OPEN HOUSE

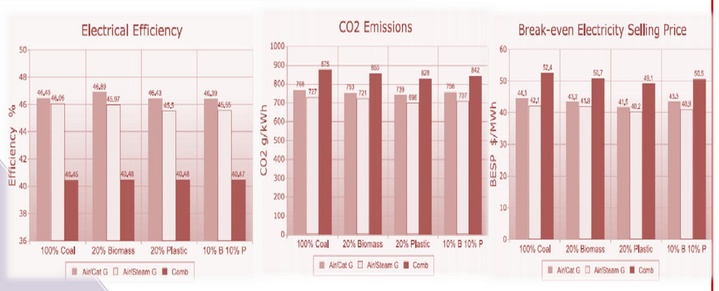
Department of Chemical Engineering

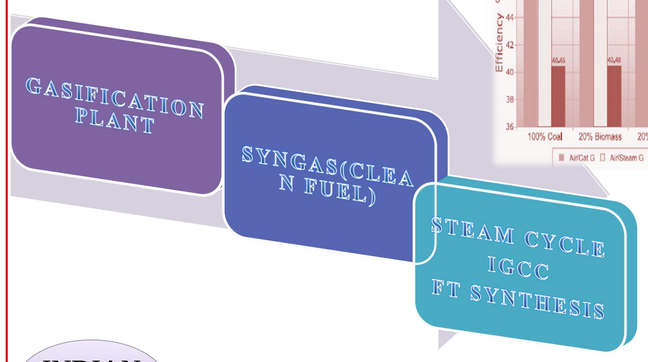
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Hydrodynamic Modeling of Industrial Fluidized Bed Gasifiers

Indranil Chakraborty, Shantanu Roy

INTRODUCTION & MOTIVATION





D.R. McIlveen-Wright et al: **A comparison of circulating fluidised bed combustion and gasification power plant technologies for processing mixtures of coal, biomass and plastic waste:** Fuel Processing Technology 87 (2006) 793–801

INDIAN COAL

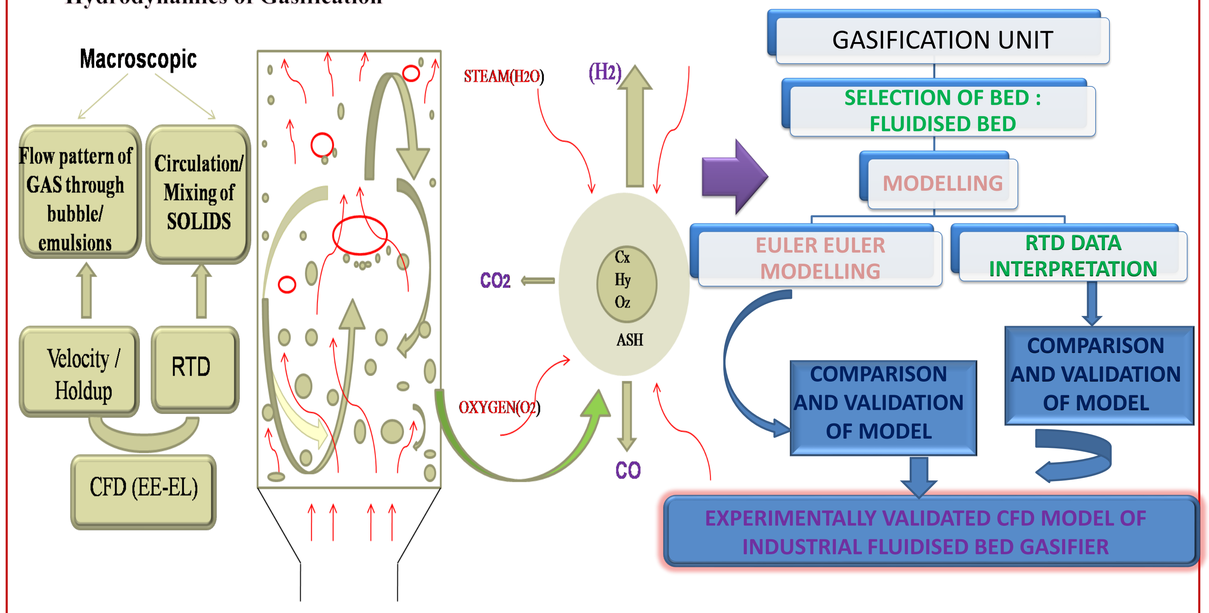
- Low Fixed Carbon Content
- High Ash Content
- High Volatile Matter Content
- High O/C and H/C Ratio
- Low Vitrinite content, less susceptible to swelling

