CHAPTER - 03

MATERIALS AND METHODOLOGY

3.1 General

The chapter mainly highlights the materials and methodology followed in the study for the synthesis of geopolymer. The geotechnical and mineralogical characteristics and source of these materials used in the proposed research such as Pond ash, MSW Reject, Red Mud and GGBFS have been reported in the chapter. The detailed characterization of these materials has been analyzed using XRF, XRD, FTIR and SEM before and after geopolymerisation processes. The strength aspect of geopolymers has been briefed and also elaborated the methodology such as mix proportion followed for the synthesis of the geopolymer. The durability studies on synthesized geopolymers have also been planned and reported the procedure adopted.

3.2 Materials

Materials used in this study are Pond ash, Red mud, MSW rejected waste fraction as base material and ground granulated blast furnace slag (GGBFS) as binder material to synthesise the geopolymer. The Pond ash is generated from thermal power stations and collected from the Obra thermal power station, Sonbhadra, Uttar Pradesh, India. MSW Rejected waste fraction was collected from MSW Processing plant, Karsara, Varanasi, India. Red mud is a residue from the development of alumina and it was collected from the Hindalco Aluminium Plant, Renukoot, Uttar Pradesh, India. The GGBFS was collected from Stallion Energy Pvt. Ltd., Rajkot, India. The photographs of each material in its raw form are shown in Fig. 3.1 to Fig. 3.4. The MSW reject appeared to be a soil-like material and was of 4 mm reject in the waste management system during the mechanical processing. Basically, the MSW rejected waste is the fraction material after the segregation of effective useful waste (recyclable waste, compost etc.) and is an inorganic soil-like fraction sent to landfill. In this study sodium hydroxide (NaOH) is used as an alkaline activator of various concentrations at 4, 6, 8 and 10M. The amount of alkaline activator for any designed mix was considered based on optimum moisture content (OMC) at which maximum dry unit weight (MDD) of the particular mix will be achieved.

3.2.1 Pond Ash

Pond Ash is generally the combined form of unutilized fly ash and bottom ash. This addition of unutilized fly ash and bottom ash is dumped into the pond. In the year 2020-21, generation of the Pond Ash is 65.132 million tons.

Fig: 3.1 Pond Ash

3.2.2 Red Mud

Red mud is a waste generated in the production of Aluminum from bauxite ore. In the year (2018-19) India generated 8855433 MT of Red Mud. Particularly the Hindalco Industries

Ltd., (Uttar Pradesh) Aluminum Plant produces the quantity of Red Mud is 946208 MT in the year 2018-19 and 933599 MT in the year 2019-20.

Fig: 3.2 Red Mud

3.2.3 MSW Rejected Waste

MSW Rejected waste is waste which is of 4-mm reject fraction during the mechanical process in a waste management system and appears like a soil material. It is obtained from different screening and crushing process of municipal solid waste. The final left-out soil-like fraction material sent to a landfill after the separation of useful waste such as recyclables and compost is called MSW rejected waste. According to CPCB (2020-21), the total quantity of solid waste generated in India is 160038.9 tonnes per day. By the year 2047, MSW generation in India is expected to reach 300 MT and the land requirement for disposal of this waste would be 169.6 km^2 against which only 20.2 km^2 were occupied in 1997 for management of 48 MT (CPCB 2000).

Fig: 3.3 MSW Reject Waste

3.2.4 GGBFS (Ground Granulated Blast Furnace Slag)

GGBFS (Ground granulated blast furnace slag) is the byproduct that originated through the development of raw steel and this waste is collected from Stallion Energy Pvt. Ltd., Rajkot, India. 300 to 540 kg blast furnace slag per ton of pig or crude iron has been produced. In this study, GGBFS was used to replace the other industrial waste to improve its strength.

