Solid Fuel Making from Oil Palm Trunk

～the development of a new squeezer～

1 Background

The use of renewable energy sources is being encouraged in order to reduce global warming. Against this backdrop, biomass is gathering more attention as a renewable energy source. While accumulating experience in the development of power generation plants that use waste biomass and geothermal heat, we started the development of technologies in a new area involving utilization of unused biomass for fuel and resource purposes. As part of the initiatives, we have been focusing on the development of conversion technologies of unused or low value biomass into biomass coke, pellets and other solid fuel forms as well as conversion into liquid fuel such as bioethanol.

In this article, we present our approach to the conversion of oil palm trunk (OPT) into pellets as an example of biomass-to-solid fuel technologies, introducing the new squeezer that we developed using our proprietary technologies for squeezing/solid-liquid separation, which constitutes the key factor in producing solid fuels from low value biomass with high water content.

2 Overview of the Technology

Focusing on the potentiality for sustainable use of an abundance of felled trunks (trees) of old oil palm as low value biomass, which are cultivated mainly in Indonesia and Malaysia, we developed the production process of biomass fuel pellets from the old OPT, and have successfully completed the demonstration test in Sumatra, Indonesia. OPTs are felled for replanting every 25 years or so because of reduced yield of palm oil from the fruit, which is an edible vegetable oil indispensable in our daily lives with a wide range of uses. The OPT felled for replanting across the world, mainly in Southeast Asia, is estimated to amount to over 30 million tons per year. While the industry is seeking a solution for effective utilization in view of its abundance, the felled OPTs are left in the fields (plantation) at present due to the high water content of approx. 70% as well as the fragility of tissues. Given the situation, we have achieved the production of a pellet-form solid fuel from such OPT through the process shown in Fig. 1.

The collected OPTs are crushed and loaded into the newly developed squeezer, which squeezes the crushed OPT to separate liquids from solids (residues). The residues are dried and formed into pellets (Fig. 2) of approx. 6–8 mm in diameter and 20 mm in length by the pelletizer.

As shown in Fig. 1, the facility configuration may look very simple, but the crucial point in the process design here is to be able to reduce the water content of the residues by the squeezer so as to be able to reduce the amount of heat energy

required for the drying process, in terms of suppressing the energy consumption and running cost of the entire facility.

Screw presses or the likes, conventionally applied as the squeezer, could not reduce the water content lower than about 50%. For further energy saving, the development of a squeezer with a higher performance in water content reduction was required.

Fig. 2: Photo of pellets

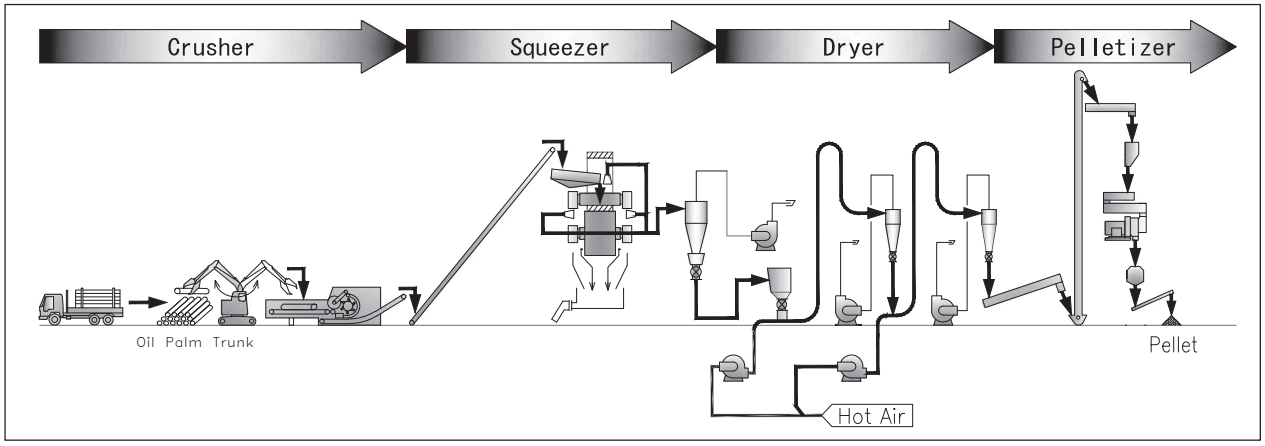

Fig. 1: Process flow

3 Advantages of the New Squeezer

Figure 3 shows a schematic view of the new squeezer developed by NSENGI. The new squeezer, designed with our proprietary technologies for rolling machines in the steelmaking field, is composed of three rolls: the upper roll, lower roll, and ring roll. The upper roll and the ring roll are arranged such that the upper roll is inscribed in the ring roll, and the lower roll and ring roll are circumscribed. The hydraulic pressure applied to the rolls produces much higher squeezing pressure compared with that of conventional squeezers. Crushed OPT as raw material is put into the ring roll, and compressed under high pressure when passing the contact point between the upper roll and the ring roll to be squeezed so that the liquids are separated from the solids (residues). The raw materials compressed at the contact point serve as a seal that prevents reabsorption of the separated liquids into the raw materials.

