X-Ray Diffraction Analysis Of Bauxite Ore In Central Peninsular, India

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Abstract

XRD analysis is crucial to examine crystalline material structure as well as atomic arrangement, crystalline size and imperfections. It is decisive for efficacy. XRD is used to identify crystallographic structure, chemical composition, and physical properties of the material and it is a non destructive technique provides detailed information about the mineral. In this research XRD is used and identified the mineralogical composition of the bauxite ore. This is a very useful method for evaluating minerals.

Keywords: X-Ray Diffraction; Bauxite; Gibbsite; Bohemite.

Introduction

In India Bauxite ore is found in peninsular region and in Jammu the extra peninsular region. Around 85 percentage of Bauxite are found in the central peninsular India, and around 74 percentage are restricted in the east coast of India. Odisha, Chhattisgarh, Andhra Pradesh, Maharastra, Karnataka, and Tamilnadu has the high quality Bauxite ore. In Gujurat and kerela low grade Bauxite are found. Bauxite deposits are found in central peninsular part of India in Mainpat plateau of Surguja province. A total 25 places Bauxite ore was found in that area and since 1998 the mining extraction of the ore is going on. The Bauxite ore is generally found with the kaolin deposit and with the laterite.

Study area

The Study area situated in toposheet no. 64N/5 and it cover around 83.33 sq.km between long E $83^{0}18'0''$ to $83^{0}22'30''$ and lat N $22^{0}43'30''$ to $22^{0}49'30''$. The study area is located in the 1060m above the MSL. In the Mainpat region the the Bauxite ore is found with laterite and kaolin. Bauxite is generally found in the subsurface region around 10 to 14 m. formed by the lynching process
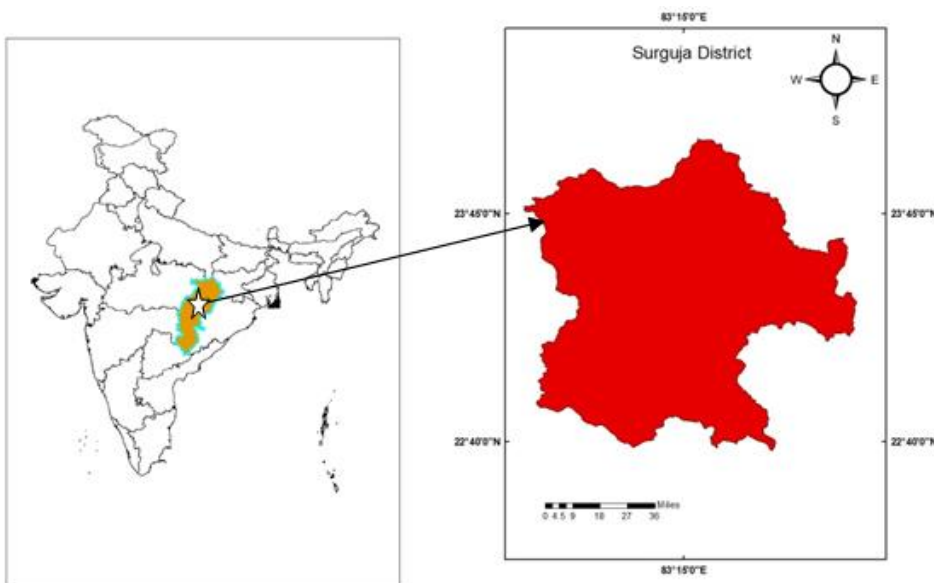

Fig 1. Study area

X- Ray Diffraction Studies (XRD)

XRD is analytical technique which is non destructive and used for the identification and estimation of various crystalline compounds known as phases, present in solid materials and powder. It is reliable and very fast method for mineral identification. Bauxite is composed of various minerals, to identify the various mineralogical properties there are several methods are there, XRD is one of the most prominent of them. XRD analysis of mineral identification of Bauxite samples was carried out in Laboratory of NIIST, CSIR, Thiruvanathapuram. by Comparing the X-Ray diffraction pattern or diffractogram identification is achieved. During the field work three samples were collected from three different areas, precautions have been taken while taking the samples.