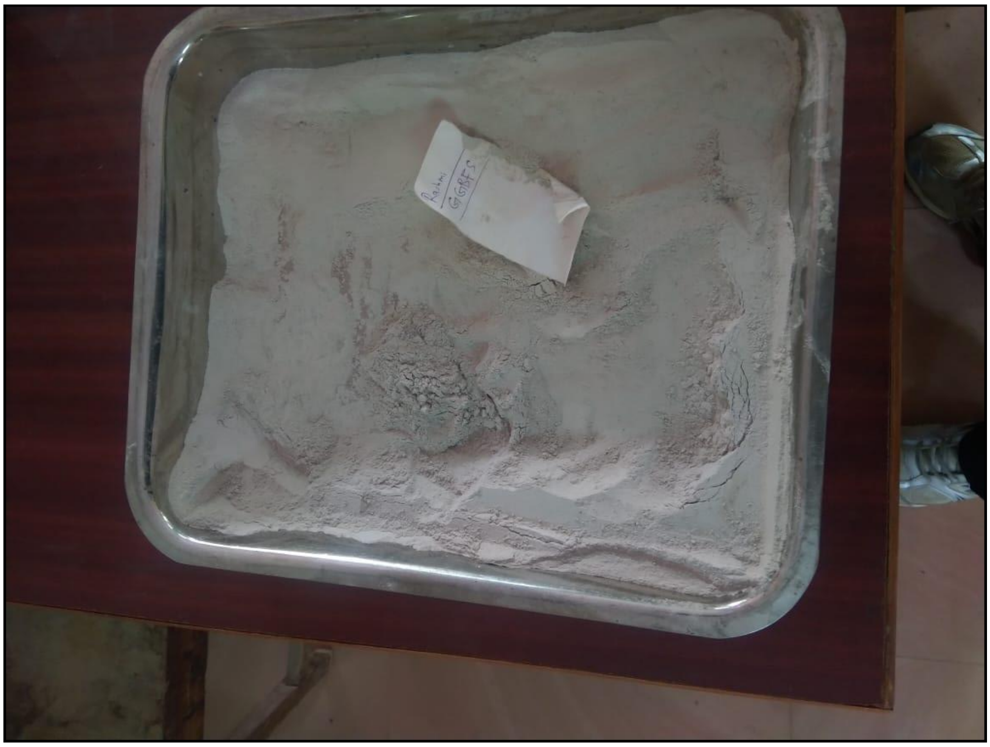

Fig: 3.4 GGBFS (Ground Granulated Blast Furnace Slag)

3.3 Microstructural and Chemical characterization of Materials

The proposed study materials have been characterized using XRF, XRD, and FTIR techniques and discussed below.

3.3.1 XRF Analysis

Table 3.1 shows the presence of various major oxides in the study materials determined using XRF analysis.

Table: 3.1 XRF Analysis of Raw Materials

Components	**SiO_2**	**Al_2O_3**	**Fe_2O_3**	**CaO**	**MgO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**
Pond Ash	57.79	25.01	4.59	0.43	0.39	0.00	0.87	1.59	0.18
MSW Reject	42.35	9.62	4.90	10.56	2.67	1.06	2.65	0.73	1.24
Red Mud	13.79	23.51	32.38	1.65	0.05	10.13	0.03	17.01	0.39
GGBFS	35.84	13.07	1.18	32.38	4.51	0.50	0.75	0.61	0.00

From XRF analysis (Table 3.1) it is reported that Pond ash consists of the maximum percentage of silica (SiO_2- 57.79 %) and alumina (Al_2O_3- 25.01 %) showing a great ability to develop geopolymer. The composition of Fe_2O_3 in Red mud is maximum (32.38%) and the percentage of silica is very low (13.79 %). While MW Reject contains aa a maximum percentage of Silica (SiO_2 – 42.35 %) and minimum percentage of alumina (Al_2O_3 – 9.62 %). Ground granulated blast furnace slag (GGBFS) also recorded the good amount of silica (35.84 %). The composition of main component in all material is calcium oxide which is responsible for achieving the strength. The percentage of calcium oxide CaO is maximum (32.38 %) in GGBFS. Having maximum percentage of calcium oxide, the material GGBFS replaced with Pond Ash, MSW Reject and Red mud for developing strength in the designed mixes.

3.3.2 XRD Analysis

The peak of Quartz in pond ash observed in strong intensity (Fig. 3.5) which shows the abundance quantity of silica in pond ash also verified from XRF analysis. While small peaks of hematite are also observed and the percentage of Fe_2O_3 (hematite) also confirmed by the XRF analysis which is very low (4.59%). In red mud the peak of silica is observed in low intensity and the peak of hematite is viewed in strong intensity. Other peaks of alumina are also observed in moderate intensity as shown in XRF analysis. The strong peak of quartz (silica) is also observed in MSW Reject. In GGBFS the peak of calcium oxide is observed in high intensity and the peak of silica is also observed in moderate intensity. While other peaks of hematite, aragonite, calcite, vaterite are also observed in small intensity.