FLUIDIZED BED

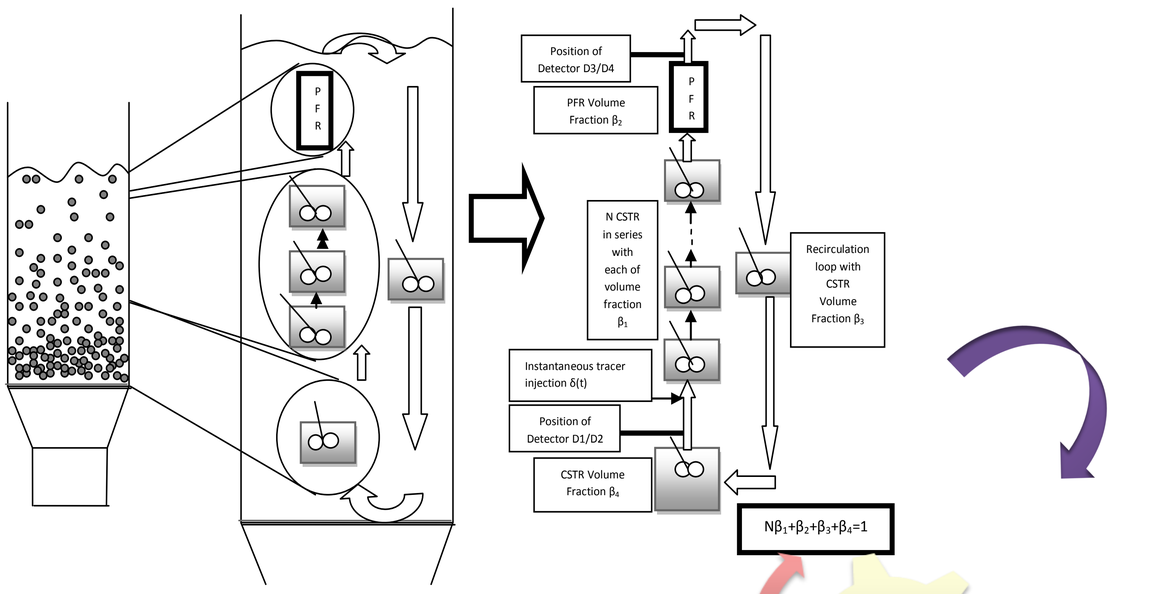
- High Turndown Ratio
- Better Heat and Mass Distribution
- Operational Temperature below Ash Fusion Temperature
- High Ash mode of Heat Distribution
- Ideal for Non Caking High Ash Coal

