

WASTE MINIMIZATION PROGRAM IN A SMALL-SCALE ELECTROPLATING FACTORY

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Wastewater from small-scale electroplating factories is one of the major issues of water quality problems in Thailand. High amounts of toxic metals are discharged daily into sewers and waterways without treatment. Most small-scale electroplating factories are in operation using simple and traditional technology of plating without pollution control facilities. As a result, high amounts of wastewater and heavymetal are threatening the environment. Operating conditions in most small-scale factories are very poor and could be a health hazard to their workers.

The waste minimization program of a selected small-scale electroplating factory was commissioned to test the feasibility of applying the program to improve the working conditions, reducing waste and using less resources of the factory.

The findings of the project are:

Environmental Auditing of the factory

The selected factory consists of 8 workers including the owner. The factory gives services in Ni and Cr plating of car and motorcycle spareparts in the city of Chiang Mai. The factory is a small scale designed in a traditional way without engineering knowledge and proper management. Dirty floors are the result of poor house keeping and no employees were properly trained in plating. Layout of plant was poorly designed which make the flow of materials complicated and difficult. Wastewater were measured as shown in Table 1.

Table 1. Wastewater generated from the factory (Before the program)

	Q (l/day)	pH	Ni (mg/l)	Cr (mg/l)	Remark
acidic wastewater	37.6	0.87	0.07	0.06	165 work pieces/month
alkaline wastewater	157.0	7.77	1.5	0.1	
Ni wastewater	1340.0	6.34	99.2	7.4	
Cr wastewater	672.0	6.26	0.9	204.0	
Total	2206.6	Loss g/d	134.26	147.05	

Wastewater disposed of by the factory was about 2,206 l/day. The Ni waste was about 1340 l/d with Ni concentration of 99.2 mg/l and Cr concentration of 7.4 mg/l. The Cr waste was about 672 l/d with Cr concentration of 204.0 mg/l and Ni concentration of 0.9 mg/l. The contamination of Ni in Cr waste and Cr in Ni waste could easily be seen which theoretically could be avoided. The acidic waste and alkaline waste were about 37.6 l/d and 157.0 l/d respectively. It was estimated that Ni and Cr loss through waste water were about 134.2 g/l and 147.0 g/l respectively.

Introducing Waste Minimization Program

The waste minimization program was introduced in order to improve the situation. It is as follows:

- To improve the working conditions and mixing of wastewater, layout of plant was adjusted according to process flow.
- To reduce amount and concentration of wastewater in each stream, dragout tanks were added into the process.
- To reduce the amount of wastewater, spraygun was used instead of open hose
- To reduce wastewater end up on the floor, hangers were introduced
- To ease wastewater treatment, facilities, waste were segregated through layout change.
- A series of training programs were introduced to operators to show their way of operations compared to the proper one.

The total cost of the program was about 100,000 Baht

The Result After Adjustment

The factory was monitored and the result of wastewater auditing was as shown in Table 2. After adjustment, wastewater was reduced to 357.4 l/d or about 83.8% reduction. Ni wastewater was reduced to 104.7 l/d with higher Ni concentration of 224 mg/l. Cr wastewater was reduced to 195.7 mg/l with Cr concentration of 200 mg/l. There are insignificant amount of Ni in Cr waste and Cr in Ni waste.

Table 2. Wastewater generated from the factory (After the program)

	Q (l/day)	pH	Ni (mg/l)	Cr (mg/l)	Remark
acidic wastewater & alkaline wastewater	57.0	5.12	0.04	0.02	271 work pieces/month
Ni wastewater	104.7	5.78	224.0	0.08	
Cr wastewater	195.7	3.43	0.06	200.0	
Total	357.4	Loss g/d	23.48	39.09	

Acidic and Alkaline wastewater were reduced to 57.0 l/d without metal contamination. Ni and Cr loss were reduced to 23.48 g/d and 39.09 g/d respectively

The economic evaluation was performed and it was found that the saving cost of water, chemicals and treatment was about 200 B/d. With the investment of 100,000 Baht for the program, the return period would be about 500 days (1.36 years).

Suggestion for Further Implementation

The result shows that the waste minimization program is feasible for small scale plating factories in Thailand. However, there are still some barriers to the promotion of the activities. Small scale factories will not be able to pay for the consultant fees to perform the waste minimization program since the program need time and qualified experts in assisting the program. Consultant firms are also not interested in working for the small scale industry. The government should financially support the institutions and organizations such as universities or NGO's to do the job and to give free services to small scale industries in order to keep the environment clean and to save the country's resources.