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著者(和文)	Tran Ngoc Minh Quyen
Author(English)	Ngoc Minh Quyen Tran
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論 文 要 旨
THESIS SUMMARY

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学生氏名： Student's Name	Tran Ngoc Minh Quyen	指導教員（主）： Academic Advisor(main)	Prof. Kiyohiko Nakasaki
		指導教員（副）： Academic Advisor(sub)	

要旨（英文 800 語程度）
Thesis Summary（approx.800 English Words ）

With economic development and rapid population growth over last few decades, a considerable amount of solid waste from domestic, industrial and agricultural activities has been generated. The major part of solid waste is the food waste that is collected from the household, convenient store, restaurants, and several food-processing facilities. Food waste is easily putrefied and releases a nuisance odors and leachate, thereby poses a threat on human health. Food waste is rich in nutrient, so the composting is a promising alternative for food waste management that enables the valuable organic contents of food waste to be reused, but some characteristics of food waste, especially low pH, raise a challenge to engineers who apply composting for food waste recycling. The acidity of food waste is due to the accumulation organic acids that are not only accumulated during the food waste storage but also generated during the composting. Moreover, composting is the complex biodegradation process where many microorganisms coexist and interact. Understanding the interactions of the coexisted microorganisms is indispensable for optimization of composting process. To solve the low pH problem for composting acceleration, the notion about using an organic acids-degrading microorganism was proposed, thereby the succession of microorganisms toward the successful composting was observed and a better understanding of the interaction of coexisted microorganisms was obtained.

Firstly, it was demonstrated from a previous study that two characteristic lactic acid bacteria; *Pediococcus acidilactici* TM14 (PE), a homofermentative lactic acid bacterium, and *Weissella paramesenteriodes* TA15 (WE), a heterofermentative lactic acid bacterium may contribute for the acceleration of composting. To elucidate the role of PE, PE was inoculated into compost raw material composed of rabbit food with the addition of organic acids that simulate food waste. The growth of PE produced lactic acid and inhibited the production of acetic acid which is detrimental to indigenous microorganisms. So an indigenous fungi *Paecilomyces* sp. QH1 having the ability to degrade organic acids was able to grow. Thus the organic acids contained in the compost material were completely decomposed and the environmental conditions were adjusted allowing for the activity of thermophilic bacteria, which play important roles in composting. In consequence, organic matter degradation in the composting was accelerated.

Secondly, contributions of another lactic acid bacterium, the WE, was elucidated to produce acetic acid which is harmful to composting microorganisms resulting in the inhibition of vigorous organic matter degradation while it was confirmed the PE produced the lactic acid and enhanced the organic matter degradation. These results indicate that two different types of lactic acid bacteria showed quite different effects on the composting. Moreover, it was affirmed that the effects of these two microorganisms, when they coexisted, on composting strongly depended on the initial ratio of PE to WE. If the PE/WE was larger than $10^{1.5}$, accumulation of both lactic acid and acetic acid were restricted probably because so-called loss-loss interaction of two microorganism, and resulted in the acceleration of composting though the WE grew faster than the PE.

Thirdly, it was confirmed that QH1 was only effective in the mesophilic phase leading to the delay of composting where the organic acids were generated during the thermophilic phase. In this demand, a thermophilic microorganism that can degrade the organic acids at the thermophilic condition was successfully isolated. The results of the identification showed that the nucleotide sequence of this isolated thermophile is closely related to *Bacillus coagulans* and it was designated as IP1. This microorganism accelerated the composting by elevating and preventing the drop of pH levels during the composting.

These obtained results enabled me to suggest that the prevention of the acetic acid accumulation during the storage can be obtained by the inoculation of homofermentative lactic acid bacterium such as *Pediococcus acidilactici* TM14 into the food waste incoming to waste management facilities. Moreover, the remediation of failed composting causing by organic acids can be observed by inoculation of the organic acids-degradation microorganisms such as *Paecilomyces* QH1 and *Bacillus coagulans* IP1 in the composting. The application of these useful microorganisms can help to construct the recycle- oriented society.