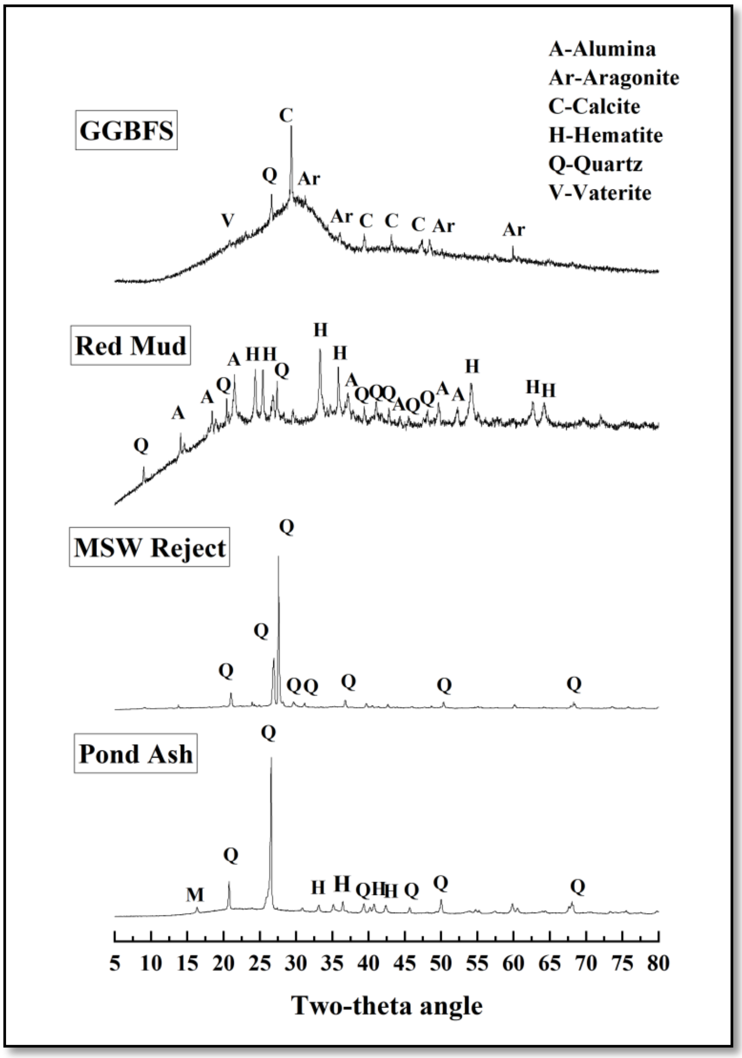

Fig: 3.5 XRD Analysis of All Raw Materials

3.3.3 FTIR Analysis

From FTIR analysis (Fig. 3.6) it is observed that the first peak of wavenumber is centered at the 466 cm^{-1} in pond ash, 463 cm^{-1} in MSW Reject, 452 cm^{-1} in Red mud and 473 cm^{-1} in GGBFS (Komnitsas et al., 2015) which represented to the bending vibration of Si-O-Si. The second peak is recognized at 780 cm^{-1} in Pond ash and at 785 cm^{-1}in MSW Reject, at 567 cm^{-1} in Red mud and at 692 cm^{-1} in GGBFS linked to the Si-O stretching which indicates the presence of quartz (Vasquez et al., 2016; Zhang et.al.2012; Komnitsas et al., 2015). The third peak detected at 1089 cm^{-1} in Pond ash, at 1037cm^{-1} in MSW Reject, at 995 cm^{-1} in Red mud and at 992 cm^{-1} in GGBFS associated with the pattern of asymmetric stretching vibration of

Si-O-T (T: Tetrahedral Si or Al) which found in the range of wavenumber 1200 cm^{-1} and 950cm^{-1} (Ismail et al., 2014). The fourth intense peak is identified at 1440 cm^{-1} in MSW Rejected waste, in Red mud at 1455 cm^{-1} and 1440 cm^{-1} in GGBFS linked to the C-O-C or O-C-O asymmetric bond (Zawrah et al., 2016; Ismail et al., 2014). Another peak is noticed at 1647cm^{-1} in MSW Rejected waste, 1645 cm^{-1} in Red mud is attached to the stretching vibration of bond –OH. The vibration of H-OH stretching (3200 cm^{-1} and 3600cm^{-1}) is noticed at the band 3426 cm^{-1} in Pond ash, 3418 cm^{-1} in MSW Rejected waste, 3290 cm^{-1}in Red mud and 3442 cm^{-1} in GGBFS (Ismail et al., 2014).

