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TEQIP

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TOPIC:

- DEVELOPMENT OF METHODS FOR MOISTURE REDUCTION AND DRY BENEFICIATION OF IRON ORE.

TRAINING PERIOD:

- ONE MONTH UNDER TEQIP-III (TECHNICAL EDUCATION QUALITY IMPROVEMENT PROGRAMME) HELD AT INDIAN INSTITUTE OF TECHNOLOGY (HYDERABAD)

Dry beneficiation – Iron ore slimes

It is the process which avoids the excessive use of water during beneficiation of ores. It is significant at the places of water scarcity.

Different methods for dry beneficiation explored are as follows:

WATER ABSORBING POLYMER(WAPs)

- IN THIS METHOD 100 gm OF IRON ORE SLIMES IS TREATED WITH SODIUM POLYACRYLATE FOR PERIOD OF 2 HOUR FOR MOISTURE ABSORPTION.

HEATING WITH OVEN

- IN THIS METHOD 100gm OF ORE IS TREATED IN AN OVEN FOR 1 HOUR FOR EVAPORATION OF MOISTURE AND WEIGHT LOSS IS TRACKED IN EVERY 15 MINUTES DURATION.

COMBINATION OF WAPs AND OVEN

- IN THIS FIRST THE ORE IS TREATED WITH WAPs FOR 2 HOURS AND THEN HEATED IN AN OVEN FOR 1 HOUR 15 MINUTE FOR EVAPORATION OF MOISTURE.

REDUCTION OF ORE USING MICROWAVE

- IN THIS METHOD 10gm ORE SAMPLE IS HEATED IN A MICROWAVE FOR 1 MINUTE, RESTED FOR ANOTHER MINUTE AND PROCESS IS REPEATED 5 TIMES.

COMBINATION OF WAPs AND MICROWAVE

- IN THIS METHOD 100gm OF ORE SAMPLE IS FIRST RESTED ON WAPs FOR 1 HOUR AND THEN 10gm OF THAT IS HEATED IN AN INTERVAL OF 1 -1 MINUTE IN A MICROWAVE

DRY HIGH INTENSITY MAGNETIC SEPARATOR

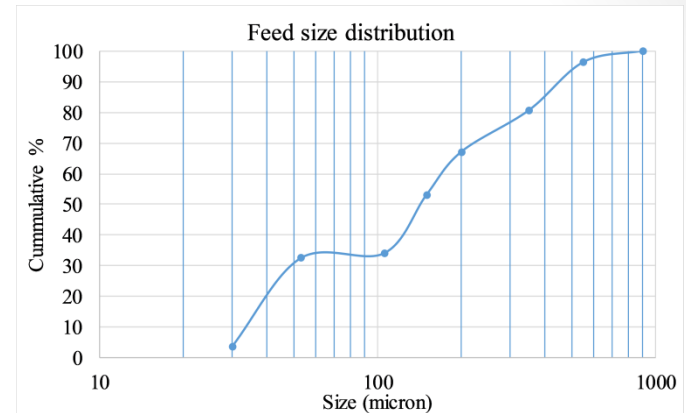
- IN THIS METHOD THE ORE IS PASS THROUGH A ROLLAR MAGNETIC SEPARATOR WHICH SEPARATES MAGNETIC AND NON MAGNETIC MATERIAL FROM THE ORE . THE MAGNETIC SAMPLE COLLECTED WILL HAVE HIGHER % OF Fe.

HYDROCYCLONE

- IN THIS PROCESS FIRST WE FIND THE UNDER AND OVER FLOWRATES OF WATER AT DIFFERENT PRESSURE I.E. 1.5,2,3 kg/cm³.
- THE WET SEPARATION OF THE IRON ORE SLIME SLURRY IS TAKEN BY HYDROCYCLONE OPERATION @ 5% SOLIDS AND 1.5 kg/cm³. THE FLOW RATE, % SOLIDS AND THE IRON PERCENTAGE IS CALCULATED AT EACH STREAM.

