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항생제는 미생물이 원인이 되는 질병으로부터 인간을 비롯한 생물계를 구제하는 장점으로 인해 많이 사용되어 왔으나 항생제 오·남용은 내성률을 높여 급기야는 어떠한 항생제도 듣지 않는 슈퍼박테리아를 출현시키는 등의 사회문제를 야기하게 되었다. 의약분업 이후 의료기관의 항생제 사용은 어느 정도 규제가 이루어지고 있으며 사용량에 있어서도 다소 감소추세에 있다. 그러나 축수산업에 사용되는 항생제의 오남용이 또 다른 사회문제로 야기되고 있다. 전체 항생제 사용량의 50%정도를 소비할 것으로 추정되는 축수산업에서는 연간 1500톤 정도의 항생제가 가축의 질병치료뿐만 아니라 성장촉진 목적으로 무분별하게 사용되고 있다.

이처럼 축수산업에서 이루어지고 있는 항생제 과다사용은 항생제의 내성균을 발현시켜 가축의 질병치료를 어렵게 할 뿐만 아니라, 더 나아가 가축의 항생제 내성균이 그 내성을 인체에 전달하여 사람의 질병치료도 어렵게 만들 수 있는 등 심각한 피해를 초래할 수도 있으며, 항생제의 과다사용으로 인해 축산 분뇨의 형태로 자연계에 배출될 경우에도 심각한 수질오염의 원인 및 이차오염을 유발할 가능성이 높다.

환경부는 항생제로 인한 환경오염의 영향의 심각성을 인식하여 전자파 등 유해물질 노출실태 및 건강영향 조사(전자파, 항생제, 소음의 건강영향조사)를 통하여 하천에 대한 항생제와 진통제 등 의약품질 잔류 실태 조사에 착수한 바 있다. 현재, 선진각국의 축산물 생산량 및 항생제 사용량, 주요사용 항생제, 축종별 항생제 분석 등 항생제 사용에 관한 실태 분석에 대한 자료는 수집되고 있으나, 사용하는 항생제가 축산 폐수 내에 잔류하는 정도 및 이로 인한 축산폐수처리에 미치는 영향에 관한 구체적인 연구결과는 미흡한 실정이다. 또한 축산폐수 처리에 있어서 다수의 처리장이 특정시기(7월-9월)에 질소, 인 제거에 어려움을 겪고 있는데, 축산농가의 항생제, 소독제 사용과 연관성이 있는 것으로

로 추정된다. 따라서, 대표적으로 사용되는 항생제가 축산폐수처리효율에 미치는 영향을 고찰하여 가축 분뇨 적정처리로 하천수질을 I-II 급수로 개선하는데 기여하고자 한다.

가

가

가 70mm, 70mm, 200mm

7

1L , 800ml

, DO 2 L/min

SCOD_{cr} NH₄⁺-N 500mg/l, 120mg/l

MLSS 2000 mg/l , 12

2 , 24

가

(TC)

(OTC)

. NH₄⁺-N Control 가 100

mg/l 가 ,

. SCOD 가

가

가

. 50mg/1ml
 , 3
 가 3
 . 가 NH₄⁺ - N
 가 3
 가 50 mg/l
 . SCOD_{cr}
 가 , 가
 가 50 mg/l
 가
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SUMMARY

I. Title

“ Investigation of the influence of present of antibiotics used to the efficiency of biological piggery wastewater treatment plan in Kyeonggi province ”

II. Objectives and Importance

The growing amount and biological impact of antibiotics in the environment have been widely discussed. Antibiotics are used for the treatment of diseases of humans and animals, and are also commonly applied to livestock for preventing diseases and promote growth. Approximately, 50% of antibiotics product are used in livestock industry. However, the presence of antibiotics in the wastewater from livestock farm due to its over-application should be concerned because they could change microbial ecology, increase the proliferation of antibiotic resistant pathogens, provoke toxic effect on aquatic species. In addition, these antibiotics can cause negative effect on the performance of biological wastewater treatment plan due to its antibacterial properties. It has been well-known that nitrification in wastewater treatment plants is a most important and sensitive microbiological process, which can be disturbed by the widely spectrum of toxic substances. Therefore, the present of residue of antibacterial agents in piggery wastewater would inhibit activity of nitrifying bacteria, in particular, and of other microorganisms in the biological treatment process, in general.

In this investigation, our aim is to evaluate the effect of some common used antibiotic in Korean piggery farm such as oxytetracycline (OTC) and tetracycline (TC) to nitrification rate and biological oxidation efficiency of organic compounds in aerobic reactor for treating piggery wastewater with the addition of different concentrations of those antibiotics.

III. Research scope

The experiment was conducted by the use of seven aeration reactors. Each one was a total volume of 1 L, working volume of 800 mL and constructed from Plexiglas. The content of each reactor consisted of aeration diffuser and air flow meter for adjusting air flow rate of 2 L/min.

Inoculation microorganism was activated sludge collecting from Y wastewater treatment, which has been operated for 40 days. All reactors were operated as batch mode with MLSS concentration of 2000 mg/L. Diluted piggy wastewater was used and characterized as 500 mg SCOD_{Cr}/L and 120 mg NH₄⁺-N/L.

For each batch test, one reactor was operated without any addition of antibacterial agents as control one, while the performance of other six reactors was evaluated by the addition of different concentration of OTC or TC in the range from 1 to 500 ppm. All batch test was carried out and finished whenever conversion and oxidation rate of NH₄⁺-N and organic compounds (as SCOD_{Cr}), respectively, have been constant.

In addition, the test for evaluating long-term effect of commercial antibiotic on the activity of activated sludge was conducted by repeating three cycles with the same inoculated sludge.

IV. Results

Firstly, the antibiotics used, Oxytetracycline (OTC) and Tetracycline (TC), were purchased from Sigma-Aldrich. The experimental batch tests were carried out separately for each type of antibiotic. By comparing with control reactor, the results show that there was not significant negative effect on both nitrification and bio-oxidation of organic compounds rate when the applied concentration of OTC and TC were in the range of 0.1 ppm to 100 ppm. Secondly, the commercial antibiotic product, Terramycin, that is commonly used in piggy farm and mainly consisted of Oxytetracycline was selected for subsequent experiment. In the first cycle, the results with applied antibiotic concentration from 1ppm-50ppm showed the same as control one, while nitrification rate was decreased 20% - 35% when antibiotic concentration increase to 100 - 500 ppm, respectively. After the second

repeated cycle, the nitrification rate slightly decreased in the reactors with present of antibiotic. In the third repeated cycle, in term of nitrification rate, the significant negative effects were observed in the reactors conducting with the antibiotic concentration range from 50 to 500 ppm. It could be suggested that the long-term present of antibiotic in the reactor would result in the decrease of nitrifying bacteria.

VI. Application plan

The piggery wastewater characterization should be examined in order to assess the fraction of common used antibiotics. The effects of residue antibiotics in livestock wastewater will be evaluated in full biological treatment systems. From that alternative treatment processes for high-strength antibiotics piggery wastewater might be suggested. In addition, the guideline for the usage of antibiotics in livestock farm should be regulated not only to avoid the over-application of antibiotic but also to stabilize the treatment system of such discharging source.

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