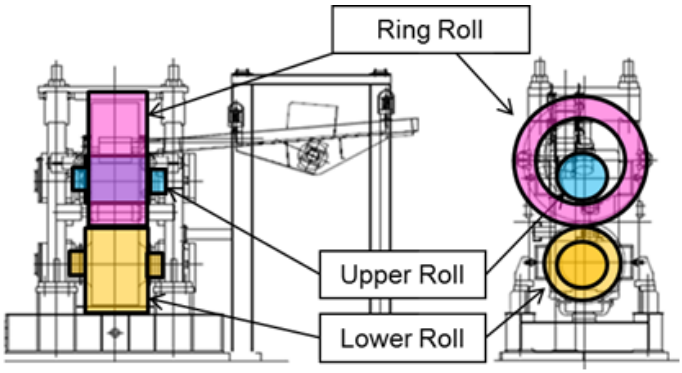

Fig. 3: Schematic view of the new squeezer

Figure 4 shows the results of a comparison of the squeezed OPT. The conventional squeezers were limited in their ability to reduce the water content resulting in no less than about 50%. In contrast, the newly developed squeezer was able to reduce the water content to as low as about 30% by compressing the raw materials under a higher pressure. As shown in Fig. 5, this has enabled a significant cost reduction of the drying heat source involved in the process.

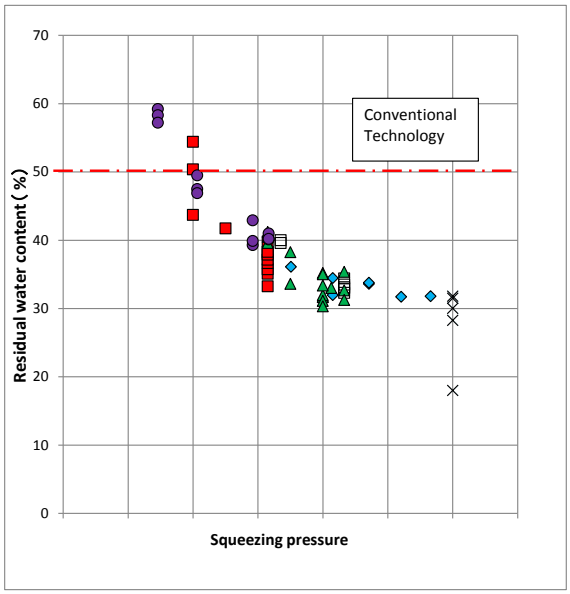

Fig. 4: Relationship between the squeezing pressure and residual water content

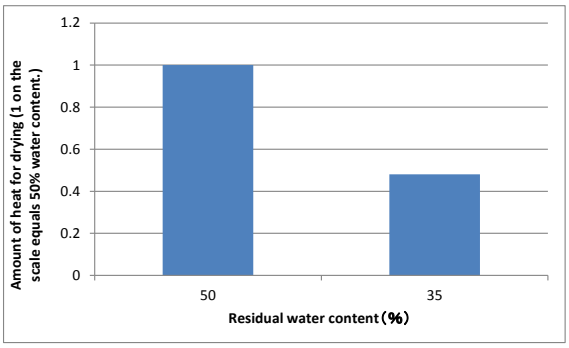

Fig. 5: Comparison of the required amount of heat for drying between conventional technology (left) and new squeezer of NSENGI (right)

4 Future Initiatives

The demonstration test in Indonesia for the solid fuel production from oil palm trunks (OPT) has been successfully completed, and we will move forward proceeding with commercial-scale plant constructions in the Southeast Asian countries. Assessment of the pellet product has also been completed in pursuit of its use as a fuel for biomass power generators, for example, the mixed-fuel combustion use at coal-fired power plants, based on which we plan to establish sales channels. And furthermore, we will continue our efforts to keep improving the squeezer for a better performance, while exploring its use in new areas.

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