OBJECTIVES

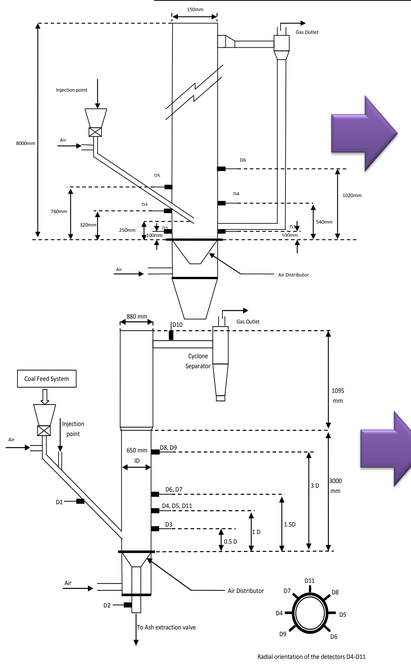
Hydrodynamics of Gasification

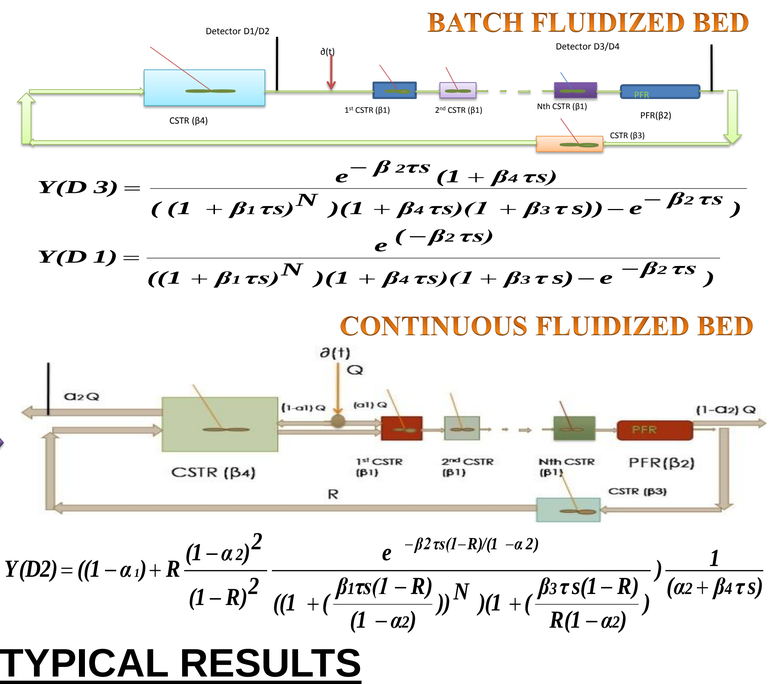


METHODOLOGY



EXPERIMENTAL SETUP / MODEL FORMULATION





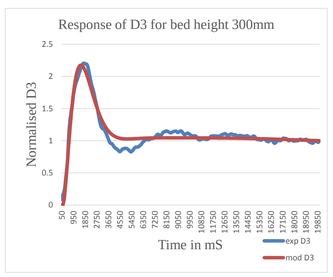
$$Y(D3) = \frac{e^{-\beta_2 \tau s}(1+\beta_4 \tau s)}{((1+\beta_1 \tau s)^N)(1+\beta_4 \tau s)(1+\beta_3 \tau s)) - e^{-\beta_2 \tau s})}$$

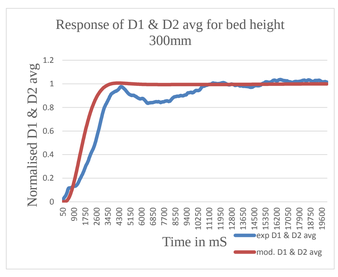
$$Y(D1) = \frac{e^{(-\beta_2 \tau s)}}{((1+\beta_1 \tau s)^N)(1+\beta_4 \tau s)(1+\beta_3 \tau s) - e^{-\beta_2 \tau s})}$$

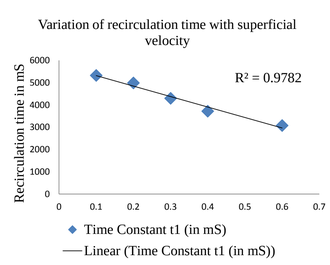
$$Y(D2) = ((1-\alpha_1) + R\frac{(1-\alpha_2)^2}{(1-R)^2}\frac{e^{-\beta_2 \tau s(1-R)/(1-\alpha_2)}}{((1+(\frac{\beta_1 \tau s(1-R)}{(1-\alpha_2)}))^N)(1+(\frac{\beta_3 \tau s(1-R)}{R(1-\alpha_2)})}\frac{1}{(\alpha_2+\beta_4 \tau s)}$$

TYPICAL RESULTS

BATCH FLUIDIZED BED

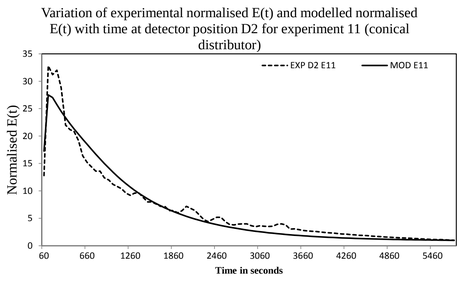




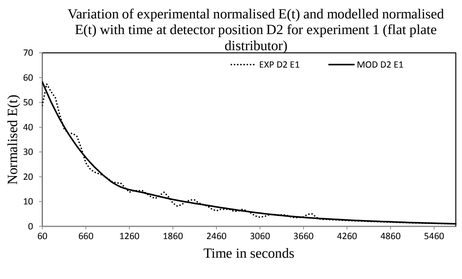


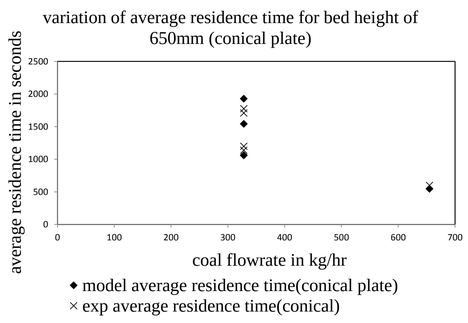
CONTINUOUS FLUIDIZED BED

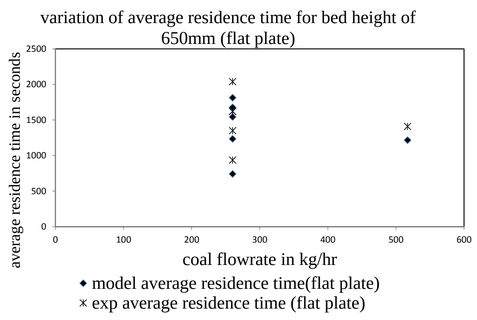
CONICAL PLATE DISTRIBUTOR



FLAT PLATE DISTRIBUTOR







SUMMARY & CONCLUSIONS

- ✓ Development of Six Parameter model for describing the Hydrodynamic behavior of Batch pilot plant
- ✓ Six Parameter model of Batch mode extended to Nine Parameter model of Circulatory Fluidized Bed.
- ✓ Model (Circulatory + Batch Fluidized bed) validated against Radio Tracer Analysis Data and analyzed.
- ✓ MATLAB code to invert transfer function numerically(Laplace to Time) with incorporated regression.
- ✓ Euler Euler modeling of continuous mode, analysis of problems associated.

ONGOING AND FUTURE WORK

