Recycling and Disposal Policies of Industrial Waste with Nonlinear Recycling Rate

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ABSTRACT

Most manufacturing plants lack proper equipment for handling industrial waste and turn to recycling centers for disposal of industrial waste. Many industrial wastes contain valuable materials and can be recycled through proper processes. It is common to assume that recycling rates are linearly proportional to the process time. However, recycling rates of chemical wastes from industries such as PCB and semiconductor manufacturing are nonlinear. That is, the quantity of valuable material retrieved from waste per unit time decreases as recycling process continues. Apparently, the time length of the recycling process becomes an important factor on the quantity of the recycled valuable material and the profit of the recycling center. This research studies the planning of waste disposal and recycling in a green supply chain with multiple plants.

This research considers two systems, one containing a single manufacturing plant and a recycling center and the other one with multiple manufacturing plants. The goal aims at setting optimal cycle time of waste disposal and recycling for cost minimization or profit maximization. In the second system, two recycling strategies, independent recycling strategy and integrated recycling strategy, are studied. Mathematical models are developed and optimal solutions can be obtained using simple search methods. Through the conducted numerical experiments, analytical results and managerial insights are obtained. The findings from this research can serve as valuable reference in management and operation for enterprises.

Keyword: nonlinear recycling rate   multiple plants   waste disposal   waste recycling