（別紙様式　14）

2018 年　03 月　05 日

論文の内容の要約

| | |
|---|---|
| 氏　　名 | Dikkumburage Jasintha Jayasanka |
| 学位の種類 | 博士（Ph.D.） |
| 学府又は研究科・専攻 | 連合農学研究科<br>Agricultural and Environmental Engineering　　専攻 |
| 指導を受けた大学 | 東京農工大学 |
| 学位論文名 | Study on Utilization of Bamboo and Wood Chips for Compost Material after the Fukushima Daiichi Nuclear Power Plant Accident〔福島第一原子力発電所事故後における竹および木材のコンポスト利用に関する研究〕 |

【論文の内容の要約】

**Background:** Sustainable agriculture contributes to environmental conservation as well as to improve and sustain the agricultural production. It aims to conserve, enhance and make more efficient use of natural resources through their integrated management. Compost management can provide numerous benefits to the sustainable agriculture and eco farming. However, the quality of the final compost should be high to promote it as a soil conditioner to improve the soil quality and the crop production. Specially, following the Fukushima Daiichi Nuclear Power Plant (FDNPP) accident many organic resources such as wood and bamboo were heavily contaminated with radioactive cesium which released from the reactors. Therefore, these materials have been refused as composting materials ever since. Relevant background information need to develop appropriate compost management system to recycling of radiocesium contaminated wood and bamboo materials are provided in chapter 1.

**Materials and methods:** To develop the compost management system, evaluation of the composting process of wood and bamboo is necessary. In chapter 2, we assessed changes in radioactive cesium ($^{134}$Cs and $^{137}$Cs) contamination and nutrient status in composts derived from wood chip, bamboo leaf and bamboo powder using rice bran and wheat meal as sub-materials. Changes in soil properties and komatsuna (*Brassica rapa* var. *perviridis*) growth were also investigated due the application of composts and initial materials at 0, 2.5, 5 and 10 kg·m$^{-2}$ input levels. In chapter 3, to determine the appropriate mixing ratio of submaterials in composting of radiocesium-contaminated bamboo, we evaluated the effects of different mixing ratios of rice bran and wheat meal

on the physico-chemical properties of bamboo compost. In addition, we developed compost models to predict changes in biomass carbon, biomass, and radiocesium concentration. In chapter 4, we compared the radiocesium ($^{134}Cs$ and $^{137}Cs$) contents of boiled and unboiled bamboo chips, and also evaluated the effect of treating the bamboo boiled water extracts with bentonite. In addition, we investigated the radiocesium concentrations and nutrient statuses of composts derived from boiled and unboiled bamboo chips under aerobic and anaerobic conditions. Furthermore, we evaluated changes in soil properties and the growth of komatsuna (*Brassica rapa* var. *perviridis*) following application of final composts at 0, 2.5, 5, and 10 kg $\cdot m^{-2}$.

**Results and discussion:** Results of chapter 2 revealed that Mixing of sub-materials significantly reduced the concentration of radiocesium and improved compost quality. Amendments of compost significantly increased soil inorganic N, available P and exchangeable K contents. Amendments of final composts also enhanced komatsuna growth. Furthermore, radiocesium contaminations of the komatsuna plants grown in these composts were below 0.1 Bq $\cdot kg^{-1}$. The results of chapter 3 revealed that all three models had a high level of accuracy in their predictions, and strong correlations were observed between the predicted and observed values (biomass carbon, $r^2 = 0.9837$; biomass, $r^2 = 0.9815$; and radiocesium concentration, $r^2 = 0.9936$). The radiocesium model can be used to determine the appropriate mixing ratio of raw materials when composting radiocesium-contaminated bamboo, and showed that when the bamboo has an initial radiocesium concentration of 300 Bq $\cdot kg^{-1}$, the blending ratio of contaminated bamboo should be <0.4 to produce an acceptable compost after 35 days of composting. In chapter 4, We found that boiling bamboo with 3% $NaHCO_3$ for 30 min reduced radiocesium concentration in bamboo chips by approximately 52%, and that the addition of 1% bentonite to the bamboo boiled water extract followed by a 60-min sedimentation treatment reduced the radiocesium contamination by approximately 75%. The compost amendments containing boiled bamboo chips mixed with rice bran and wheat meal resulted in significantly lower soil radiocesium concentrations under anaerobic conditions, and significantly higher soil N, P, and K levels under aerobic conditions The addition of aerobic composts consisting of boiled bamboo mixed with sub-materials to soil resulted in highest levels of komatsuna growth.

**Conclusions:** According to chapter 5, compost management practices which described through this study decreased the radiocesium levels of bamboo and wood chip compost lower than legislation limits imposed by the government of Japan. Proposed compost management system would help to remediate contaminated forests in the Fukushinma area while improving soil organic matter to enhance sustainability of agro ecosystem.