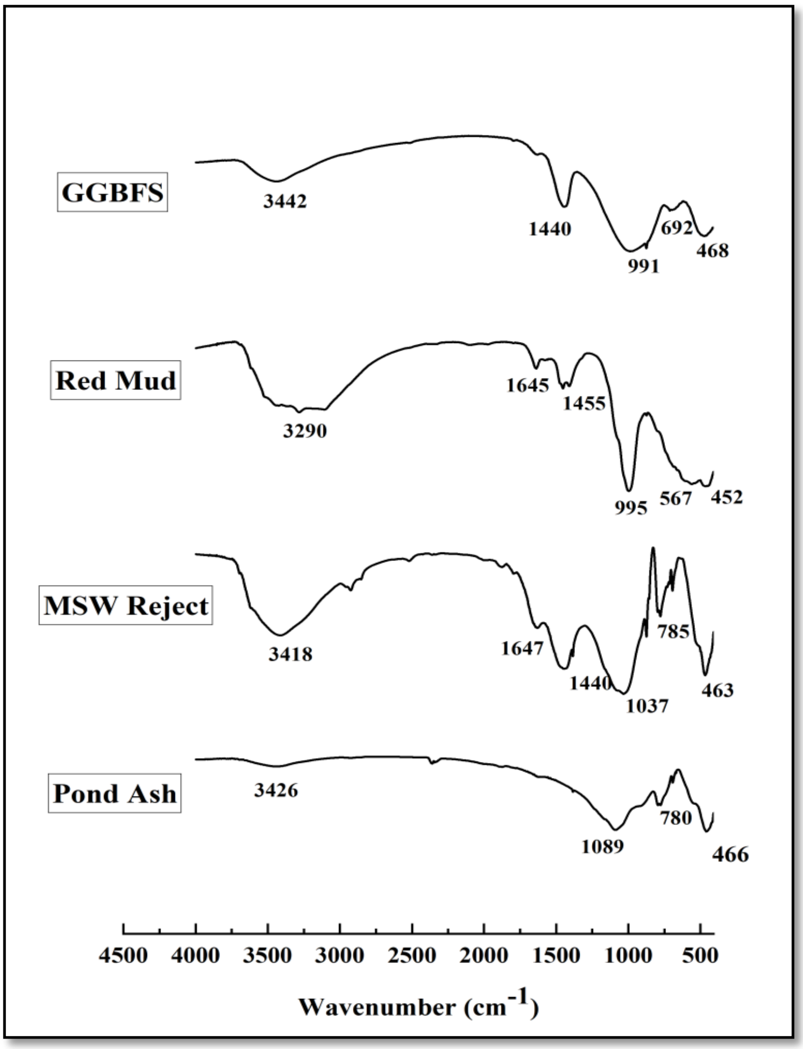

Fig: 3.6 FTIR Analysis of All Raw Materials

3.3.4 SEM Analysis

The SEM images of pond ash, red mud, MSW reject, and GGBFS have been shown in Fig. 3.7. From SEM images it is observed that pond ash has a round-subrounded shape of round–subrounded. MSW Reject waste has irregularly shaped particles. Red mud has the honeycomb-type structure from the SEM images of red mud and GGBFS has angular-shaped particles. Particles of all materials are looking in loose form.

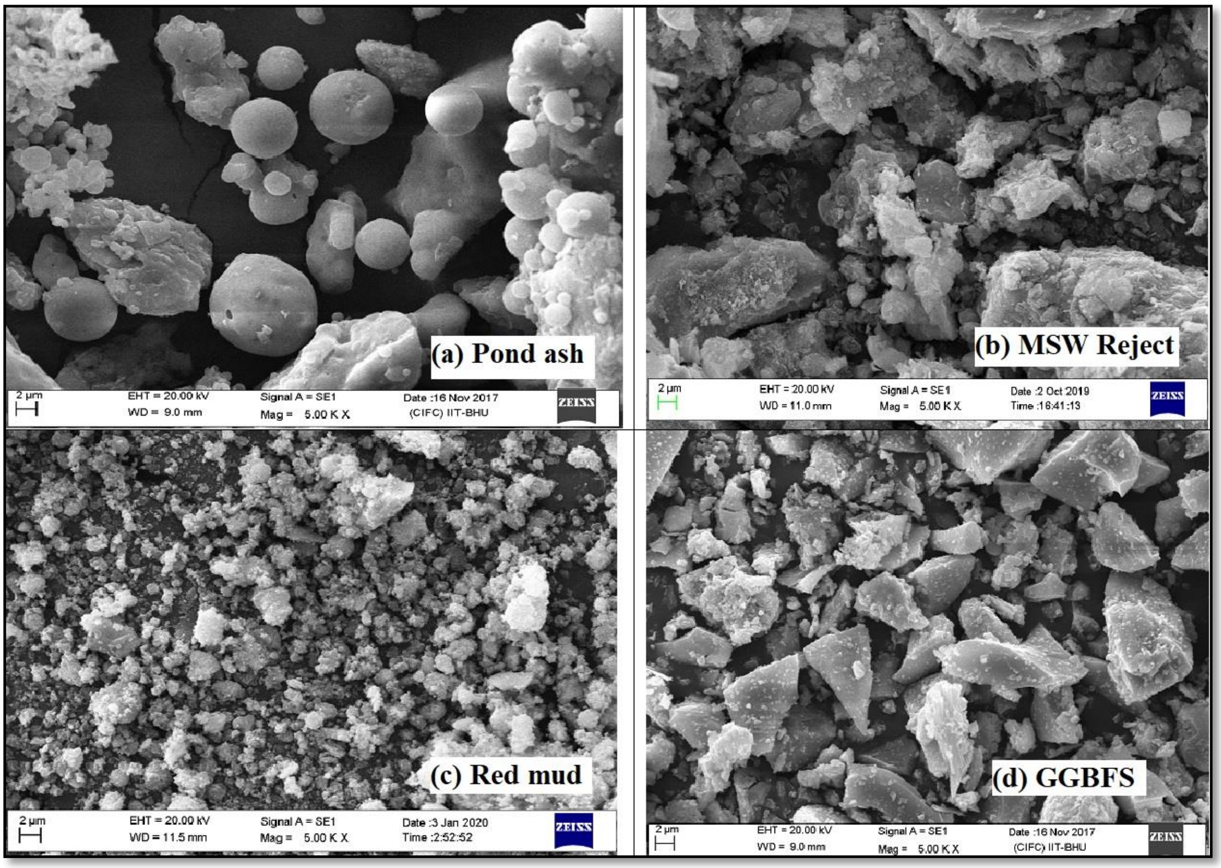

Fig: 3.7 SEM Analysis of all Raw Materials

Based on the XRF, XRD, FTIR & SEM tests conducted on Pond Ash, MSW Reject, Red Mud, GGBFS confirmed that all waste materials have found a good amount of silica and alumina. Many authors investigated that the materials having good alumina and silica percentages are good sources for geopolymerization. Geopolymerization is the reaction of alumino-silicates with an alkaline activator. As described in the literature review different types of industrial waste represented a good amount of alumina and silica by XRF study chosen for geopolymer reactions. Another reason for taking these materials for the study is availability of these materials from nearby industries.

