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Effects of mechanical activation on physicochemical properties and alkaline leaching of boron concentrate

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Abstract Boron concentrate is one of the major products created during the magnetic separation and gravity treatment of ludwigite. Nevertheless, achieving high B₂O₃ leaching efficiency in alkaline solution is difficult owing to its low B₂O₃ grade. This study proposes a mechanical activation (MA) method for the pretreatment of boron concentrate and describes the changes in B₂O₃ leaching rate of boron concentrate as a function of different ball-milling conditions. This work examines the changes in the physicochemical properties change of samples arising as a result of the MA process, in particular by PSD, BET, SEM, XRD, FTIR and TG-DSC analyses. The experimental results show that particle size, specific surface area, crystal structure, stability of chemical bonds, energy accumulation and the B₂O₃ leaching rate of boron concentrate are all significantly affected by the milling process. The B₂O₃ leaching rate exhibits an initial increase as the rotation speed and milling time are increased, and the optimum MA conditions are established as 500 rpm and 60 min. Under these conditions, the B₂O₃ leaching rate increases from 67.52% (unmilled sample) to 89.47%. The decrease in particle size from 13.2 μm to 6.2 μm and the

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