DISCLAIMER

EVALUATION OF HYPERBARIC FILTRATION FOR FINE COAL DEWATERING

DOE/PC/92550--1

DE93 012558

DOE Grant No. DE-PS22-92PC92520

First Quarterly Technical Progress Report

(September 1, 1992 - November 30, 1992)

by

B.K. Parekh (PI)
University of Kentucky

R. Hogg (Co-PI)
The Pennsylvania State University

A. Fonseca (Co-PI)
Consol Inc.

OBJECTIVES AND SCOPE OF WORK

The main objectives of the project are to investigate the fundamental aspects of particle-liquid interaction in fine coal dewatering, to conduct laboratory and pilot plant studies on the applicability of hyperbaric filter systems and to develop process conditions for dewatering of fine clean coal to less than 20 percent moisture.

The program consist of three phases, namely

Phase I - Model Development

Phase II - Laboratory Studies

Phase III - Field Testing

The Pennsylvania State University will lead the effort in Phase I, the University of Kentucky in Phase II, and Consol Inc. in Phase III of the program. All three organizations will be involved in all the three phases of the program. The Pennsylvania State University will develop a theoretical model for hyperbaric filtration systems, whereas the University of Kentucky will conduct experimental studies to investigate fundamental aspects of particle-liquid interaction in fine coal dewatering. Finally, the optimum filtration conditions identified through both phases will be tested in a Consol Inc. coal preparation plant using an Andritz Ruthner portable hyperbaric filtration unit.

INTRODUCTION

Most of the coal presently used by the utility industry is cleaned at preparation plants employing wet processes. Water, while being the mainstay of coal washing, is also one of the least desirable components in the final product. Coarse coal (+3/4 inch) is easily dewatered to a 3-4 percent moisture level using conventional vibrating screens and centrifuges. However, the main problem of excess product moisture occurs in fine (minus 28 mesh) coal and refuse. Even though fines may constitute only about 20 percent of a contemporary cleaning plant feed, they account for two-thirds of the product surface moisture. This high surface moisture offsets many of the benefits of coal cleaning, and can easily undercut the ongoing programs on recovery of fine clean coal from refuse as well as producing an ultra-fine super clean coal fuel.

Currently, most of the coal preparation plants utilize vacuum disk type technology for dewatering of the fine coal, providing dewatered product containing about 25 percent moisture. The coal industry would prefer to have a product moisture in the range of 10 to 15 percent, thereby avoiding thermal drying of coal. Hyperbaric filtration has shown potential in lowering moisture in fine coal to about 20 percent level. This project will develop fundamental information on particle-liquid interaction during hyperbaric filtration and apply the knowledge in developing optimum conditions for the pilot plant testing of the hyperbaric filter system.

APPROACHES AND PROGRESS

A final contract with U.S. DOE on the project was signed on September 29, 1992. Two project meetings were held between the University of Kentucky, The Pennsylvania State University and Consol Inc. personnel to discuss approaches to be

investigated and method of communications between the team members. A kickoff meeting on the project was organized at PETC on November 23, 1992, where researchers presented project plans to the DOE project officers.

Phase I

An extensive review of the technical literature on dewatering by gas displacement in conventional (vacuum) as well as hyperbaric filtration is in progress. Evaluation of existing models based on capillary pressures in packed beds (filter cake) suggests that these are generally oversimplified. The framework for a refined model which takes into account pressure distributions during air flow (following breakthrough) through complex porous beds has been established. Emphasis at this stage is being placed on the development of pore size/particle size/packing relationships for packed beds. A hybrid approach combining modern packing theories with the results of empirical, pore-structure studies is being followed.

Phase II

Acquisition and Characterization of Samples

Fifty-five gallon samples of froth from Pittsburgh and Illinois No. 6 coals were received from the Consol Inc. Representative samples of slurries were characterized for percent solids, particle size and ash distribution. Tables 1 and 2 list the characterization data for Pittsburgh and Illinois No. 6 froth samples, respectively. Note, that both the product had low ash content, however, the Pittsburgh seam sample had 42.2 weight percent of minus 500 mesh which contained about 78 percent of total ash, whereas Illinois seam sample had 45.8 weight percent of plus 100 mesh

size material which contained only 38.6 percent of total ash. Thus, these two products are of different characteristics.

Table 1. Characterization Data for Pittsburgh Seam Coal Froth

Size (Mesh)	Weight Percent	Ash Percent	Percent Ash Distribution
+100	2.77	2.43	0.8
100x200	19.14	2.52	5.6
200x325	13.59	3.34	5.2
325x500	22.23	3.98	10.2
-500	42.27	15.92	78.2
Feed (Calc)	100.0	8.60	100.0
(Actual)		8.78	

Table 2. Characterization Data for Illinois No. 6 Seam Coal Froth

Size (Mesh)	Weight Percent	Ash Percent	Percent Ash Distribution
+100	45.84	4.28	34.2
100x200	14.72	4.77	12.2
200x325	7.72	5.43	7.3
325x500	11.85	3.71	7.7
-500	19.87	11.14	38.6
Feed (Calc)	100.00	5.73	100.0
(Actual)		6.43	

Vacuum filtration studies of Illinois No. 6 froth sample conducted using a laboratory setup (Figure 1) showed that moisture content in filter cake varied from 21 percent to 31 percent as the cake thickness varied from 0.5 cm to 1.5 cm. Filtration studies using laboratory pressure filter are in progress.

Phase III

No activities were conducted.

FUTURE WORK

Vacuum and pressure filtration studies on both the froth samples and the third sample from Pocahontas No. 3 which will be shipped in a few weeks, will be conducted. Dewatering studies will then be conducted using various types of reagents, namely, surfactants, flocculants and metal ions.

END

DATE
FILMED
5/20/93