

A Study on The Eco-efficiencies for Recycling Methods of Plastics Wastes

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Decision-making with respect to recycling methods of plastics wastes includes a variety of factors such as environmental, economic and other elements. However, it is very difficult to consider these various factors within a single integrated index because they all possess different basic measurement units for the decision-making process. Only when all of these factors are integrated under the same index will it become possible for decision makers to select the most environmentally friendly and economically efficient alternative.

In this study, it is attempted to measure eco-efficiencies of different recycling methods such as material recycling (MR), chemical recycling (CR) and thermal recycling (TR) by using the VER(Value /Eco-costs Ratio) model. The VER model is modified from the existing EVR model which is based on the marginal prevention costs and it enables to combine the environmental and far-reaching economic aspects of the system into the integrated fashion. Cost-Benefit Analysis (CBA) is utilized to measure the value in the model and the eco-cost is calculated from the LCA results by applying the 'virtual pollution costs'. In this way, the LCA results of recycling methods can be expressed in terms of costs and, thus, the VER becomes dimensionless.

The LCA results of three different recycling methods showed that MR was the most environmentally sound recycling method and in the current situation of Korea. And, the eco-efficiencies of the recycling methods were obtained by calculating the VERs from the eco costs and CBA. The eco-efficiencies of MR, CR and TR were 2.48, 1.26 and 0.11, respectively indicating that in Korea MR is currently the most effective method and TR is not effective neither environmentally nor economically.

Key words: LCA, eco-efficiency, value/eco-cost ratio, cost-benefit analysis, material recycling, chemical recycling, thermal recycling