3.4 Geotechnical characterization

In this present study, the Geotechnical properties of Pond ash, MSW Reject, Red mud and GGBFS have been determined and the results are presented in Table 3.2. The grain size distribution of Pond ash, MSW Reject, Red mud and GGBFS were determined using dry sieving and hydrometer method as per IS: 2720: Part-4 (1985). The specific gravity of Pond ash, MSW Reject, Red mud and GGBFS were determined using a density bottle as per IS: 2720: Part-3(1980). A compaction test was done with water as pore fluid for all mixtures to determine the relationship between water content and dry density. Compaction characteristics (OMC and MDD) of raw material have been determined according to IS: 2720: Part-7 (1980). To analyze the coefficient of permeability (k) of all raw materials falling head permeability test was performed as per IS: 2720: Part-17 (1986). Unconfined compressive strength (UCS) of all raw materials used has been determined as per IS: 2720: Part-10(1991).

Table: 3.2 Geotechnical Properties of All Raw Materials

Geotechnical properties			Pond ash	MSW Reject	Red mud	GGBFS
1	Specific Gravity		2.2	2.34	3.125	2.75
2	Grain size distribution	Sand (%)	22.0	80.8	31.6	1.0
		Silt (%)	78.0	17.5	54	95.0
		Clay (%)	0.0	0.293	12	4.0
3	Compaction characteristics	Maximum dry density (g/cc)	1.18	1.524	1.52	1.57
		Optimum moisture content (%)	29.1	18	31	22.5
4	Permeability (cm/sec)		1.36×10^{-4}	2.395×10^{-4}	2.822×10^{-4}	0.412×10^{-4}

3.4.1 Specific Gravity

From Table 3.2 It is clearly observed that Pond ash shows the lowest specific gravity i.e., 2.2 in comparison to all waste materials due to light weight. The specific gravity of MSW Reject is 2.34 which indicate the lightness of the material. From the geotechnical properties, the Red mud has the highest value of specific gravity 3.125 showing its heaviness. The specific gravity of GGBFS is 2.75.

3.4.2 Grain Size Distribution

From the grain size distribution curve (Fig. 3.8) it is revealed that pond ash consists of 22.0% sand and 78.0 % silt. The percentage of sand-like particles in MSW Reject is 80.8% and the particle which comes in the category of silt is 17.5% and a very low percentage of clay-type particles in MSW Reject are 0.293%. The percentage of sand in Red mud is 31.6% the percentage of silt is 54% and the amount of clay is 12%. GGBFS has 1% of sand and 95% of silt and the clay percentage is 4%.

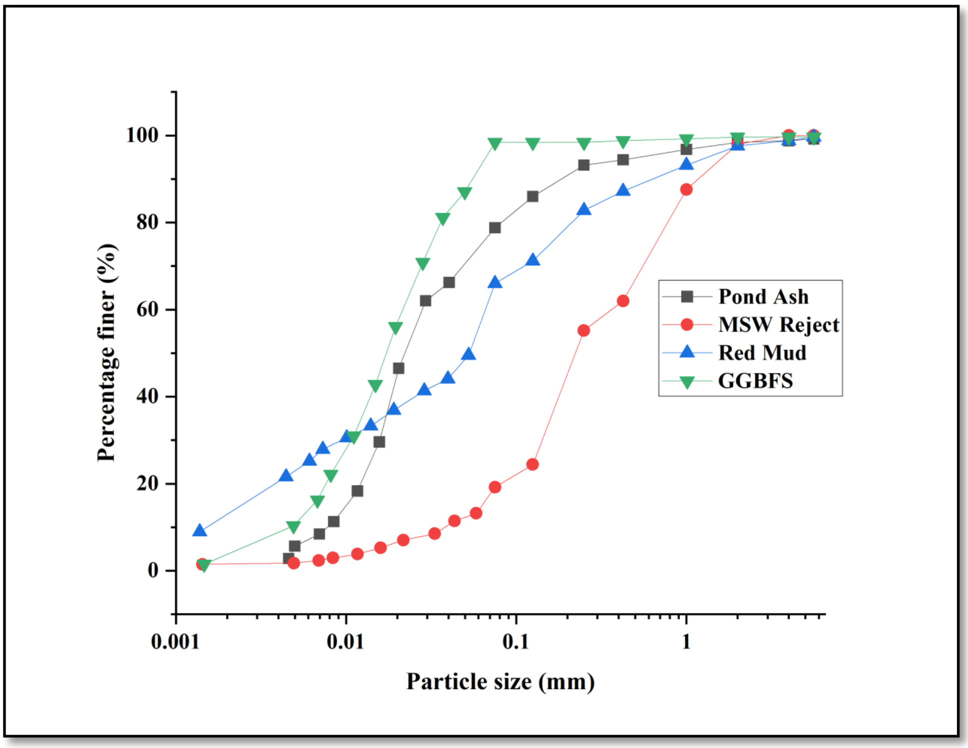

Fig: 3.8 Grain Size Distribution of All Raw Materials

3.4.3 Compaction Analysis

From the compaction analysis curve (Fig. 3.9) it is clearly said that pond ash has the lowest value of maximum dry density i.e., 1.18 g/cc among all waste materials and optimum moisture content i.e., 29.1%. The optimum moisture content of MSW Reject is the lowest (18%) in comparison with all waste material and the maximum dry density is 1.524g/cc. The compaction curve of Red mud shows the maximum dry density is 1.52g/cc and this waste material has the highest value of optimum moisture content 31%. The maximum dry density of GGBFS is 1.57g/cc and the amount of optimum moisture content is 22.5%.

