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Radiation Fusion Technology for Sewage Sterilization

M.J. Lee*, T.H. Kim, S.H.Ryu, I.H. Jung, O.M. Lee, T.H. Kim
1266 Shin Jung Dong, Jung Eup City, Jun-Buk, Korea
Advanced Radiation Technology Institute, KAERI
**Corresponding author: nihjung@kaeri.re.kr*

1. Introduction

Environmental regulation for effluent of sewage and wastewater treatment plant is going to be reinforced in terms of ecology toxicity and number of E.coli from 2011. Besides, it has been known that UV technology is not enough to be a sterilization tool due to regrowth of E.coli even after treatment with UV. Therefore it needs a novel technology for both restriction of E.coli regrowth and treatment of toxic materials in order to meet the environmental regulation being enforced. Electron beam has unique capabilities on destruction of chemicals and sterilization of microbial. In this study, field study on destruction of antibiotics and endocrine disruptors, reduction ecological toxicity and E.Coli regrowth was carried out using by mobile electron beam accelerator. Experimental results showed that irradiation on effluent could effectively reduce not only ecology toxicity but regrowth of E.coli by destruction of chemicals and complete sterilization.

2. Methods and Results

Experiments were carried out in the sewage treatment plant shown by following figure 1.

Mobile electron beam accelerator (MEB) was installed at the end of final stage of treatment. It is called by effluent. Effluent was introduced to the storage tank and controlled by optimum irradiation dose and discharged after analyses. The most of irradiation dose was controlled by the range of 0.5 to 2.0 kGy.

Wastewater effluent samples before and after disinfection (UV and MEB), were assayed for two groups of bacteria (total bacteria and total coliform bacteria). Medium for selective culture was prepared according to Standard Method. Both standard membrane filter analysis and plate count technique were used for enumerating bacteria.

2.1 On-site examination at sewage treatment facility

On-site examination at sewage treatment facility was performed belonged to J. city with mobile electron beam accelerator(MEB) with the following condition.

- Spec. of MEB: 0.6 MeV, 33 mA, 20 kW
- Irradiation intensity: 0.5～1.0 kGy
- Treatment capacity: 150 ton/day

The process diagram, the pictures of installed MEB at site and flow being treated sewage water by electron beam are shown at fig. 1, 2 and 3.

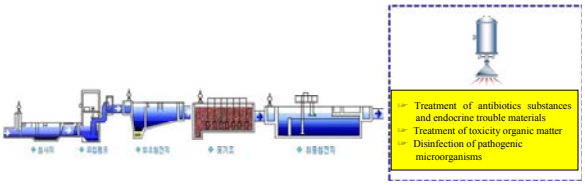

Fig. 1. The process diagram of on-site examination by MEB.

Fig. 2. Picture of installed MEB at site.

Fig. 3. Flow of sewage water being treated by electron beam.

Monitoring of a wastewater treatment plant at J. city showed that 1) UV disinfection efficiencies were 21-99 % and 19-85% and 2) electron beam accelerator 99.9% and 99.9% in averages for total bacteria and total coliform bacteria, respectively (Fig. 4. Microbial regrowth after UV and gamma radiation disinfections were also evaluated for 4 days. Repaired microorganisms after UV disinfection significantly increased, while electron beam irradiation showed almost no microorganism regrowth (Fig. 5). Electron beam accelerator as a disinfection process was much more effective than a UV process.

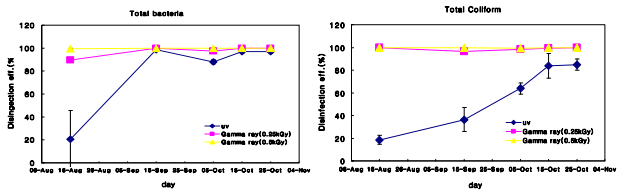

Fig. 4. Monitoring of secondary-level effluent for total bacteria and total coliform bacteria after UV and gamma radiation as a disinfection process.

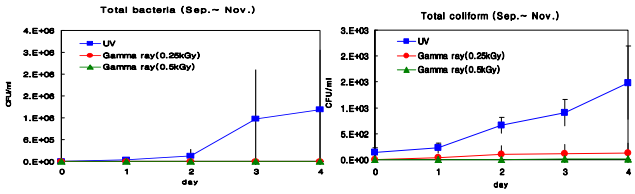

Fig. 5. Comparison of microbial regrowth after UV and gamma radiation as a disinfection process.

3. Conclusions

We can make conclusions through the on-site experience with sewage water of J. city by the MEB as follows.

- Perfect sterilization and restriction of regrowth of E.coli in effluent by E-beam
- Good result in reduction of ecological toxicity by radiation
- Easier decomposition of antibiotic substances and endocrine trouble materials by E-beam

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