PULSATION-ASSISTED FLUIDIZED BED FOR THE FLUIDIZATION OF HIGH MOISTURE AND IRREGULAR PARTICLES AND ITS APPLICATION FOR BROWN COAL FLUIDIZATION

Yuping Liu, Chemical Engineering Department, IHI Corporation, Japan
yuping_liu@ihi.co.jp
Hiroaki Ohara, Chemical Engineering Department, IHI Corporation, Japan

High moisture content and irregular particle is difficult to be fluidized. This is due to the existence of large particles which would affect the fluidization performance. Also, a high moisture content would induce channeling during the fluidization. Pulsation-assisted fluidized bed (PAFB) with the combination of pulsed and steady flow as the fluidized gas was found to be able for the wet biomass particles fluidization [1]. In this study, fluidization performance of high moisture content particle with wide size distribution was investigated in both PAFB and steady fluidized bed.

As shown in Fig. 1, oscillation was more serious and large bubbles were found in PAFB. The bubble size could be controlled in PAFB by adjusting the pulsed flow frequency. Results showed that compared with a steady-flow fluidized bed, pulsation-assisted flow (1~6 Hz) could increase the mass ratio of large particles at the bottom of the fluidized bed by over 10wt% (Fig. 2). Pulsation-assisted flow could also increase the mixing rate and break the liquid bridge between the solid particles by the large generated bubble. This could cause fluidization period 8 times than that with a steady flow, when high moisture content particles were added into the bed semi-continuously. Fluidization finally stopped due to the increasing bed moisture content (Fig. 3). A predicted model was developed to investigate the bubble size effect on the fluidization performance and compared with the experimental results. The optimal operation condition for the pulsed flow in PAFB was investigated based on the developed model.

Based on the basic study results, PAFB was applied for the brown coal fluidization. Brown coal has a wide size distribution and a high moisture content (40~65 wt%wb) which was commonly difficult to be fluidized. Results showed that in PAFB, a good fluidization performance was confirmed for the brown coal even at a moisture content of 45wt%wb, however, channeling occurred in the steady flow fluidization. Large brown coal particles could be removed from the bottom of the bed. A PAFB brown coal dryer would be developed in the near future.

REFERENCES

1.D. Jia, O. Cathary et al. Fluidization and drying of biomass particles in a vibrating fluidized bed with pulsed gas flow, Fuel Process Technol, in press.

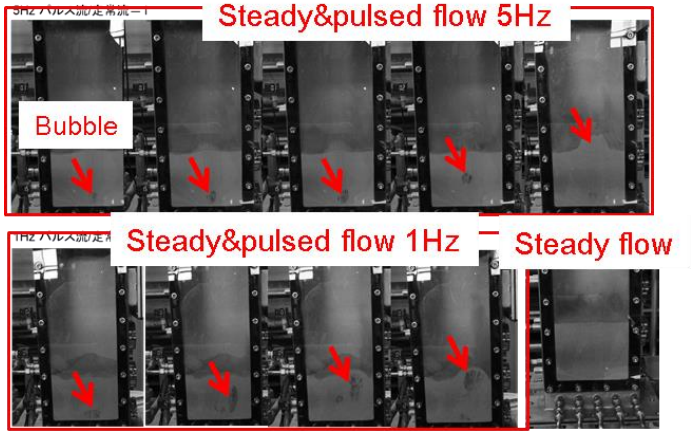

Fig. 1. Relationship between the fluidization performance and pulsed flow

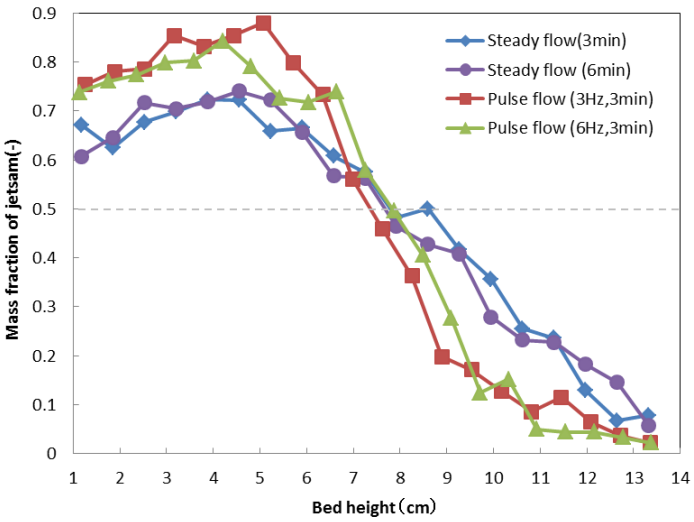

Fig. 2. Segregation in the fluidized bed with steady flow and pulsation-assisted flow

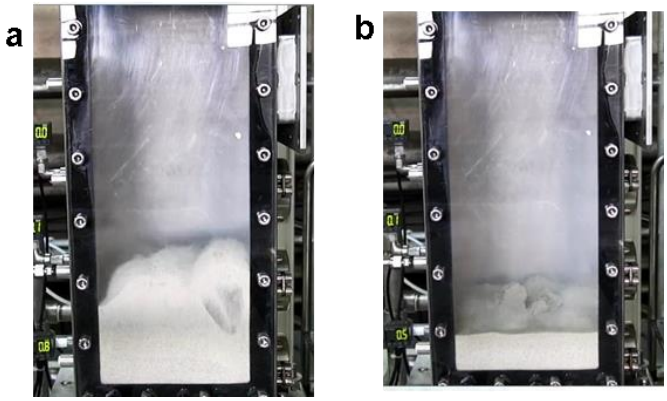

Fig. 3. High moisture content particles fluidization. a. PAFB, b. Steady-fluidized bed