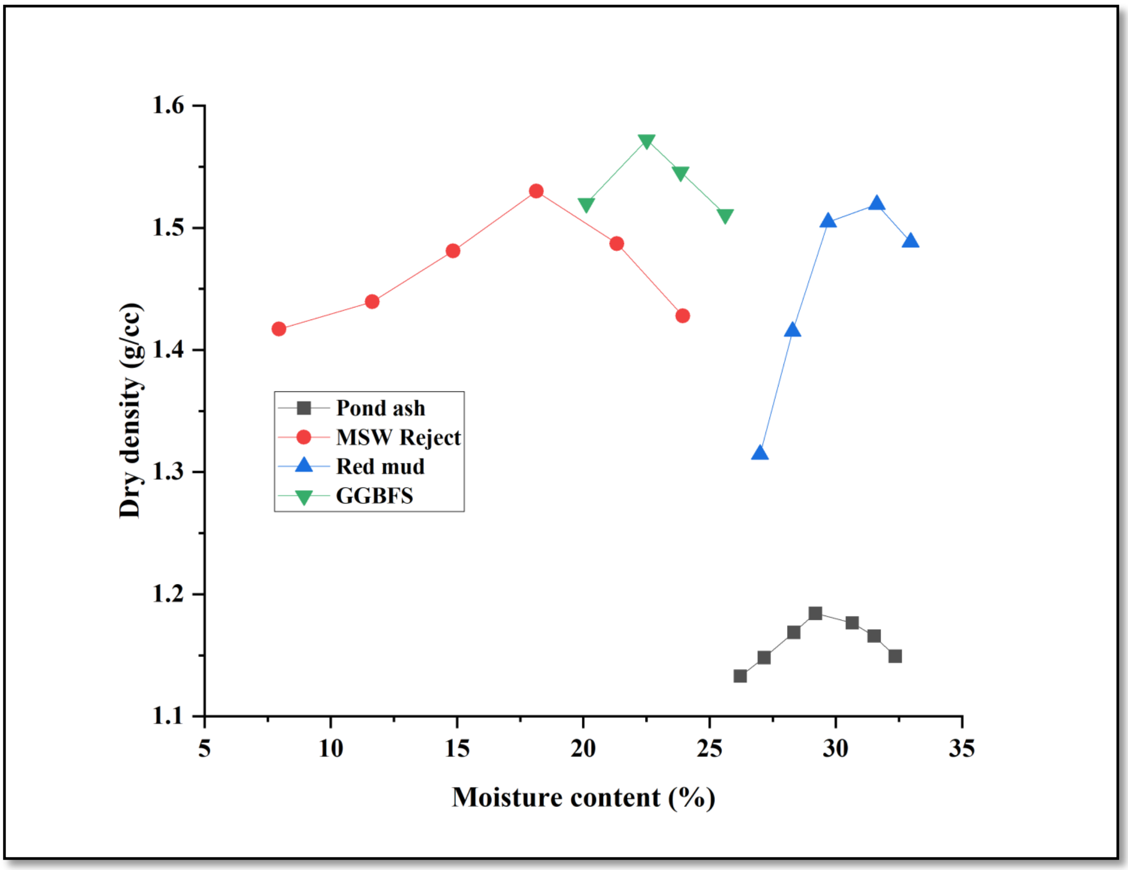

Fig: 3.9 Compaction Analysis of All Raw Materials

3.5 Alkaline Activator

In a geopolymerisation process, the use of an alkaline activator is the essential solution in dissolving the Si, and Al ions. In the present study, sodium hydroxide (NaOH) as an alkaline activator at different concentrations 2, 4, 6, 8 and 10M has been used. The pallets of NaOH have been used in making the alkaline activator solution. The amount of alkaline activator is considered on the basis of optimum moisture content (OMC) at which maximum dry unit weight (MDD) of the particular mix has been obtained in the compaction test.

3.6 Methodology

After the characterization of the raw materials, the experiments were designed to synthesize the geopolymer using waste materials Pond ash, MSW Reject and Red mud with the GGBFS with the activation of NaOH at different molarities. In this study, the effect of GGBFS on Pond ash, MSW Reject and Red mud and the effect of Red mud on the Pond ash have been analyzed. At the rate of 10% Pond ash, MSW Reject and Red mud are substituted with GGBFS and Pond ash is also substituted with Red mud at the rate of 10%. Four types of geopolymer Pond ash-GGBFS, MSW Reject-GGBFS, Red mud-GGBFS and Pond ash-red mud have been designed. The mix proportions are designed as P_mG_n , M_aG_b, R_xG_y and P_uR_v .

P_mG_n denoted the Pond ash-GGBFS mixes where P and G denoted Pond ash and GGBFS respectively while m and n denoted the percentage of Pond ash and GGBFS respectively. These mixtures referred to $P_{100}G_0$, $P_{90}G_{10}$, $P_{80}G_{20}$, $P_{70}G_{30}$, $P_{60}G_{40}$, $P_{50}G_{50}$, $P_{40}G_{60}$, $P_{30}G_{70}$, $P_{20}G_{80}$, $P_{10}G_{90}$, P_0G_{100}.

