Accepted Manuscript

Techno economic analysis of chemical looping system for Indian power plants

Soumya Satyakanta Sethi, Sujit K. Dutta, Jayant, Manish Kumar

PII: \$2352-1864(17)30208-0

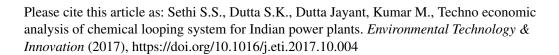
DOI: https://doi.org/10.1016/j.eti.2017.10.004

Reference: ETI 164

To appear in: Environmental Technology & Innovation

Received date: 27 June 2017

Revised date: 16 September 2017 Accepted date: 22 October 2017



This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



ACCEPTED MANUSCRIPT

Techno economic analysis of Chemical looping system for Indian power plants

Soumya Satyakanta Sethi

Department of Mechanical Engineering, National Institute of Technology Rourkela, Rourkela 769008, INDIA

Sujit K. Dutta

Combustion Science and Technology Group, CSIR-Central Institute of Mining and Fuel Research, Digwadih, Dhanbad 828108, INDIA

Jayant

Department of Chemical Engineering, Manipal Institute of Technology, Manipal 576104, INDIA

Manish Kumar

Combustion Science and Technology Group, CSIR-Central Institute of Mining and Fuel Research, Digwadih, Dhanbad 828108, INDIA

Abstract

Chemical looping combustion (CLC) has been developed as a major new generation CO2 capture technology which involves inherent CO2 separation and high system conversion efficiency. The technology is well-known to have low energy penalty, as compared to other technologies. This paper intends to carry out a numerical investigation on the flow characteristics of the chemical looping combustion (CLC) process using the cold model fabricated and commissioned by CSIR-CIMFR, Dhanbad. It attempts to visualize the hydrodynamic viability of the system, which is very important to know the effect of the configuration of the system on circulation of the oxygen carrier particles. Cost analysis for a power plant implemented with chemical looping based capture system in Indian condition has also been presented. The pressure drop profile, volume fraction distribution of particles and fluidization patterns are analysed and found to give expected results. The effects of gas phase and solid phase velocity are also studied, through which, similarity in flow pattern of ilmenite as well as air can be seen in both the plots. Through the cost analysis, higher temperature in both air reactor as well as fuel reactor has been found to increase plant efficiency while residence time in both reactor was found to have a little effect on the plant efficiency. As cost for O&M for gasifier was found to be more, change and modification of the gasifier unit will play a major role towards increasing the plant efficiency with incorporation of chemical looping as a carbon capture system.

Keywords chemical looping; cold model; computational fluid dynamics; economic analysis

1. Introduction

Coal serves as the backbone of the Indian power sector, contributing to around 61% of India's net installed capacity (CEA, 2016). Multiple researchers have suggested that the dependence on coal will increase at least up to 2050 (Garg and Shukla, 2009; Chikkatur and Sagar, 2009). However, the greenhouse gas (GHG) emissions associated with coal combustion pose a major challenge to the ecological sustainability.

Download English Version:

https://daneshyari.com/en/article/8858043

Download Persian Version:

https://daneshyari.com/article/8858043

<u>Daneshyari.com</u>