Table .1 List of peaks generated by XRD for Different Mineral Phase (sample 1)

Pos. [°2Th.]	d-spacing [Å]	Rel. Int. [%]	Name of the Mineral Phase
14.4839	6.11058	5.85	Boehmite
18.3163	4.83978	100.00	Gibbsite
20.3011	4.37086	9.45	Gibbsite
22.1187	4.01561	1.43	Diaspore

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25.2907	3.51871	11.31	Anatase
28.1153	3.17129	2.77	Boehmite
36.6096	2.45262	2.44	Gibbsite
37.0860	2.42220	1.64	Anatase
37.6764	2.38559	3.16	Anatase
38.2945	2.34849	2.19	Boehmite
44.1700	2.04877	2.53	Gibbsite
45.4533	1.99386	1.81	Gibbsite
47.9683	1.89503	2.10	Anatase
48.9942	1.85772	1.07	Hematite
50.5693	1.80349	1.75	Anatase
53.8604	1.70080	1.88	Hematite
54.4026	1.68512	1.97	Hematite
62.6306	1.48207	0.98	Gibbsite
63.7972	1.45775	1.07	Hematite
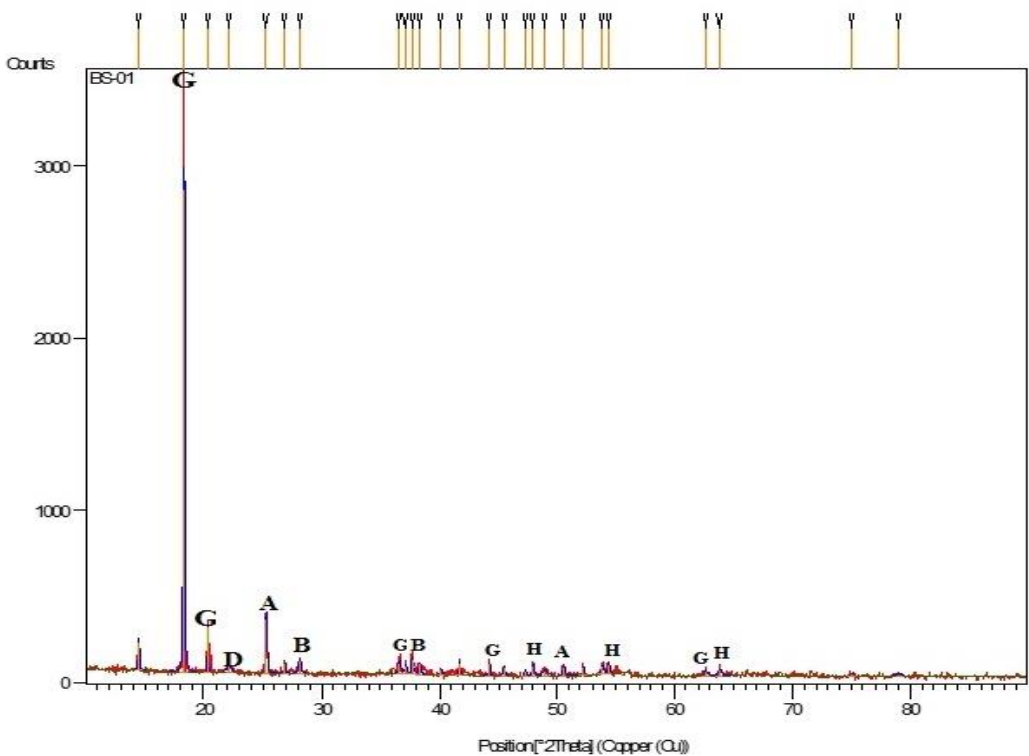
Fig. 2 X-Ray Powder Diffraction for (Sample no.1)

Table 2. List of Peaks generated by XRD for Different Mineral Phase (Sample no.2)

