LCA study of cable drums

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Wooden cable drums are used for transporting and installing communication cables. They are used outdoors and are easily damaged by mishandling and use in harsh environments. Recently, plastic drums have been considered as a possible replacement for wooden drums. However, plastic products are made from oil, fossil fuel, and their environmental effects are much debated. We have conducted a field survey, and used it as a basis for models. We have also undertaken an inventory analysis and impact assessment. The results are sensitive to drum weight and the number of times the drum is reused. We also discuss a way to reduce the environmental impact of these plastic drums.

Keywords: Cable drum, Inventory analysis, Impact assessment

I. INTRODUCTION

Information technology (IT) is becoming a key term in the new century and telecommunication companies, such as NTT, are actively supporting IT. However, whether IT is an ecological friendly technology or not remains an important issue. It has been said that IT will reduce the burdens placed on the environment because of the reduction in the need to travel. We reported teleconferencing could reduce the environmental burden of business trips. However, IT needs a telecommunication infrastructure and its ecological burden has not been evaluated in detail. This study is a contribution to our goal, which is to reveal the ecological impact of this infrastructure.

Cable drums (Fig. 1) are needed when we install telecommunication cables. Long cables are cut and wound onto the drums at a factory and then transported to construction sites. The empty drums are subsequently collected and transported back to the factory, reused a number of times, and then thrown away. Cable drums are made of wood or polypropylene (plastic) and consist of two disks and a tube. The disk and tube diameters are about 80 and 35 cm, respectively. Wooden drums have been used for a long time but recently plastic drums have been introduced because of their lighter weight and longer lifetime.

Fig. 1. Plastic cable drums.
II. PRECONDITION

Our basic models for studying the wooden and plastic drums are shown in Fig. 2. These models begin with the felling of timber or raw material extraction and culminate with waste disposal and recycling. For this study, we selected an L5-4 wooden drum (19-26 kg/unit) and an L4-7 plastic drum (18 kg/unit). The weight of the wooden drum depends on its water content. A new wooden drum is heavy and becomes lighter over time if it does not get wet. We chose average weights of 26 and 19 kg for new and reused wooden drums, respectively. Plastic drums have only recently been installed and the average number of times they can be reused is not yet known. We therefore selected two conditions, namely 20 times of reuse, which is the actual case at present, and 40 times of reuse, which is the expected number.

Their function was set at the winding and installation of 131 m of color-coded polyethylene (CCP) telecommunication cable. The method of disposal involves a combination of incineration, closed-loop recycling (recycled materials are used only for cable drums) and open-loop recycling. We set the proportion of incineration (20%), open-loop recycling (50%) and closed-loop recycling (30%) for the plastic drum based on data for outside-use plastic communication tools and not according to cable drum use. This is because few plastic drums have yet been recycled. The open-loop recycling process is regarded as outside of the boundary and the environmental burdens it imposes are disregarded.

We used the TEAM software and DEAM database (developed by the ECObilAN Corporation) in our investigation.

III. RESULTS OF INVENTORY ANALYSIS

The results of our inventory analysis are shown in Fig. 3. The carbon dioxide emissions during production and usage were almost the same. The levels during the disposal processes were all negligible. Here we did not include the carbon dioxide generated when the wooden drum was incinerated because this carbon dioxide would be absorbed in a relatively short period and itself be converted into wood. The usage and production processes, respectively, are important with regard to nitrogen oxide and sulfur oxide emissions. The total emission depends on several conditions, and we cannot conclude which drums are superior. In terms of energy consumption, the production processes imposed heavy environmental burdens and the wooden drums proved worse than the plastic drums under all conditions. There are several reasons for this. (1) A plastic drum is lighter than a wooden drum thus reducing the burden of transportation. (2) A plastic drum can be reused 4 to 8 times more often than a wooden drum and this reduces the burdens of production and disposal. (3) Only 62% of a log is used to make a drum, however we take the feedstock energy in the unused part into consideration.
IV. RESULTS OF IMPACT ASSESSMENT

The results of our impact assessment are summarized in Fig. 4, which shows that a plastic drum is worse as regards resource depletion than a wooden drum. This can be explained by the fact that fossil fuel is used to produce the raw material for the plastic drum. By contrast, a plastic drum is superior to a wooden drum in terms of eutrophication. The wooden drum disposal process is a considerable problem. A long-life plastic drum is superior to a wooden drum in relation to other environmental categories, namely the greenhouse effect and air-acidification. This is because a once reused drum cuts the process burden in half.

V. POSSIBILITY OF IMPROVEMENT

To find a way to improve the environmental impact of plastic drums, we developed two new disposal process scenarios and analyzed the life-cycle inventory.

Scenario 1: The plastic drums are used 20 times and subjected to 100% closed-loop recycling.

Scenario 2: The plastic drums are used 40 times and subjected to 100% closed-loop recycling.

The results of our impact assessment based on the new scenarios and former results are shown in Fig. 5. Each value is normalized by the basic results (20 times of reuse). Here, the basic conditions, including the disposal process, consisted of 50% open-loop recycling, 30% closed-loop recycling and 20% incineration. Scenario 1 reduces the environmental burden in all categories. Except with regard to the greenhouse effect, 100%-closed-recycling is more effective than 40 times of reuse. Scenario 2 provides
the ideal conditions for the future, in that it can reduce the environmental burden by more than 50%.

VI. CONCLUSION

We evaluated the ecological impact of cable drums made of different materials. Plastic drums are favorable in terms of energy consumption and eutrophication, but not as regards resource consumption. The environmental burden imposed by the plastic drums can be eased by using the drums for much longer period and by disposing of them through closed-loop recycling.

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REFERENCE