Feed details

- INITIAL MOISTURE CONTENT: 1%
- Fe CONTENT (ESTIMATED BY TITRATION) IN
-200 MICRONS: 34.1%
- FEED SIZE: -200



METHODS IMPLEMENTED

MOISTURE REDUCTION :

- WATER ABSORBING POLYMER (WAPs)
- HEATING WITH OVEN
- COMBINATION OF WAPs AND OVEN
- HEATING WITH MICROWAVE
- COMBINATION OF WAPs AND MICROWAVE

BENEFICIATION :

- HIGH INTENSITY MAGNETIC SEPARATOR
- HYDROCYCLONE

Results

TABLE 1
FOLLOWING ARE THE RESULTS OBTAIN DURING EXPERIMENT OF WAPs + OVEN

Mixture(gm.) (SAMPLE+WATER)	Wt. after WAPs(gm.) (2 HOURS)	Moisture loss after WAPs (%)	Wt. after heating with oven(gm.) (1 hour 15mins)	Moisture loss after heating with oven
90+10	94	6	87	7
85+15	97	3	83.5	13.5
80+20	92	8	77	15
70+30	75	25	64	11

TABLE 2
FOLLOWING ARE THE RESULTS OBTAIN DURING HEATING OF ORE IN A OVEN

Mixture (Sample + Water)	After 15 min. (wt. in gms)	After 30 min. (wt. in gms)	After 45 min (wt. in gms)	After 60 min (wt. in gms)	Moisture loss (%)
90+10	98	94.5	90	89	11
85+15	97.5	91.5	86	84.5	15.5
80+20	94	89	83.5	80.5	19.5
75+25	93.5	86	79	75.5	24.5

TABLE 3
FOLLOWING ARE THE RESULT OBTAIN DURING HEATING IN A MICROWAVE (% MOISTURE EVAPORATED)

SECS	Feed % moisture			
	10%	15%	20%	30%
20	0.1	0.7	6.3	11.6
40	3	3.8	11.4	23.7
60	5.9	8.5	16.9	30.6
90	9.4	13.3	19.4	31.5
120	10.6	15.8	21.1	31.5

TABLE 4

FOLLOWING ARE THE RESULTS OBTAIN DURING EXPERIMENT WITH WATER IN HYDROCLONES

Pressure In Kg/cm ³	Bucket wt.	OF	UF	OF	UF	Feed
1.5	0.4	1.46	0.91	1.06	0.51	1.57
	0.4	1.48	0.97	1.08	0.57	1.65
	0.4	1.65	1.01	1.25	0.61	1.86
				0	0	1.693333
2	0.4	2.06	1.13	1.66	0.73	2.39
	0.4	2.24	1.17	1.84	0.77	2.61
	0.4	2.38	1.23	1.98	0.83	2.81
				0	0	2.603333
3	0.4	2.9	1.37	2.5	0.97	3.47
	0.4	3.07	1.42	2.67	1.02	3.69
	0.4	3.2	1.49	2.8	1.09	3.89
						3.683333

TABLE 5

FOLLOWING ARE THE RESULTS OBTAIN DURING EXPERIMENT WITH WATER + IRON ORE IN HYDROCLONES

	plate wt.	plate + slurry	Plate + dried	% solids	% Fe
Feed	139.5	1074	171.184	3.3905	34.15126
Overflow	142.5	1000.5	157.165	1.7092	53.48992
Underflow	143.5	678	179.15	6.6698	55.95868

TABLE 6

% BENEFICIATION IN HYDROCYCLONE – 38.97%

FOLLOWING ARE THE RESULTS OBTAINED FOR DRY BENEFICIATION BY ROLLER MAGNETIC SEPARATION

	Mixed		200		-200	
	M	NM	M	NM	M	NM
wt fraction	0.957	0.033	0.663	0.229	0.960833	0.040833
fe%	48.96385	45.2607	53.07846	36.20856	23.45327	37.44294
feed fe%	45.55		39.56		34.25	
% beneficiation	7.49		34.17		-31.52	

Observation and Discussion

- WAPs REQUIRES MUCH TIME.
- OVEN REQUIRES HIGH POWER.
- ROLLER MAGNETIC SEPARATOR COULD NOT WORK EFFICIENTLY AT < 200 MICRONS PARTICLE DISTRIBUTION.

Conclusion

- MICROWAVE REQUIRES LESS TIME AND POWER IN COMPARISON TO OTHER TWO DRYING PROCESSES.
- AS WE TRIED ONE EACH METHOD OF DRY AND WET BENEFICIATION, WET IS MORE SUITABLE FOR FINES, AS SEPARATION OF FINES CAUSES MANY PROBLEM DURING DRY BENEFICIATION. THE DRY BENEFICIATION IS SUITABLE FOR $+500$ SIZE PARTICLE.

THANK YOU