

Study on drying and carbonization characteristic of dyeing wastewater sludge

SeungHan Ryu, JangSeung Choi, DongHoon Shin, Jun-hyung Park, SangHun Lee, SeogJin Jo

Department of Research and Development, Eco friendly Research team, Korea dyeing Technology Center
404-7, Pyongri-6 Dong, Seo-gu, Daegu, 703-834, Korea
E-mail: rsh1007@dyetec.or.kr

1. Introduction

Carbonization is a kind of pyrolysis process to produce char from organic materials under an inert atmosphere. In order to evaluate the quality of char as fuel, proximate analysis and calorific value were examined. The composition of raw sludge had a significant influence on the quality of produced char. The higher the ratio of carbonate and volatile matter in sludge, the higher calorific value of char produced.

Moreover, an equation to estimate calorific value of char was developed by using the weight fraction of fixed carbon and volatile matter in char. Temperature's control was performed to improve the quality of char. But the char's calorific value was lower than common fuel such as coal, petrol, briquet etc.

Therefore, the char was mixed with high calorific value's matter such as coal, briquet etc. for using available fuel. In this study, chars derived from dyeing wastewater sludge were characterized from the standpoint of solid-fuel and reducing quantity of sludge. Dyeing wastewater sludge dried sludge were carbonized at 350°C, 450°C and 550°C for 20 - 30 min. under anoxic.

2. Materials and Methods

Dyeing wastewater sludge used in this study were taken from a synthetic textile dyeing factory located in Daegu industrial dyeing complex, Daegu City, Korea. Flow diagram of 50kg/h pilot scale dry and carbonization process and Operation condition for drying and Carbonization process were showed following table 1 and figure 1.

Table 1. Operating condition for dry and carbonization process

Drying stage	Entrance Temp	385~430°C
	Outlet Temp.	165~190°C
	RT	20~40 min
Thermal decomposition stage	RT	25 min
	Combustor Temp.	850°C

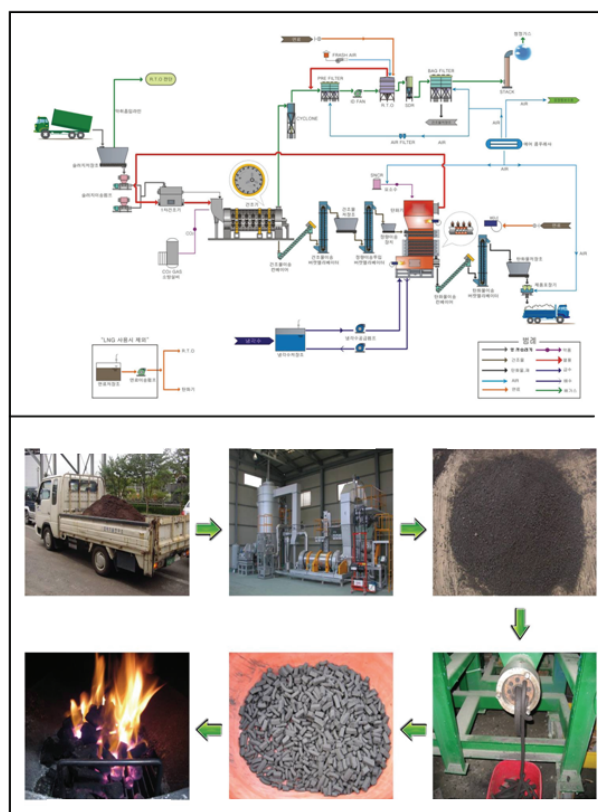


Fig. 1. Flow diagram of 50 kg/h pilot scale Drying and Carbonization process

3. Result and discution

3.1. Characteristics of drying and carbonization sludge

Table 2. shows the results of drying and carbonization. The reduction rate weight and volumn was 67% at the drying stage and 29% at the carbonization stage (totally 96%). The thermal characteristics of drying and carbonization products were 3,594kcal/kg respectively, and 3,102kcal/kg respectively.

3.2. Assessment of carbide as solid- fuel.

It was evaluated whether carbonization would be available as a new technology for thermal treatment and recycling waste as fuel. We were tried utilize organic waste sludge from dyeing wastewater treatment plant as a starting material to process a solid fuel.

Therefore, we have investigated with possibility of carbide as solid-fuel. Quality of dyeing sludge carbide for solid fuel's Characteristics are showed below table 3. Carbide's (after carbonization) caloric value are 3,000 kcal/kg). This results are not enough caloric value(>3500kcal/kg) for standard quality of soil fuel. So we were mixed with soft coal for increased caloric value(upto 3500kcal/kg).

Table. 2. Characteristics of drying and carbonization

Contents	Moisture (%)	Volatile (%)	Ash (%)	Fixed Carbon (%)
Raw sludge	82.0	72.2	27.8	0
Drying sludge	9.2	72.2	27.8	0
Carbide	3.2	59.7	40.3	0

Table. 3. Elements analysis of dryin and carbonization

Contents	C	H	O	N	S	Cl
Raw sludge	41.4	5.5	17.2	4.7	2.1	0.98
Drying sludge	41.3	4.9	18.3	4.3	2.2	0.97
Carbide	39.0	2.3	9.7	3.9	4.4	0.16

4. Conclusions

As a result of conduction a study on it, it has been demonstrated that in case the carbonization is adopted in treatment of waste, the following Characteristics are embodied. reduction of environmental pollution load, recycling the final treated material as resources and alternative energy source such as solid fuel. From the national point of view, it is necessary to support a study on carbonization which is available as a technology for recycling waste stably and further give a legal qualification for thermal treatment to it in the future

Table 4. Quality of dyeing sludge carbide for solid fuel

Contents	Standard quality of Solid fuel	carbide	Soft-coal 1	Solid fuel (carbide : Soft-coal)	
				2:8	3 : 7
Caloric value (kcal/kg)	>3,500	3,000	6,880	6,104	5,716
Ash (%)	< 20	40	11	16.8	19.7
Moisture (%)	< 10	4	6	5.6	5.4
Chlorine (%)	<2.0	1.4	0.7	0.84	0.91

5. Acknowledgements

The authors would like to acknowledge the Education innovation program for Resources Recycling, from Ministry of Environment (ME), Korea for the financial support of this work.

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