M_aG_b denoted the MSW Reject-GGBFS mixes where M and G denoted MSW Reject and GGBFS respectively, while a and b denoted for percentage of MSW Reject and GGBFS respectively. These mixes referred to $M_{100}G_0$, $M_{90}G_{10}$, $M_{80}G_{20}$, $M_{70}G_{30}$, $M_{60}G_{40}$, $M_{50}G_{50}$, $M_{40}G_{60}$, $M_{30}G_{70}$, $M_{20}G_{80}$, $M_{10}G_{90}$, M_0G_{100}.

R_xG_y denoted the Red mud-GGBFS mixes where R and G denoted Red mud and GGBFS respectively, while x and y denoted for percentage of Red mud and GGBFS respectively.

These mixes referred to $R_{100}G_0$, $R_{90}G_{10}$, $R_{80}G_{20}$, $R_{70}G_{30}$, $R_{60}G_{40}$, $R_{50}G_{50}$, $R_{40}G_{60}$, $R_{30}G_{70}$, $R_{20}G_{80}$, $R_{10}G_{90}$, R_0G_{100}

P_uR_v denoted the Pond ash-Red mud mixes where P and R denoted Pond ash and Red mud respectively, while u and v denoted for percentage of Pond ash and Red mud respectively. These mixes referred to $P_{100}R_0$, $P_{90}R_{10}$, $P_{80}R_{20}$, $P_{70}R_{30}$, $P_{60}R_{40}$, $P_{50}R_{50}$, $P_{40}R_{60}$, $P_{30}R_{70}$, $P_{20}R_{80}$, $P_{10}R_{90}$, P_0R_{100}.

After designing the mix, the specific gravity, grain size distribution and compaction characteristics, of each designed mix of Pond ash- GGBFS, MSW Reject- GGBFS, Red mud-GGBFS and Pond ash-Red mud mix proportions have been determined as per IS: 2720: Part-3(1980), IS: 2720: Part-4 (1985) and IS: 2720: Part-7 (1980**)** respectively. The flow of water (Permeability) in all these designed mixes like Pond ash-GGBFS, MSW Reject-GGBFS, Red mud- GGBFS and Pond ash-Red mud also determined as per IS: 2720: Part-17 (1986). Three identical compacted specimens of each designed mix were prepared as per IS:2720:Part-10(1991) by adding the amount of alkali activator equivalent to the OMC of the particular mix to the oven-dried Pond ash- GGBFS, MSW Reject- GGBFS, Red mud-GGBFS and Pond ash-Red mud proportions. After preparation samples were wrapped in polythene bags for maintaining the moisture content and kept in desiccators for the curing period 1, 7, 28 and 56 days. After completion of the curing period of the prepared samples, the unconfined compressive strength has been determined according to IS: 2720: Part-10(1991).

Table: 3.3. Details of experimental planning for Pond ash-GGBFS mixes

Sample designation	$P_{100}G_0$	$P_{90}G_{10}$	$P_{80}G_{20}$	$P_{70}G_{30}$	$P_{60}G_{40}$	$P_{50}G_{50}$	$P_{40}G_{60}$	$P_{30}G_{70}$	$P_{20}G_{80}$	$P_{10}G_{90}$	P_0G_{100}
Pond ash (%)	100	90	80	70	60	50	40	30	20	10	00
GGBFS (%)	00	10	20	30	40	50	60	70	80	90	100
Alkaline solution (Concentration)	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M	2, 4, 6, 8, 10 M
MDD(g/cc)	1.18	1.23	1.25	1.29	1.31	1.35	1.36	1.37	1.47	1.50	1.57
OMC (%)	29.1	26.5	27.5	26.8	26.5	26.3	26.16	25.9	23.8	23.5	22.5
Wt of the mix(gm)	102.15	106.70	107.75	111.20	113.35	116.70	117.20	118.85	127.40	130.00	135.30
NaOH (mL)	29.72	28.27	29.63	29.8	30.03	30.69	30.66	30.79	30.32	30.56	30.45
Si* (wt%)	38.14	29.69	28.43	33.48	13.52	17.7	5.61	9.05	6.62	14.26	4.4
Al* (wt%)	7.83	15.33	17.46	12.07	5.9	5.74	2.31	4.04	4.07	4.59	3.34
Si/Al (ratio)	4.87	1.93	1.62	2.77	2.291	3.08	2.42	2.24	1.62	3.10	1.31
Ca* (wt%)	0	0	3.01	6.94	6.45	7.13	2.97	6.91	7.64	22.6	23.13
Ca/Si (ratio)	0	0	0.105	0.207	0.477	0.402	0.529	0.763	1.154	1.584	5.25

Table: 3.4 Mix proportions, alkali concentration and testing parameters of MSW reject-GGBFS

