

## Studying the potential of slag waste particle as suspended solid drag reducing agent

*Siti Nuraffini Bt Kamarulizam; Hayder A Abdul Bari; Nithiya D/O Arumugam*

Faculty of Chemical & Natural Resources Engineering, University Malaysia Pahang, Lebuhraya  
Tun Razak, 26300 Kuantan, Pahang Darul Makmur

### ABSTRACT

Main by product in ore smelting which is slag from tin production in Malaysia has become a trigger for this investigation. Slag waste can be categorized as suspended solid. Utilization of this waste in transportation of fluid can reduce the pressure drop in pipelines. Several studies have shown that addition of minute quantities of suspended solid additives can reduce the drag in pipe and maintain the pressure drop along the pipelines. Experimental works have been conducted in the laboratory in order to test slag waste in a closed loop of turbulence water flowing system. Flow tests were conducted using water as the transport liquid. The experimental work starts by pumping water from reservoir tank that had mixed with slag powder was pumped with varies flow rates in two different pipe diameters (0.025 m ID and 0.038 m D.I). The types of pipe used are PVC pipe. The testing length of this flow system is 2.0 m. The pressure drop and drag reduction were measured in the flow varying concentrations of suspended solid (slag). After adding the suspended solid to the water, the results have shown that the percentage drag reduction ( $Dr\%$ ) over 60% in certain range and condition. This experiment has proven that slag waste particle can be a potential drag reducer in flow system.

### KEYWORDS:

Suspended Solid; Turbulent flow; Drag reducing agent; Pipeline system

## **ACKNOWLEDGMENT**

I wish to express deepest gratitude to University Malaysia Pahang for providing the grant and facilities to support this research work. Appreciation extended to the supervisor and co-supervisor for their guidance, advice and encouragements. I am very thankful to staff of Faculty of Chemical & Natural Resources Engineering as well who helped in any way.

## **REFERENCES**

1. Arranaga, AB. 1970. Friction reduction characteristics of fibrous and colloidal substances. *Nature*. 225:447-449. DOI 10.1038/225447A0
2. Bari, HA.A., E. Suali and Z Hassan, 2008, Glycolic acid ethoxylate lauryl ether performances as drag reducing agent in aqueous media flow in pipelines, *J. Applied Sci.*, 8 4410-4415 ISSN 1812-5654
3. Gyr, A. and H.W. Bewersdorff, 1995, *Drag Reduction of Turbulent Flows by Additives*, Springer ISSN: 1812-5654
4. Mowla, D. and A. Naderi, 2006, Experimental study of drag reduction by a polymeric additive in slug two-phase flow of crude oil and air in horizontal pipes. *Chem. Eng. Sci.*, 61: 1549-1554. DOI: 10.1016/j.ces.2005.09.006
5. Singh, RD. 1990, *Encyclopedia of Fluid Dynamics*, Vol 9, Gulf Publishing Co , Houston, Texas, Chapt. 14 425-480.