

DEVELOPMENT OF THE NEW SOLIDIFYING MACHINE FOR WASTE PLASTICS FOR SUPPLYING THE SOLIDIFIED PLASTICS AS ALTERNATIVE FUEL OF COAL

Kazuyoshi Yamaguchi

Japan Science & Technology Agency (JST) Innovation Plaza Miyagi

6-6-5 Minami-Yoshinari, Aoba-ku, Sendai 989-3204, Japan.

E-mail: yamaguchi@miyagi.jst-plaza.jp

1. Introduction

We have constructed the waste plastics recycling system in Tohoku district and started the system operation in January 2004 under “Tohoku Industrial Cluster Committee for Recycling-oriented Society” that Tohoku Bureau of Economy, Trading and Industry has been controlling. The new company named “Waste Recycle Promoting Organization” has been established in August 2006. This company supplies the alternative fuel of coal that is produced from the waste to metal or paper production works and guarantees the qualities of the fuel.

The hard waste plastics can be supplied as a fuel by crushing the materials under 50 mm. But the crushed soft waste plastics cannot be supplied because they are scattered in the yard. Therefore, they must be solidified before supplying.

In the last symposium held in Cheju Island, we have introduced the solidifying machine for soft waste plastics with heating the crushed materials during transportation by the screw feeder in the casing. This machine melts the block surface, and cuts the half-melt block to about 50mm. But this machine cannot solidify the high water content or papers mixed soft waste plastics.

In this paper, we will introduce the new compact solidifying machine with the low price for the soft waste plastics that have various properties.

2. Circumstances in the development of new solidifying machine

The former solidifying machine that we have developed cannot solidify the papers mixed soft waste plastics because the mixed materials are scorched when the material temperature is over 200°C and are not solidified when plastics mixed ratio is under 70%. Furthermore, the motor load is very high when the water content is over 10%.

We needed to develop the new solidifying machine that is compact and cheap for the soft waste plastics that have various properties, for example, with high water content or with papers mixed.

Fig. 1 shows the outline of the developed machine. In this machine, the procedure of solidifying is as follows:

- (1) The crushed soft waste plastics under 10mm are charged in the hopper.
- (2) The materials are dropped from the hopper and transported to the cylinder casing by the screw feeder whose casing is heated from the outside.
- (3) The materials in the casing are pushed by the cylinder with oil pressure, and transported through the several holes in the metal that is heated from the outside.
- (4) The materials whose surface is half-melt are flown out of the holes in the metal, and cut every 100 mm length.
- (5) Two metals with several holes are lined up in this machine.

In the following paragraph, I will mention the details in the development of this machine.

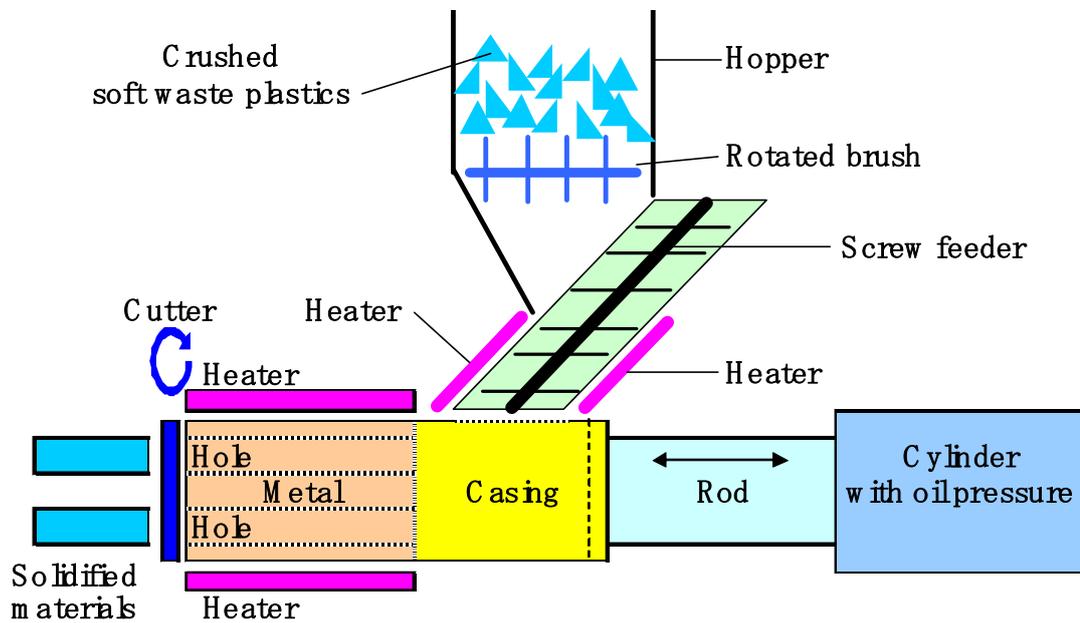


Fig.1 Outline of the new solidifying machine developed

2.1 First trial

At first, we adopted the transportation of the dropped materials from the hopper by the cylinder pushing with air pressure to the cylinder casing, and the pushing number was several times. And the metal with 1 hole was also adopted.

