results of the investigation for the surface waters pollution with different ions, pH, electric conductibility and organic substances from Smithfield-Periam swine breeding complex. Concentrations of magnesium, sulphates, sodium and potassium are situated under the limits accepted for the first class of the surface waters in the new system of cleaning. Electric conductivity values are over the limits accepted by STAS for the surface waters in the old cleaning system and framed in standard limits in the new wastewaters cleaning system. pH of the analyzed wastewaters is framed in the standard of the surface waters for both cleaning wastewaters systems. With the exception of organic substances, the new system of wastewaters cleaning used in the Smithfield–Periam swine farm is better and in the same is avoiding the pollution for surface waters.

Key words: pollution, swine, pH, ions, wastewaters

Introduction

Treatment and disposal of stock breeding manure, especially pig slurry, always pose an ecologic problem. The related problems include emanation of malodor, detrimental gases and microorganisms and contamination of the surface and underground waters and soil. Sludge and wastewater sediment can serve as a source of phosphorus pollution because of the high phosphorus concentration.

In some countries with intensive livestock systems (particularly Eastern Europe), manure is discharged directly into the surface water, often after first having been treated in lagoons. This implies complete loss of nutrients and organic matter in the manure. Direct discharge into surface water causes an-aerobiosis in
the water, because the easily decomposable fraction of the manure will start to decompose immediately using all dissolved oxygen and killing the water fauna and flora. In addition, the load of nutrients in the manure will contribute to water eutrophyzation and heavy metals will cause toxicity.

Conductivity is a measure of water’s ability to carry an electrical current. Many inorganic acids, bases, and salts are good conductors while organic compounds such as glucose are poor conductors. Conductivity can be used to indicate the total dissolved solids (TDS) content of water. Water temperature affects conductivity. Standard temperature for conductivity measurement is 25ºC.

Magnesium when combined with sulfate can cause scouring. Magnesium contributes to water hardness, and like calcium, can form scale which blocks screens and drinkers. Calcium contributes to water hardness, and can cause a build up of scale in screens and drinkers. The resulting reduction in water volume supplied to the pig can decrease performance.

Sulfate forms salts with calcium, sodium and magnesium. Sodium is commonly found in groundwater and by itself, poses little threat to a pig’s health. However, if sodium is present with sulfate, scouring and a decrease in performance can occur.

Phosphorus tends to leach easily from fields where manure has been spread because the nutrient proportion in manure does not match the needs of crops; therefore phosphorus tends to be in excess. Leaching of P from agricultural land into surface water is an important contribution to its eutrophyzation. This may lead to excessive growth of algae and eventually to anaerobic water. The water becomes smelly and water life is seriously disturbed.

Chloride by itself has little effect on pig performance. The maximum recommended chloride level of 250 mg/l for people is based on taste, not health hazard. As chloride levels of water are often lower than sodium levels, any decreases in dietary salt (sodium chloride) must be done with caution or a chloride deficiency can result. Very high chloride levels may indicate a pollution problem.

Potassium is commonly found in the environment, but is rarely found in groundwater above a level of 50 mg/l because potassium binds tightly to the clay fraction of soils. Iron is an essential nutrient. As iron concentration in water is far below toxic levels, no guidelines have been established for livestock watering. Iron concentration affects the water delivery system. When groundwater is pumped to the surface, the presence of oxygen converts soluble iron into insoluble iron (which causes rust stains in sinks). If iron-fixing bacteria are present in the well, they produce a red slime which can clog water lines, screens, and even the well casing. As the bacteria can be introduced during the drilling process, all equipment should be disinfected after each well is completed. pH of groundwater is normally 7.4 to 8.8. Pig performance is not directly affected by pH; however, pH affects how well chlorine acts as a bacterial agent. The higher the pH, the less effective chlorination will be in fighting a bacterial problem.
Material and Methods

Researches were made in the swine complex Smithfield–Periam with the purpose of establishing the wastewater pH, electric conductibility and also the content in different ions. In these farms, manure evacuation is made with a system that uses liquid beds with canals and successively dams. Canals are washed from middle of the shelters to the extremities and liquid manure is gathered in large basins. From basins wastewaters are pumped with pump stations one and two and get in the lagoons. Finally are discharges in the Mureș River by pump station three.

Water samples for analyses in the old cleaning system were took from: pump station one, lagoon number six, pump station three, discharge in the Mureș Rive, one km downstream and one km upstream and from borehole in the new cleaning system.

Results and Discussion

Data for results obtained after samples were analyzed in the old and new system of wastewater cleaning, from Smithfield Group –swine farm are displayed in table 1.

