Evaluation of actual recycling rates of waste lubricating oil at oil recycling facilities by material flow analysis

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ABSTRACT

Recycling and refining of waste lubricating oils generated from the industries, automobiles and other manufacturing units are gaining lot of interest in Korea and around the world mainly because of the resource depletion of petroleum refinery and environmental concerns upon disposal and treatment. In case of developed nations, waste lubricant oil is considered as a source of energy and therefore converted into either high-grade fuel or low-grade fuel or base oil, and refined oil. Although incineration of high grade fuel and low grade fuel is commonly practiced in countries such as US and Europe, conversion of waste lubricant oil to re-refined oil as a resource recovery requires large amounts of subsides and incentives by government. In Korea, waste lubricating oil was included in the extended producer responsibility (EPR) in 2003 to better manage and recycling of the oil. In 2012, Korea produced 1,425,598 kℓ and sold 991,207 kℓ of lubricating oil. In this study, actual recycling rate of waste lubricant oil is calculated based on waste oil entering into a waste oil recycling facility; this waste oil usually includes waste gas, sludge and moisture content. Therefore, the aim of the paper is to determine the actual recycling rate of waste lubricating oil by using material flow analysis (MFA). According to the study, a total of 10 site visits to waste oil recycling facilities with a survey containing 34 questions were made around the country. The material flow of inputs and outputs, and byproducts through recycling and refining processes of waste lubricating oil in the recycling facility was carefully studied. Based on the results, most of waste lubricating oil at the recycling facilities was treated either by chemical treatment, vacuum distillation and high temperature pyrolysis. It was found that the actual recycling rates were approximately 93.4% for chemical treatment method, 81.4% for vacuum distillation method, and 80.6% for high temperature pyrolysis. More recycling processes and stages for the vacuum distillation and high temperature pyrolysis are required to high-grade fuel oil, which resulted in lower actual recycling rates at the facilities.

Keywords: waste lubricating oil, recycling, recycling rate, material flow analysis