CFD simulation and hydrodynamics characterization of solids oscillation behavior in a circulating fluidized bed with sweeping bend return

Can Zi, Jingyuan Sun, Yao Yang, Zhengliang Huang, Zuwei Liao, Jingdai Wang, Yongrong Yang, Guodong Han

PII: S1385-8947(16)31219-0
DOI: http://dx.doi.org/10.1016/j.cej.2016.08.127
Reference: CEJ 15693

To appear in: *Chemical Engineering Journal*

Received Date: 27 April 2016
Revised Date: 22 August 2016
Accepted Date: 28 August 2016

Please cite this article as: C. Zi, J. Sun, Y. Yang, Z. Huang, Z. Liao, J. Wang, Y. Yang, G. Han, CFD simulation and hydrodynamics characterization of solids oscillation behavior in a circulating fluidized bed with sweeping bend return, *Chemical Engineering Journal* (2016), doi: http://dx.doi.org/10.1016/j.cej.2016.08.127

CFD simulation and hydrodynamics characterization of solids oscillation behavior in a circulating fluidized bed with sweeping bend return

Can Zi[1], Jingyuan Sun[1,2**], Yao Yang[1], Zhengliang Huang[1], Zuwei Liao[1], Jingdai Wang[1], Yongrong Yang[1], Guodong Han[3]

[1] *State Key Laboratory of Chemical Engineering*, *College of Chemical and Biological Engineering*, *Zhejiang University*, *Hangzhou* 310027, *China*

[2] *School of Engineering and Digital Arts, University of Kent, Canterbury, Kent CT2 7NT, U.K.*

[3] *Tianjin Branch Company of SINOPEC, Tianjin, 300271, China*

Abstract:

Solids oscillation circulation is an unstable solids flow behavior exhibited during the start-up process of a circulating fluidized bed (CFB) with sweeping bend return. It results in significant pressure fluctuation and particle loss, further brings about difficulties in establishing a stable solids circulation and blockage of the heat exchanger for recycling gas. However, the oscillation mechanism and hydrodynamic characteristics of the solids oscillation circulation are still far from understanding, since the variation of solids transfer rate, gas flow rate and their complex interactions are still unknown. In this work, the Eulerian-Eulerian method has been employed for the simulation of solids oscillation circulation in a two-dimension (2D) CFB. The results indicate that solids oscillation circulation is triggered by the formation of slugging in the downer, which leads to a decrease of the downer pressure drop and a sharp increase of the riser bypass gas velocity. Besides, intense slugging fluidization is observed in the downer at larger valve opening or higher inlet gas velocity. Moreover, statistical hydrodynamic shows uniform lateral solids volume distributions in the riser

* *Corresponding author. Tel.:+86-0571-87951227; fax: +86-0571-87951227.

Email address: zdyqsjy@163.com.

Present address: School of Engineering and Digital Arts, University of Kent, Canterbury, CT2 7NT, U.K.