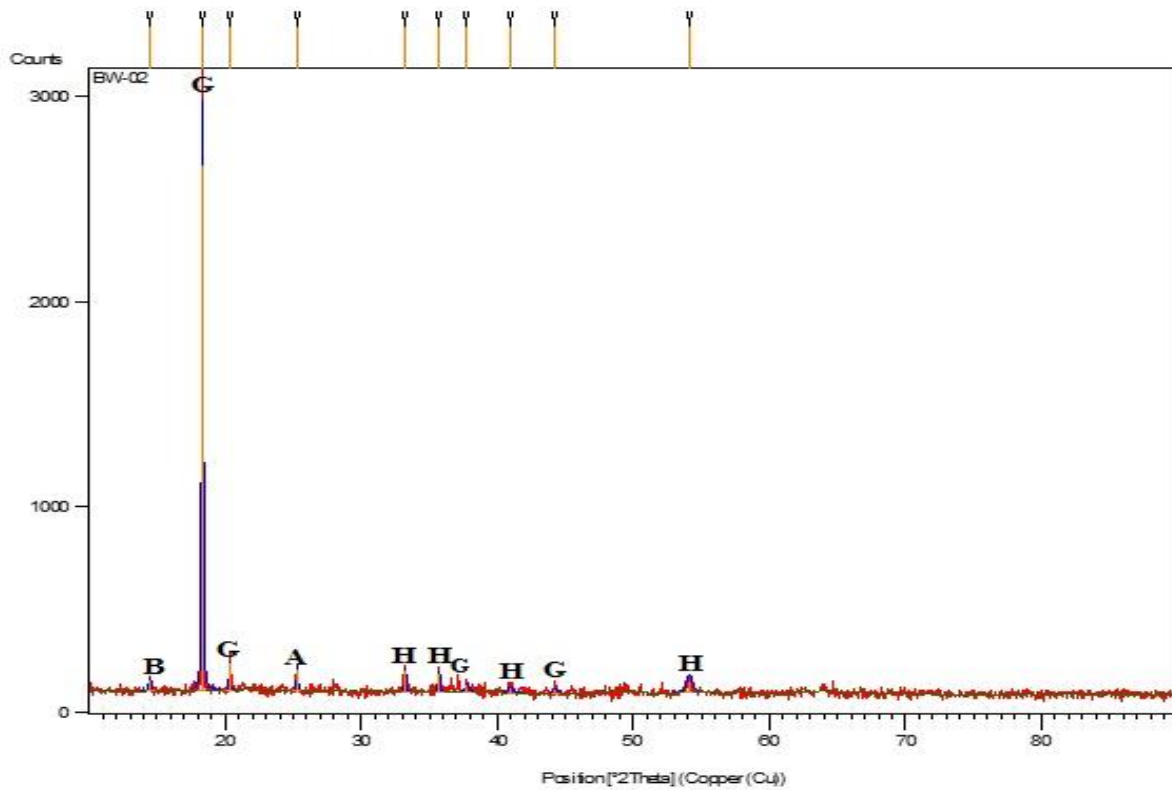| Pos. [°2Th.]	d-spacing [Å]	Rel. Int. [%]	Name of the Mineral Phase
14.4804	6.11207	2.14	Boehmite
18.3055	4.84259	100.00	Gibbsite
20.2982	4.37147	5.04	Gibbsite
25.2881	3.51906	4.33	Anatase
33.1765	2.69815	4.13	Hematite
35.6544	2.51611	3.52	Hematite
37.7084	2.38364	1.41	Gibbsite
40.9518	2.20203	1.24	Hematite
44.2100	2.04700	0.87	Gibbsite
54.1655	1.69193	2.31	Hematite

Fig. 3 X-Ray diffraction pattern for (Sample no.2)

Table 3. List of Peaks generated by XRD for Different Mineral Phase (Sample no.3)

Pos. [°2Th.]	d-spacing [Å]	Rel. Int. [%]	Name of the Mineral Phase
14.4975	6.10488	9.54	Boehmite
18.3234	4.83791	100.00	Gibbsite