Although the solidified materials could be produced with this machine, the production speed was not so high, under 40kg/h compared with the aimed value of 100kg/h. We changed the hole diameter from 30 to 60mm ϕ , but the solidified materials condition was not so good even if the speed was increased.

2.2 Second trial

We increased the number of hole in the metal from 1 to 9. As a result, the production speed was increased to 80kg/h, but the solidified materials condition was not so good. In

addition to the solidified blocks production, the high amount of fine materials under 5mm was produced.

In order to suppress the fine materials production, we needed to decrease the production speed to about 30kg/h, and as a result, the production of fine materials was decreased to the amount under 5%.

The plastics mixed ratio over 40% and the temperature of materials about 200°C are necessary for the solidification of materials with the fine amount production under 5%.

2.3 Final trial

Through the above two trials carried out, the following items have been clarified.

(1) The preheating of materials is necessary during the transportation of materials to the cylinder casing.

(2) The transportation of materials by the cylinder pushing with air pressure is not sufficient for increasing the production speed of solidified materials.

(3) The maximum diameter of the hole in the metal is 30mm ϕ . If the diameter is over 30mm ϕ , the amount of fine materials under 5mm is increased over 5%.

In order to maintain the high production speed of solidified blocks and the low content of fine materials, the aforementioned specification of the machine was adopted based on the above three items clarified.

3. Results of the solidification of the soft waste plastics with papers mixed

The developed machine shown in Fig. 1 can solidify the soft waste plastics with papers mixed to the solidified blocks whose diameter is 30mm ϕ and length is about 100mm called RPF (Refuse plastics and papers fuel). And this RPF is effective to use the alternative fuel of coal in the paper production works, etc. Fig. 2 shows the crushed materials and the produced RPF by use of the soft waste plastics with papers mixed.

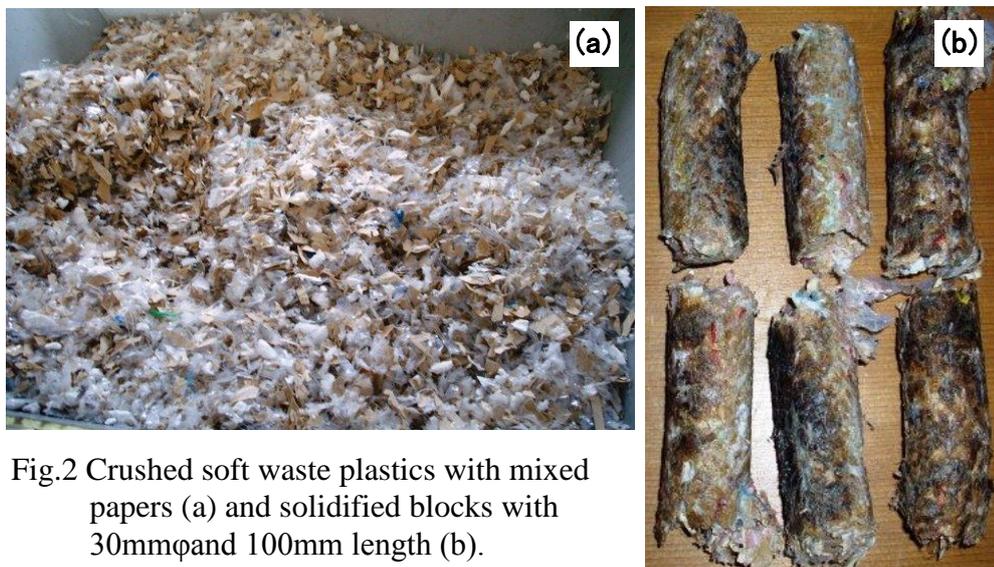


Fig.2 Crushed soft waste plastics with mixed papers (a) and solidified blocks with 30mm ϕ and 100mm length (b).

4. Conclusion (Future subjects)

From now on, it is necessary to confirm the conditions for solidifying the soft waste plastics that have various properties, for example, high water content materials by use of the developed machine.

The soft waste plastics dischargers in Tohoku district want to install this compact and low-priced machine, produce the solidified materials, and use the materials as an alternative fuel of coal or oil in their own plant. In addition, they want to sell the materials to metal or paper production works.

The minor traders who gather the soft waste plastics in Tohoku district and produce the solidified materials also want to sell the solidified materials as an alternative fuel to the works that use the fossil fuel.

The aforementioned new company named “Waste Recycle Promoting Organization” will connect the solidified materials producer and the materials user in Tohoku district and the buying and selling contract between two traders will be concluded.

Reference

- [1] K. Yamaguchi, Proceedings of the 4th ISFR2007 “*Feedstock Recycling of Plastics & Other Poly-meric Materials*”, **2007**, 467-470.