Potential Effect of Biomass Addition with Pakistani Low Rank Coal on Emission of SO_2

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Abstract

Emission of SO_2 *during combustion of fossil fuel had many environmental problem like acid rain, corrosion effect due to sulfur content in coal etc. in this regard study was made to investigate the potential of biomass for sulfur dioxide reduction. Three different biomass were blend with coal under different ratio like 90/10, 80/20, 70/30 and 60/40. The minimum emissions were observed during co-combustion of coal with -300ppm at ratio of* LC80%+BTW 20% and *maximum emission was sort out at 100%LC. It could be making easily decision on utilization of biomass with coal for favorable results regarding emission of* SO_2 *from co-combustion process.*

Key words: lignite; coal; biomass; blending ratio; co-combustion; SO_2

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INTRODUCTION

Biomass-coal co-combustion represents a near-term, low-risk, low-cost, sustainable, renewable energy option that promises reduction in net CO_2 emissions, reduction in SOx and often NOx emissions, and several societal benefits (Baxter, 2005). Among the combustion technologies, bubbling fluidized-bed and circulating fluidized-bed systems have proven efficient for burning biomass, particularly rice husk (Fang et al., 2004; Kuprianov et al., 2006; Permchart and Kuprianov, 2004; Armesto et al., 2002; Natarajan et al., 1998). Because of the CO_2-neutralityand low sulfur content of sustainable cultivated biomass, co-firing biomass with coal has recently intensified, to reduce the negative environmental impacts of coal combustion. Besides awareness of the environmental impacts of power generation using fossil fuels (mainly coal) (McIlveen-Wright et al., 2007; Narayanan and Natarajan, 2007; Tillman, 2000; Turn et al., 2006; Joseph et al., 2000; Sami et al., 2001), the disposal of municipal solid waste (Suksankraisorn et al., 2004; Dong et al., 2002) and energy recovery from industrial waste (Atimtay and Topal, 2004; Gayan et al., 2004; Armesto et al., 2003; Skodras et al., 2002) strengthen the case for utilizing biomass via co-firing with fossil fuel. Apart from reducing CO_2, co-firing biofuels with coal is a proven technique for reducing SO_2 and NOx emissions from burning coal (Sami et al., 2001; Suksankraisorn et al., 2004; Dong et al., 2002; Atimtay and Topal, 2004; Armesto et al., 2003; Laursen and Grace, 2002). Globally there is an increasing trend towards the co-combustion of coal and biomass for production of energy (Sarkar et al., 2014). Study was made to measure the potential effect of biomass on emission of SO_2.

MATERIALS AND METHODS

Lignite coal were collected for co-combustion with particle size 300micron and three different biomass are tree leaves, cow dung manure and banana tree waste

Sample of coal and biomass were crushed and grinded to form homogenous size of particle under the optimized sieve size 300micron meter. Different blending ratio was made to investigate the optimized condition for burning in fluidized bed combustor. Emission of SO_2 was measured using stack gas analyzer when sample burned at 300°C. For co-combustion laboratory furnace were used and emission of gases measured by emission analyzer. Fig 01 shows the successive steps for co-combustion for analysis of different gases. Samples of three different biomass and lignite coal were blended under ratio of 10/90, 20/80, 30/70 and 40/60 for measuring the emission value of SO_2 under mesh size of 300micron.

Figure 1: Methodology for Experimental Work

RESULTS AND DISCUSSION

Lignite coal with different biomass was used to see their effects on emission through co-combustion of coal and biomass.

Effect of Coal and Banana Tree Waste on Emission of So_2

Different ratio of banana tree waste was used for co-combustion with lignite coal to investigate the effect on SO_2 emission. Addition of banana tree waste had potential impact on usage with lignite coal for effective removal of SO_2 emission. In fig emission of SO_2 observed at LC80%+BTW 20% about -300ppm and maximum emission observed by combustion of coal separately , it was clearly highlight that addition of biomass give a best results and minimum emission of SO_2.

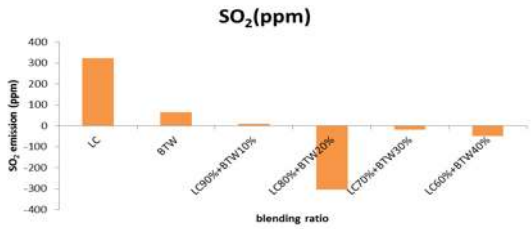

Figure 2: Effect of different blending ratio of coal and banana tree waste on SO_2 emission

EFFECT OF COAL AND TREE LEAVES ON EMISSION OF SO_2

Addition of tree waste with lignite coal had significant effect on emission of SO_2byhighlighting fig 02 it is clear view effect of addition tree waste with coal regarding SO_2 emission after combustion. When tree leaves separately combustion give a minimum emission of SO_2 and lignite coal maximum emission by addition of tree leaves with lignite coal SO_2 emission decreases.

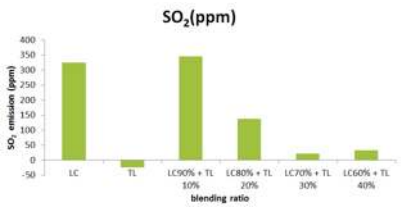

Figure 3: Effect of different blending ratio of coal and tree leaves on SO_2 emission

Effect of Coal and Cow Dung Manure on Emission of So_2

During combustion of carboneous material different emission are emitting, these emission were observed by using emission analyzer. SO_2 also emitting during combustion of coal and cow dung manure. The maximum emission of SO_2 observed at blending ratio 90%lc+10%cdm and minimum emission observed at 80%lc+20%cdm**.** This shows that when addition of 20% cdm it controls the emission of SO_2 which are not controlling during combustion of coal separately. Addition of cdm gave a minimum amount of SO_2.

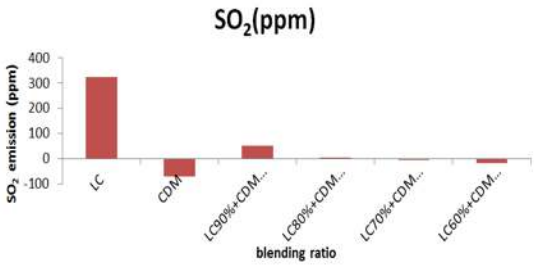

Figure 4: Effect of different blending ratio of coal and Cow dung manure on SO_2 emission

CONCLUSION

Co-combustion had many advantages over combustion of fossil fuel due to addition of biomass emission percentage decreases. Three biomass were used for co-combustion with Pakistani low rank coal. Biomass addition had advantage over emission of SO_2 through co-combustion technique. Banana tree waste addition had good effect with coal co-combustion but as far as other biomass was concerned there is no enough effect on emissions. The minimum emission of SO_2 observed at 80% lignite coal and 20%banana tree waste. It could be say that biomass candidate source for energy over emission balance.

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