Sample Designation	$M_{100}G_0$	$M_{90}G_{10}$	$M_{80}G_{20}$	$M_{70}G_{30}$	$M_{60}G_{40}$	$M_{50}G_{50}$	$M_{40}G_{60}$	$M_{30}G_{70}$	$M_{20}G_{80}$	$M_{10}G_{90}$	M_0G_{100}
MSW Reject (%)	100	90	80	70	60	50	40	30	20	10	0
GGBFS (%)	0	10	20	30	40	50	60	70	80	90	100
Alkaline concentration (M)	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10	4,6,8,10
MDD (g/cc)	1.524	1.6	1.606	1.57	1.614	1.626	1.624	1.59	1.58	1.516	1.57
OMC (%)	18	18.8	18.49	19.6	18	17.8	18	18.5	20.25	22.25	22.5
Wt of the mix (g)	131.36	137.92	138.43	135.33	139.12	140.16	139.98	137.05	136.19	130.67	135.30
NaOH (mL)	23.64	25.92	25.59	26.52	25.04	24.94	25.19	25.35	27.57	29.07	30.45
Si* (wt%)	6.07	6.23	4.49	14.28	5.63	6.48	8.46	7.68	6.07	30.27	4.4
Al* (wt%)	1.92	ND	3.04	6.06	2.44	3.76	5.08	3.26	3.19	12.19	3.34
Ca* (wt%)	2.25	4.74	4.47	12.14	4.82	9.12	15.78	9.51	10.76	46.54	23.13
Ca/Si* (ratio)	0.37	0.76	0.99	0.85	0.85	1.40	1.86	1.23	1.77	1.53	5.25

Table: 3.5 Mix proportions, alkali concentration and testing parameters of Red mud-GGBFS

Sample Designation	$R_{100}G_{0}$	$R_{90}G_{10}$	$R_{80}G_{20}$	$R_{70}G_{30}$	$R_{60}G_{40}$	$R_{50}G_{50}$	$R_{40}G_{60}$	$R_{30}G_{70}$	$R_{20}G_{80}$	$R_{10}G_{90}$	$R_{0}G_{100}$
Red mud (%)	100	90	80	70	60	50	40	30	20	10	0
GGBFS (%)	0	10	20	30	40	50	60	70	80	90	100
Alkaline concentration (M)	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8 ,10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10
MDD (g/cc)	1.52	1.53	1.55	1.544	1.562	1.596	1.576	1.556	1.56	1.538	1.57
OMC (%)	31	30.32	28.5	27.4	26.8	24.6	24.8	24	22.8	22.2	22.5
Wt of the mix (g)	130.93	131.79	133.517	133.00	134.55	137.47	135.75	134.03	134.37	132.48	135.23
NaOH (mL)	40.58	39.95	38.05	36.44	36.05	33.81	33.66	32.16	30.63	29.41	30.42
Si* (wt%)	2.30	3.00	3.59	2.64	4.81	7.92	ND	ND	ND	ND	4.4
Al* (wt%)	6.35	5.14	6.70	3.80	6.74	9.94	ND	ND	ND	ND	3.34
Ca* (wt%)	0.42	0.89	2.49	2.65	2.45	5.51	ND	ND	ND	ND	23.13
Ca/Si* (ratio)	0.001	0.29	0.69	1.00	0.509	0.69	ND	ND	ND	ND	5.25

***ND- Not Detected**

Table: 3.6 Mix proportions, alkali concentration and testing parameters of Pond ash-Red mud

Sample Designation	$P_{100}R_0$	$P_{90}R_{10}$	$P_{80}R_{20}$	$P_{70}R_{30}$	$P_{60}R_{40}$	$P_{50}R_{50}$	$P_{40}R_{60}$	$P_{30}R_{70}$	$P_{20}R_{80}$	$P_{10}R_{90}$	P_0R_{100}
Pond ash (%)	100	90	80	70	60	50	40	30	20	10	0
Red mud (%)	0	10	20	30	40	50	60	70	80	90	100
Alkaline concentration (M)	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10	2,4,6,8, 10
MDD (g/cc)	1.157	1.181	1.229	1.287	1.37	1.43	1.459	1.513	1.519	1.53	1.57
OMC (%)	31.2	31.65	31	24.26	23.7	25	23.6	23	25.6	27.85	22.5
Wt of the mix (g)	99.66	101.73	105.86	110.86	118.01	123.18	125.67	130.32	130.84	131.79	135.23
NaOH (mL)	31.09	32.10	32.81	26.89	27.96	30.79	29.65	29.97	33.4	36.70	30.42

Table 3.3 to Table 3.6 shows the experimental planning of the Pond ash-GGBFS, MSW reject-GGBFS, Red mud-GGBFS, and Pond ash-Red mud geopolymers synthesis. The test samples are kept curing for 7, 28, and 56 days. The curing methods are followed using polythene curing and water curing. The Si/Al and Ca/Si ratios are reported based on SEM-EDX, and XRF data of the individual wastes used in the study.

3.7 Summary

This chapter discussed the proposed waste materials and their chemical, mineralogical and geotechnical characterization with an aspect of their possibility of role in the synthesis of geopolymer materials. This chapter has also discussed the utility of GGBFS and alkali activators in synthesizing the geopolymers. Based on the characterization of base materials proposed in the study using XRF, XRD and FTIR analysis has confirmed that above mentioned waste material has been found suitable for geopolymerization. The detailed methodology planned in this chapter is briefed and discussed in the forthcoming as separate chapters separately and concluded.