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論　文　の　要　約

報告番号	甲 第　1063　　号	氏　名	佐藤　尚文
学位論文題目	UTILIZATION OF LOCAL-AVAILABLE BIOMASS RESOURCES FOR WASTEWATER TREATMENT: APPLICATIONS TO SEWAGE AND LEACHATE TREATMENT AT SOLID WASTE DISPOSAL SITES IN SRI LANKA (汚水処理を目的とした地域バイオマス資材の有効活用:スリランカにおけるし尿及び廃棄物処分場浸出水処理への適用)		

論文の要約

1.Introduction

Sri Lanka has recently appeared as a middle income country (MIC) with a growth rate averaging 5-7% over the past a couple of years. In spite that MIC status of Sri Lanka and the remarkable gains made the achieving several of the Millennium Development Goals (MDGs), significant issues remain with regard to poverty, income disparity, social inequality and environmental issues. One of environmental issues is the water pollution caused by the improper discharged of collected sewage and the poor solid waste management (SWM) in Sri Lanka.

5.1 Investigation on current condition and issues of municipal solid waste management in Sri Lanka

The expenditure of solid waste management of some local authorities reaches approximately from 13% to 34% in the total expenditure. The estimated discharge amount of waste in whole country exceeds 6,000 tons/day in 2000, while the waste composition of municipal waste in Sri Lanka composed of approx. 70% of bio-degradable waste i.e. kitchen or garden waste, approx.20% of recyclable waste such as plastic or paper, and the others. Although the number of off-site compost was only five (5) in 2000, it has rapidly increased for a decade and reached totally 105 compost plants in 2011. There are four categories of final disposal facilities categorized as class A (< 10 tons/day), class B(10-50 tons/day), class C (50-200 tons/day) and class D (200 > tons/day) according to technical guideline in 2007. The number of local authorities in Sri Lanka in accordance with the category belonging to class A is 200, class B is 70, class C is 11 and class D is three (3). There are some requirement for applicable engineered landfill; 1) use of local available material, topography, natural condition and public acceptance as “Site specific” 2) less construction cost and less O&M cost as “Low cost”, 3) simple structure, easy maintain and operation as “Sustainable”, and 4) less pollution and easy mitigation system as “Environmentally friendly”.

5.2 Development of wastewater treatment method by local-available biomass resources: Preliminary works and current performance of coconut-fibre biofilm treatment system (COTS) in Sri Lanka

In order to solve serious environmental degradation caused by improper treatment of wastewater from collected sewage and leachate at dumping sites, it is essential to develop sustainable, low environmental impact, and low cost wastewater treatment

systems. The coconut-fibre biofilm treatment system (COTS) utilizes coconut-fibres as a biofilm support, which are easily available in Sri Lanka.
Some COTS were constructed at some local authorities to treat wastewater. From each COTS, water samples, coco-fibre and sludge samples were taken and used for laboratory analyses. In addition, in-situ measurements characterizing present environmental conditions of COTS were carried out. As a result, the COTS were not fully well operated compared to the initial stage of operation due to lack of maintenance and improper operation. Especially, to enhance microbial activity in the treatment tank, sludge removal from tank must be carried out regularly.

5.3 Development of wastewater treatment method by local-available biomass resources: Microcosm experiments on a coconut-fibre biofilm treatment system for evaluation wastewater treatment efficiencies

The microcosm experiments on a COTS were carried out to evaluate wastewater treatment efficiencies in the laboratory using two wastewaters, synthetic sewage and leachate, with different pollutant loads. Three coconut-fibre conditions were set as a single bundle (low fibre density: LFD), two bundles (high fibre density: HFD), and no coconut fibre (blank). The wastewater was first circulated in the system for six weeks (circulation stage) and then discharged from the treatment tank for 7–24 weeks (treatment stage). Water quality parameters of effluents, pH, DO, EC, BOD, COD, TC, and TN, were measured at one-week intervals, and the sedimented sludge in each treatment tank was collected to determine C, N, and P contents. Results showed effective reductions in BOD and COD in the LFD and HFD conditions for the synthetic leachate, indicating that the coconut fibre contributed to the treatment of wastewater. On the other hand, the fibre density had less or no effect on the reduction of water quality parameters in the synthetic sewage. For both synthetic sewage and leachate, the C and N consumptions generally increased in the order of blank, LFD, and HFD. In particular, sludge sedimentation contributed to C consumption under the HFD condition.

5.4 Conclusions and perspectives

There are still many issues of wastewater caused by solid waste management and wastewater management in Sri Lanka such as illegal dumping, low recycling rate, difficulties in landfill sitting, poor technical capacity on landfill operation and so on in spite of the acts, regulations and strategies related to SWM, and technical and financial supports through donor-oriented projects. Based on water quality analyses, the filed COTS constructed in Sri Lanka performed well to treat wastewater at the initial stage. Due to lack of maintenance and improper operation, however, the performance degraded after several years, suggesting the proper guidance and training to operators are needed to maintain the facility. The results of laboratory tests showed that the microcosm COTS contributes to the reduction of water quality parameters. The removal % of pollutants was dependent on the load conditions and the proper control of pollutant loads is effective to improve the treatment efficiencies of sewage and leachate in COTS. In order to solve existing and future wastewater issues, the proper policy decision, affordable and applicable technology for final disposal site, proper financial, and awareness program should be more encouraged.