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AN INNOVATIVE AND ECO-FRIENDLY BENEFICIATION METHOD OF UPGRADING LOW-GRADE SAND TO GLASS-GRADE SILICA SAND: A CASE OF GUDUR DEPOSITS, EAST COAST OF SOUTH INDIA

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Abstract

High grade resources in Gudur Silica Sand (GSS) deposits, Nellore district., Andhra Pradesh are fast depleting due to intensified mining. If the vastly available low-grade resources are enhanced in their quality, cost and time of importing high-grade sand from elsewhere can be zeroed down. The iron content in raw sands varies widely from 800-1800 ppm, making them not suitable for clear glass manufacturing. As the low iron (Fe_2O_3 200-500 ppm) silica sands are now exhausted, the current situation necessitates an innovative beneficiation methodology that can reduce the iron content so that low grade sands are enhanced to high grade. Three types of iron impurities are noticed such as i) iron oxides, ii) iron coating on sand grains and iii) inclusions within sand grains. The iron coating on sand grains is crucial and contributes to the major proportion of Fe_2O_3 content. Multi-stage beneficiation of silica sand involves scrubbing, screening, attrition, removal of coarse and heavy minerals, dewatering and drying. While spiral process can remove the heavy minerals, removal of coated iron oxide on sand grains is a difficult task by conventional attrition or washing. Several existing methods involve use of strong chemicals such as acids and bases which are harmful for the environment as well as the working personnel. Therefore, it is necessary to innovate a new methodology without impacting the environment. This study presents an environment-friendly method, to reduce the coated iron oxide on sand grains. The method involves addition of about 10 grams of $Ca(ClO)_2$, mixed in 100 ml of distilled water, at every 10-15 minutes during the attrition process. This method has reduced the overall iron content by 50% or more (e.g., 800 ppm to 350 ppm). The availability of $Ca(ClO)_2$ is ubiquitous and the cost is also low. The tailing water, obtained after washing, that contained permissible Cl^- content, was found to be non-hazardous. Thus, the proposed method is cost-effective, eco-friendly and offers an ease of implementation. The investigation was successful on the laboratory scale and can be implemented at plant scale operations.

Keywords: Silica sand, Beneficiation, Glass-grade, Iron content, Glass making, Float glass, Clear glass.