From the data in table 1, it can be seen that pH – 7.4 in 2006 respectively 7.2, of the water from the control borehole are framed in the limit values admitted by the current Law for surface waters.

From table data it comes out that chlorine ion (44.11 mg/l in 2006 and 41 mg/l in 2008) in analyzed samples lies under the standard limits accepted for the surface waters in both systems of wastewater cleaning.

As regarding the concentration of Mg²⁺ (42.03 mg/l in 2006 and 38.9 mg/l in 2008), SO₄²⁻ (166 and 174.3 mg/l), Na⁺ (32 and 18 mg/l) and K⁺ (3.29 and 2 mg/l) ions are situated under the lower limits of the standard values admitted by the Law no. 458/2002, changed and modified by the Law 311/2004. Calcium (Ca²⁺) and phosphorus (P⁰) values of ions are framed between the limits of the standard for the surface waters.

Electrical conductivity of water samples is used as an indicator of how salt-free, ion-free, or impurity-free the sample is. The purer the water is, the lower the conductivity (the higher the resistivity). Wastewaters electric conductibility - 1015 mg/l, lies among the standards accepted for the surface waters in the samples took from wastewaters in the old cleaning system. In the new system electric conductivity -887 mg/l lies under the admitted standard for the surface waters.
Table 1

Results for old and new system of wastewater cleaning in Smithfield Periam swine farm

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Values/ Sample point collection</th>
<th>Values admitted by the Law 458/2002 changed and completed by the Law 311/2004</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2006</td>
<td>2008</td>
</tr>
<tr>
<td>PH</td>
<td>7.4</td>
<td>7.2</td>
</tr>
<tr>
<td>Chlorines (Cl(^{-})) mg/l max</td>
<td>44.11</td>
<td>41</td>
</tr>
<tr>
<td>Calcium (Ca(^{2+}))</td>
<td>126</td>
<td>136.3</td>
</tr>
<tr>
<td>Magnesium (Mg(^{2+}))</td>
<td>42.03</td>
<td>38.90</td>
</tr>
<tr>
<td>Sulphates (SO(_4^{2-}))</td>
<td>166</td>
<td>174.3</td>
</tr>
<tr>
<td>Sodium (Na(^{+}))</td>
<td>32</td>
<td>18</td>
</tr>
<tr>
<td>Potassium (K(^{+}))</td>
<td>3.29</td>
<td>2</td>
</tr>
<tr>
<td>Phosphorus (P(^{+}))</td>
<td>2</td>
<td>1.5</td>
</tr>
<tr>
<td>EC at 25(^{\circ})C µ S/cm max</td>
<td>1015</td>
<td>887</td>
</tr>
<tr>
<td>Total hardness</td>
<td>28.7</td>
<td>28.08</td>
</tr>
<tr>
<td>Organic substances</td>
<td>112.2</td>
<td>74.72</td>
</tr>
<tr>
<td>Phenols</td>
<td>0.002</td>
<td>0.0</td>
</tr>
<tr>
<td>Phosphate</td>
<td>0.13</td>
<td>0.1</td>
</tr>
<tr>
<td>Iron (Fe(^{+}))</td>
<td>0.03</td>
<td>0.01</td>
</tr>
<tr>
<td>Manganese</td>
<td>0.008</td>
<td>0.006</td>
</tr>
</tbody>
</table>

Organic substances in aquatic sediments are known to be an important phase for contaminant partitioning and transport. The samples analyzed reveal an exceeding of three times more (74.72 mg/l) than admitted standard limits and even more in the old system of wastewater cleaning of 82.2 mg/l. Those high values result after the slurry spreading on the field and washed in the soil.

As regarding the concentrations of phenols, phosphate, iron and manganese in both systems of wastewaters cleaning lies under the standard limits admitted for the surface waters.

Conclusions

1. Concentrations of magnesium, sulphates, sodium and potassium are situated under the limits accepted for the first class of the surface waters in the new system of cleaning, while in the old system only magnesium and sulphates lie under the lower accepted limit.
2. Electric conductivity values are over the limits accepted by STAS for the surface waters, excepting the discharge in the Mureș River where the conductivity is frame in the first class of surface waters in the old cleaning system and framed in standard limits in the new wastewaters cleaning system.

3. Ph of the analyzed wastewaters is framed in the standard of the surface waters for both cleaning systems.

4. Properly handled, stored and applied manure will not jeopardize the integrity of surface water. For concentrated pork operations, the discharge of manure into lakes, streams or other surface water bodies it must be strictly prohibited.

5. With the exception of organic substances, the new system of wastewaters cleaning used in the Smithfield –Periam swine farm is better and in the same is avoid the pollution of the Mureș stream.

References


