PREPARATION AND CHARACTERISATION OF MAGNESIUM SULPHATE HEPTAHYDRATE FROM KIMBERLITE TAILINGS


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Weathered Kimberlite tailings of Panna Diamond Mines were characterised by DTA and XRD techniques. The XRD pattern shows the presence of serpentine, quartz, calcite, hematite, magnetite and anatase phases. DTA curve indicates first endothermic peak at 125°C due to dehydration of the mineral and second endo peak at 670°C due to dehydroxylation of serpentine closely followed by an exothermic peak at 810°C associated with the formation of forsterite. XRD and DTA studies of sulphuric acid leach residue of the Kimberlite shows the disappearance of serpentine phase with the appearance of CaSO₄·2H₂O phase. The product MgSO₄·7H₂O obtained after purification and crystallisation. From the optical emission spectroscopic analysis, the product was found to contain Ca, Fe and SiO₂ as trace impurities.

About 1.5 to 2.0 million tonnes of weathered Kimberlite tailings containing 22% MgO and 32% SiO₂ are stock piled at Panna Diamond Mines of M/s Mineral Development Corporation Limited. Sahu and Venkatesan [1] reported the use of these tailings for iron ore sintering, preparation of glazed and mosaic floor tiles. Kimberlites are generally ultramafic rocks with a main matrix of serpentine [Mg₃Si₂O₅(OH)₄] and phlogopite [KMg₂(OH)₂(AlSi₃O₁₀)] with chlorite {(Mg,Fe,Al)₆(OH)₈ [(Al,Si)₄O₁₀]} and carbonate as subordinate minerals [2–4]. The various leachants reported for the dissolution of magnesium metal values are HCl [5], aqueous SO₂ [6] and H₂SO₄ [7, 8].

The present paper deals with the XRD and TG-DTA techniques employed for the characterisation of the weathered Kimberlite tailings, leach residue and product MgSO₄·7H₂O obtained during processing of the Kimberlite by H₂SO₄ leaching.

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Experimental

To carry out XRD, DTA and leaching studies, the sample was ground to -80 mesh BSS. X-ray diffractograms were obtained with Philips automatic powder diffractometer and DTA runs were taken using Netzsch simultaneous STA 409 model instrument. Samples of 175 mg were run at a heating rate of 10 deg/min in platinum crucibles under static air using calcined alumina as reference. 20 g of sample was taken in a conical flask fitted with a thermometer and condenser was leached with sulphuric acid on heater cum magnetic stirrer. The analysis of Mg, Ca and Fe was done by using Perkin Elmer 372 atomic absorption spectrophotometer and SiO₂ by colorimetry. Chemical analysis of Kimberlite indicate 13.62% Mg, 6.67% Ca, 7.34% Fe, 33.0% SiO₂.

Results and discussion

The XRD patterns of the Kimberlite shows the presence of serpentine, quartz, calcite and chlorite as major phases and hematite, magnetite and anatase (TiO₂) as minor phases (Fig. 1). The TG-DTA curve of the sample was indicated in Fig. 2. TG curve shows two major weight loss regions in the

![Graph showing X-ray diffraction patterns of Kimberlite sample and leach residue.](image)

**Fig. 1** X-ray diffraction of Kimberlite tailings and H₂SO₄ leach residue

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