



## **ACTIVE CARBON INDIA PRIVATE LIMITED**

### **Preheating of the Combustion Air in the Rotary Kiln with Steam Coils**

#### **SUMMARY OF THE OPTION**

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Active Carbon India Pvt. Ltd., with a plant capacity of 1500 tons/year, is a leading manufacturer of granular activated carbon prepared from coconut shell charcoal. The plant operates two rotary oil fired kilns in parallel. The kiln represents the heart of the process wherein raw carbon (roasted coconut shells) is activated by steam to form granular activated carbon. Based on the discussions and feedback, the Team identified ‘combustion of furnace oil in the kiln’ as one of the key focus areas, wherein it was perceived that there existed a significant margin for improvement (in combustion efficiency) and thereby reduction in furnace oil consumption and consequent GHG reduction.

Furnace oil is burnt to produce heat in the kiln and in an ambience of low oxygen the granular coconut shells undergo devolatilisation and with simultaneous injection of steam, the coke gets activated. The option, of ‘Preheating the combustion air to the kiln’, was evolved based on the following observations.

The air required for the combustion of furnace oil was supplied at ambient condition of 30 °C. An excess of 250 kg/hr of steam (generated from waste exhaust hot gas of kiln) was available after a modification involving interconnection of flue gas paths of both of kiln # 1 and 2, to maximize waste heat recovery potential. The above option resulted in annual saving of around 16.5 kL of furnace oil worth US\$ 6715 (Rs.2.89 lakhs). The option was implemented with a one-off initial investment of US\$ 2200 (Rs.94,600) which has been paid back within 4 months of its implementation.

#### **KEY WORDS**

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India, Chemicals, Fuels and Combustion, Rotary Kiln

#### **OBSERVATIONS**

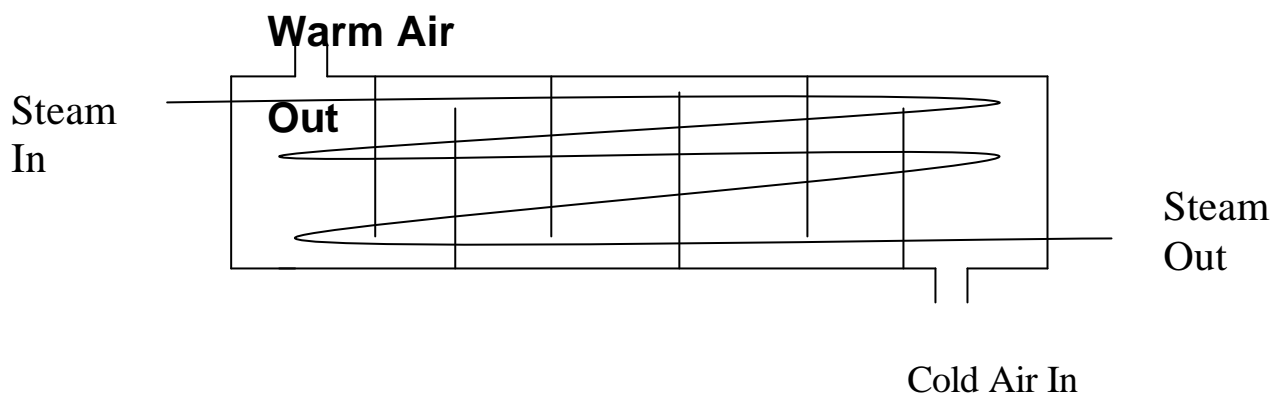
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- The air required for the combustion of the furnace oil was of the order of 700 kg/hr (at 10 per cent excess air) and admitted to the burner at a temperature of 30 °C (ambient)
- It was observed that after inter connection of the flue gas paths of kiln 1 and 2, steam generation was around 900-950 kg/hr, whereas the total steam requirement, inclusive of the driers, amounted to 600 – 710 kg/hr. On an average, about 250 kg/hr of steam was in excess and was being vented. Ways of utilizing this excess steam was explored.

#### **OPTIONS**

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In order to affect furnace oil savings directly at end use, the combustion air to the kiln was preheated from 30°C to 120°C by using a part of the excess vented steam. Preheating of 30°C air was effected using a steam to air heat exchanger (steam coil air preheater). This resulted in reduction in fuel oil consumption which was otherwise used in heating the air.



## RESULTS

### Financial benefits:

- Investment: US\$ 2200 (Rs.94,600)
- Annual operating cost: no change
- Annual cost savings: US\$ 6715 (Rs.2.89 lakhs), (= 16.5 kL of FO X Rs.17.5/L of FO @ Rs.43/ US \$)
- Payback period: 4 months

### Environmental benefits:

- Annual energy savings: 16.5 kL of Furnace Oil, calculated as follows:
  - Charred coconut shell chips feed rate: 280 kgs/hr
  - Quantity of fuel fired: 50 liters/hr (45.5 kg/hr)
  - % Excess air: 10% (2% O<sub>2</sub>)
  - Total Qty. of combustion air: 700 kg/hr, (=45.5 kg FO/hr X 14kg air/kg FO 1.1Excess air factor)
  - Heat required to preheat combustion air from 30<sup>0</sup>C to 120<sup>0</sup>C: 15120 kCal/hr = 700 kg/hr X 0.24 c<sub>p</sub> X (120<sup>0</sup>C-30<sup>0</sup>C))
  - Equivalent furnace oil reduction: 15120/(10,000 X 0.8) (@ 80 % combustion efficiency) = 16.5 kL
- Annual GHG reduction: 49.5 tons CO<sub>2</sub> (= 16.5 kL of FO X 3 tons of CO<sub>2</sub>/ kL of FO)[1]

## FOR MORE INFORMATION

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