|			
20.3088	4.36921	16.05	Gibbsite
20.5546	4.31751	7.04	Gibbsite
25.3106	3.51598	8.19	Anatase
26.5115	3.35938	2.11	Gibbsite
26.9086	3.31070	3.53	Gibbsite
28.1930	3.16272	5.72	Boehmite
33.1405	2.70099	1.58	Hematite
36.3919	2.46679	2.29	Gibbsite
36.6297	2.45132	3.62	Gibbsite
37.0952	2.42162	3.85	Anatase
37.6723	2.38584	6.65	Gibbsite
38.3008	2.34812	4.52	Boehmite
40.1568	2.24377	1.50	Hematite
44.1495	2.04967	4.48	Gibbsite
45.4247	1.99505	2.63	Gibbsite
47.3700	1.91756	2.12	Anatase
47.9581	1.89541	1.59	Anatase
48.8071	1.86440	2.21	Boehmite
54.4682	1.68325	2.29	Hematite
55.2168	1.66218	1.53	Boehmite
62.6012	1.48269	0.99	Gibbsite
63.7587	1.45853	2.72	Hematite
71.8308	1.31318	1.24	Boehmite
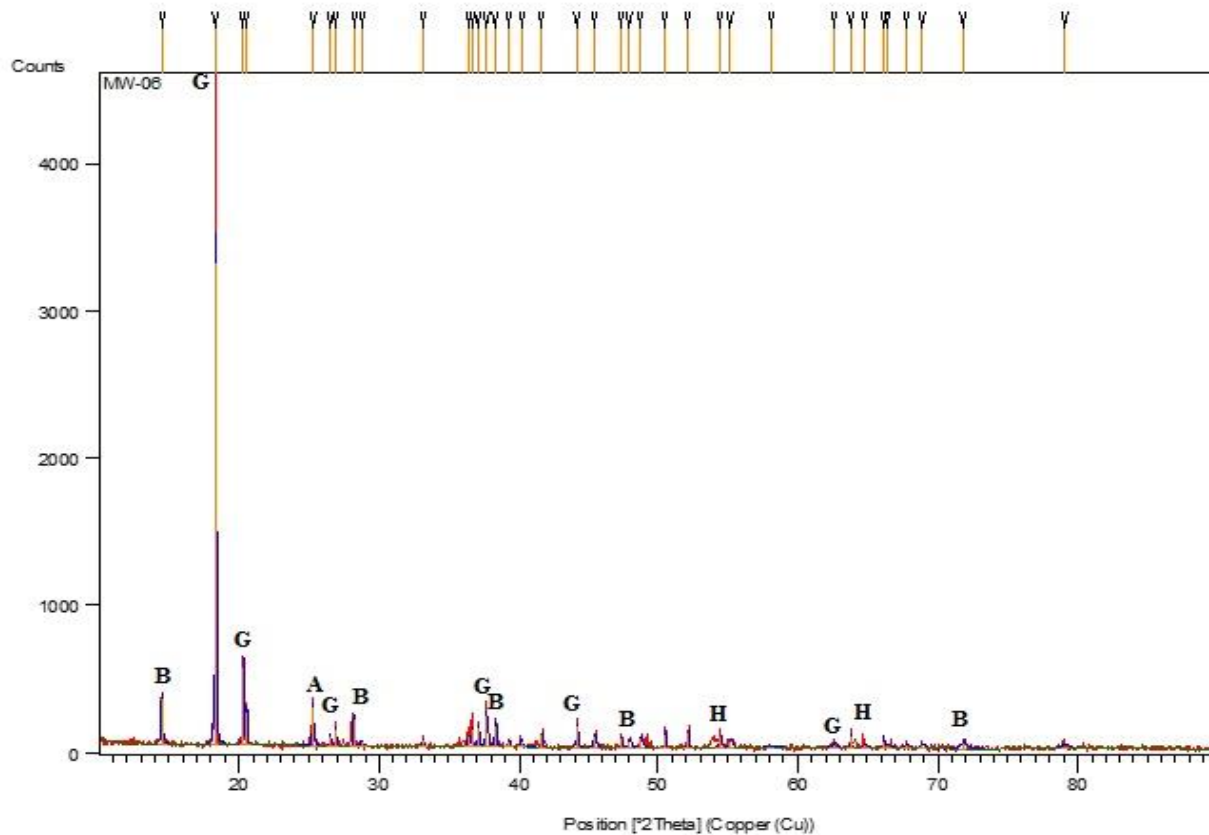
Fig. 4 X-Ray Powder Diffraction Pattern for (Sample no. 3)

Results and Discussion

XRD studies are carried out the in three samples collected from the study area. In all the three samples shows that the presence of Gibbsite, Anatase, Diaspore, Hematite and bohemite. In the first location of Barima west has shown the normal grade of Bauxite, while the second location of the study area Barima south has the high grade of Bauxite and similarly the third location of the study area Narvadapur has also high grade of Bauxite.

Conclusion

XRD analysis offer identification of different minerals like gibbsite, anatase, bohemite, hematite minerals have been identified in most of the bauxite samples. It is a nonferrous metal and principle ore of aluminum and has a huge impact in modern industry. Haematite, Goethite, Bohemite and silica are the various iron oxide bauxite ore are present in it. Pink is the original color of Bauxite with little impurities it shows brownish.Bauxite has pisolitic and oolitic structure and its hardness varies from low specific gravity to 2.6. In the Aluminium extraction plant of BALCO is operational at Korba, based on the leased bauxite blocks of Mainpat in Surguja district from their own Mine Lease area (MLA), lease hold areas of Chhattishgarh Mining Development Corporation (CMDC). And other operators are at

Kalahandi, Bolangir, Koraput, Sundargarh and Sambalpur of Odissa are the main bauxite producing districts.

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