CHAPTER 6

CONCLUSIONS AND SUGGESTIONS FOR FUTURE WORK
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The results obtained by the tests conducted, experiments performed and observations made in this work of reclamation of CO₂ / silicate moulding sand emerge with the conclusions mentioned in this chapter.

6.1. CONCLUSIONS

(a.) CO₂ / sodium silicate moulding sand can be successfully reclaimed by thermo-pneumatic method.

(b.) Following are the optimal values for the effective reclamation of CO₂ / sodium silicate bonded sand by the thermo-pneumatic process consisting of fluidized bed and scrubbing cell:

- Pressure at fluidized bed : 2.5 Bar.
- Pressure at scrubbing cell : 4.0 Bar.
- Temperature in fluidized bed as well as scrubber : 675°C
- Percentage of sodium silicate of binder mixed during moulding : 4 %
- Cycle Time for fluidization : 13–15 minutes (Second cycle onwards, because the first cycle takes 45 minutes from cold condition).
- Time of scrubbing : 4 to 5 minutes.

(c.) The state of the reclaimed sand which was scrubbed without fluidization does not restore the original properties of the sand. This proves that carrying out the fluidization process before scrubbing is quite essential for effective reclamation.
(d.) When fluidization is carried out by eliminating scrubbing process as per the optimal conditions mentioned above, pH was in the range of 9 to 10. The AFS number was observed to be far below normal value. As such, this proves that the fluidization without scrubbing does not have required effect on the sand to be reclaimed, per contra, the fifth series of experiments indicated that the scrubbing process without fluidization is also not effective for reclamation of sodium silicate / CO₂ sand. The results clearly indicate that the combination of both scrubbing and fluidization is far more effective than either of the two.

(e.) Pollution is totally eliminated in this method by provision of dust collectors and cyclone separators.

(f.) The values of the sand property measurements of the reclaimed sand are comparable to the values of new sand, which indicates that the reclamation is effective. For instance, the sand properties like AFS No., LOI, permeability, compactability are almost equal to that of fresh sand.

(g.) Quality of the casting produced with the reclaimed sand is as good as that of obtained with new sand mixtures.

(h.) The nett savings, by adopting thermo-pneumatic reclamation process is Rs. 25,320 per year for the proto-type reclamation unit of capacity 15 Kg i.e. 60 Kg / Hour = 960 Kg / Day (2 shifts). This is for the prototype scale and the cost / T of reclaimed sand for the prototype worked out to be

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Rs. 84.50. On a larger commercial scale of the unit with a capacity of 24 T / Day the cost savings are estimated to be of the order of Rs. 16 Lakhs per year i.e. Rs. 223 / T of reclaimed sand.

(i.) The combination process, namely combination of thermal and pneumatic, where the pneumatic is itself a combination of fluidization and scrubbing stages, appears to be the most effective process to yield good quality reclaimed sand.

(j.) The properties of this sand approximate those of the fresh sand, and the casting quality with the reclaimed sand is also found to be adequate.

(k.) Advantages of using fluidized bed is that it produces calcined sand of high and uniform quality, is very easy to operate and maintain and it does not require any waste water treatment facilities.

(l.) Advantages of scrubbing cell is that it is capable of performing a controllable amount of work on individual sand grains, and returns a product that consistently meets grain distribution specifications. Reasonable control in the reduction of coating thickness can be accomplished through this reclamation method employing pneumatic scrubbing along with fluidization.

(m.) This method of reclamation is economical and maintenance cost of equipment is negligible.
6.2. **BASIC REQUIREMENTS FULFILLED**

Main three basic requirements are fulfilled in the silicate sand reclamation system.

- It maintains a consistently acceptable LOI (Loss on Ignition) by reducing binder coating on the sand grain. Na$_2$O is also reduced as much as economically possible.

- The CO$_2$ sand reclamation system avoids excessive generation of fines caused by fracturing of sand grains by optimizing the pressure and retention period in the scrubber.

- Fines in the reclaimed sand are maintained at low levels by removing maximum amount of fines generated during metal pouring.

6.3. **THE FUTURE**

6.3.1. **Sustainable Waste Management**

There will be a greater uptake of CO$_2$ sand reclamation in future years as the price and scarcity of virgin sand increases. This, combined with the rising costs of landfill disposal, will improve the viability of silicate sand reclamation techniques. CO$_2$ Reclamtion will be strongly supported as a sustainable form of waste management.

6.3.2. **No Health Hazards**

Entirely enclosed of CO$_2$/silicate sand reclamation system assures clean, safe and non-polluting atmosphere. Further, no toxic effluents would contaminate the
environment. Additionally, the hazards with respect to the health, accident and explosion are ruled out.

The noise level is significantly reduced. Labour injury level due to mechanical motion and excess material movement is reduced. The health of shop floor personnel improves due to a sharp reduction in the air particulate levels, noise and fumes.

6.3.3. Economic Viability

A significant impact is made on the environment when upto 90% of spent sand with binder is reclaimed and not dumped. The economic viability of reclaiming sand instead of dumping improves dramatically when such reclamation comes as a by product.

6.3.4. Suggestions for Safety Features

❖ Heating chamber over temperature should cut off power to the heaters.

❖ Low fluidizing gas pressure should cut off power to the heaters.

❖ Thermo couple failure should be indicated.

❖ Audio visual alarm during all inter lock operations should be provided.

❖ Resumption of operation should be possible only if faults are corrected.