

*Design of Coal Desulfurization Processes to Improve the Environment***Objective**

---

The objective of this IPRO is to choose an appropriate method for desulfurizing coal. Three types of methods were researched in order to find the best way to desulfurize coal- chemical, physical and biological. Our chosen method was a chemical method, oxydesulfurization, which uses high temperature and pressure along with steam and air to bind oxygen to sulfur in the coal and later remove the two as SO<sub>2</sub>. This method was developed using fluidized bed reactors. Last, a profitability analysis and costing estimate of the process was performed.

**Organization**

---

Our method for getting the entire group involved in as much of the IPRO as possible involved having many small groups with different goals to be completed throughout the semester. These groups become a main focus for a week or two, each with deadlines that needed to be met; after the goals of the group were accomplished, the members moved on to the next step and continued building and growing towards our main goal of designing a pre-combustion desulfurization process.

The following groups were created throughout the semester: Coal Research Group, Coke Research Group, Desulfurization and Coal Analysis Group, Physical, Chemical, and Biological Desulfurization Methods Groups, Process Design Group, Costing and Profitability Analysis Group, Safety Group, and Unit Operations Description Group.

**Accomplishments**

---

Our group determined that oxydesulfurization was a fitting method for this project. The total amount of sulfur removed was 86%, which was above the limit of 81% set by the EPA. We were able to remove 95% of pyritic sulfur along with 72% of organic sulfur. An incoming feed of 70 tons/hr leads to a total of 2080kg of sulfur removed per hour (total sulfur before removal amounting to 2416kg).

Also, we performed a profitability analysis and cost estimate of our process to determine whether or not the process is feasible. A price of \$88/ton was found to clean our basis of 554,400 tons of coal/year. Sales from the process amount to \$98/ton of coal treated, giving a pre-tax profit of \$10/ton. Total capital investment on the process plant is \$14,346,725.

**Team Members**

---

Salil Benegal (CHEM)  
 Anthony Doellman (PHYS)  
 Andrew Keen (CHE)  
 Gregory Kisiel (CHEM)  
 James Maratt (CHE)

Amy McDowell\* (CHE)  
 Adejoke Ogunride (CHE)  
 Oscar Olmos (CHE)  
 Myint Toe (CHEM)

Advisor:  
 Mohammed Ehsani

\*team leader