Chapter 7

Conclusions

7.1 Conclusions

This study was aimed to explore the methodology for suppression of dust emission from haul road of opencast coal mines by application of water soluble laboratory synthesized polymers.

The following conclusions can be drawn out of the present research work:

1. For the case study mine, haul road dust sample contained 20% of silt. Also, the sample contained 43.81% oxygen, indicating that it mostly consisted of various oxides of aluminum, silicon, potassium and iron.

2. Eight polymers were synthesized – four are unhydrolyzed polymers, and four are their hydrolyzed products. It was that higher the intrinsic viscosity of the products, higher was the molecular weight as well as capability to retain moisture.

   For PAMPS-co-PAM, intrinsic viscosity (66.37 dl/g) and molecular wt. (336.84×10^5 Da) were the highest, followed by GG-g-PAM, AP-g-PAM and PAM.

3. For hydrolyzed grafted products, higher the neutralization equivalent (carboxylate ion content) of polymer, higher was the solubility which leads to higher moisture retention efficiency of the polymer.

Neutralization equivalent (carboxylate ion) of H-PAMPS-co-PAM was 4000, whereas that for both H-AP-g-PAM & H-GG-g-PAM was 2000, and for H-PAM was 1500.

4. Thermogravimetric analysis shows that all the developed polymers were thermally stable up to 50 °C – the ambient peak atmospheric temperature at mines during Indian summer seasons.

5. Higher the moisture content of the haul road dust, lower was its emission rate.

6. Effectiveness of the developed polymeric solution, in comparison to application of water alone, depends on the type of the polymer as well as the temperature of ambient atmosphere in the zone of dust suppression application. For H-PAMPS-co-PAM, it was observed that:

    - At 25 °C after 8 h of application, compared to water alone system, it heled dust particles to hold 22.87 % more moisture, resulting in by 2.2 times reduction in dust emission.

    - At 35 °C after 7 h, moisture holding efficiency increased by 27.87 % and dust emission rate reduced by 3.57 times.

    - At 45 °C after 2 h, moisture holding efficiency increaseed by 35.44 % and dust emission rate reduced by 3.97 times.

7. Especially in the summer seasons, it would be possible to save water through application of the developed polymeric solution, since the number of water sprinkling per shift would be reduced.

8. Finally, from the above study it can be concluded that among all the synthesized polymers, **H-PAMPS-co-PAM** performed the best as haul road dust suppressant.

High performance of this polymer can be explained by the fact that a single unit of H-PAMPS-co-PAM molecule can hold up to 11 molecules of water at a time, whereas a single unit of PAM molecule can hold at best only 4 molecules of water at a time.

7.2 Suggestions for Future Studies

On the basis of the present investigation, the results provided innovative dimensions for the future research and practical industrial applications. –A few suggestions for the for the coming research in this area.

- Field application may be tried for haul road dust suppression with the laboratory developed and other commercially available polymers.
- On the basis of the field application, economic analysis may be done for haul road dust suppression system using the synthesized polymer vis-à-vis only-water application.
- Detail study may be carried out by repeating the experiment sufficient number of times, to see the variability and standard deviation in moisture retention under a particular condition of temperature and time.
- Developed polymeric materials may be applied for other areas including temporary civil roads and construction sites.