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REVIEWER'S REPORT

Manuscript No.: IJAR-56063

Title: Effect of the particle size distribution on the heat transfer mechanisms and the heat storage capacity in ceramic inserts made by alkaline activation

Recommendation:
Accept as it is .....
Accept after minor revision.....
Accept after major revision .....
Do not accept (*Reasons below*).....

Rating	Excel.	Good	Fair	Poor
Originality		-		
Techn. Quality		--		
Clarity		-		
Significance		-		

Reviewer Name: Dr Gulanwaz

Detailed Reviewer'sReport

The manuscript entitled *"Effect of the particle size distribution on the heat transfer mechanisms and the heat storage capacity in ceramic inserts made by alkaline activation"* addresses an important topic linking particle size distribution, alkaline activation, and thermal performance of ceramic inserts for improved stoves. The subject is relevant in the context of energy efficiency, environmental sustainability, and reduction of deforestation. However, although the study presents promising experimental work, several major and minor issues must be addressed before the manuscript can be considered for publication.

First, regarding the **title and abstract section**, the title (lines 1–5) contains formatting issues and spacing errors (e.g., missing spaces in "Effectof," "distributiononthe"). These should be corrected for clarity and professionalism. The keyword list is relevant, but some terms are repetitive (e.g., "thermal behaviour," "storage capacity," and "thermal tests" could be streamlined).

In the **Introduction section (lines 6–33)**, the authors provide a general background on ceramic inserts and geopolymers. The environmental motivation is well presented (lines 7–15), and the link with alkaline activation is appropriate (lines 16–27). However, the introduction lacks a clearly formulated research gap. While previous works are cited (lines 23–27), the manuscript does not explicitly explain what limitation in the existing literature this study aims to address. The objective is mentioned in lines 31–33, but it remains general. The authors should clearly state the novelty of their approach, especially regarding the role of particle size distribution in thermal storage performance.

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The **Materials and Methods section (lines 34–118)** provides geological descriptions of the raw materials. The contextual information about Thiéky and Sebikhotane clays (lines 35–66) is detailed, but some parts read more like geological survey reports rather than scientific material characterization. Quantitative mineralogical or chemical analyses (e.g., XRD, XRF) are missing, which weakens the scientific basis of the study. For example, lines 149–156 refer to kaolinite and illite transformations, but no mineralogical data are presented earlier to confirm their presence.

In section 2.5 (lines 84–99), the preparation of NaOH solutions is described. However, there appears to be a serious calculation inconsistency. For C2 (6 mol/L, 10 L), the reported mass is 24000 g (line 98), whereas mathematically it should be $6 \times 40 \times 10 = 2400$ g, not 24000 g. This must be clarified immediately, as it affects the reproducibility and credibility of the experimental procedure.

Section 2.6 (lines 100–118) explains the insert formulation. The percentages of raw materials are clearly stated (lines 103–106), which is positive. However, the justification for selecting 500 µm and 1600 µm sieve fractions (lines 107–109) is insufficient. Since particle size distribution is central to the study, a more rigorous explanation of the granulometric control strategy is required.

The description of the laser granulometer (lines 120–134) is technically correct and references ISO 13320. However, it remains generic and resembles textbook information. The manuscript should focus more on the actual measurement conditions (dry or wet mode, refractive index used, number of runs, reproducibility).

In the **Results and Discussion section (lines 145 onward)**, the interpretation of particle size distributions (lines 148–163 and 169–184) is theoretically sound and well-articulated. The discussion linking fine fractions to dehydroxylation and sintering is scientifically coherent. However, the manuscript refers to figures (Fig 3, Fig 4, Fig 5) without presenting numerical granulometric parameters (D10, D50, D90). Providing these quantitative values would significantly strengthen the analysis.

In section 3.4 (lines 209–273), the boiling water test is well structured, and the explanation of heating and cooling phases is clear. The interpretation of C1 performing better in terms of thermal inertia (lines 263–269) is logical. However, no statistical analysis is presented. Since five inserts were made per solution (line 116), the authors should report average values and standard deviations to validate reproducibility.

The combustion test results (lines 274–344) are informative. The temperature differences between C1, C2, and the reference insert are clearly discussed. However, the discussion is partially repetitive (lines 306–344 appear duplicated in content). Additionally, the relationship between particle size distribution and combustion performance is not quantitatively demonstrated; it remains largely interpretative.

In the weight variation analysis (lines 345–376), the authors provide a coherent explanation of mass loss mechanisms. The interpretation of moisture diffusion and porosity differences is reasonable. However, no direct porosity measurement (e.g., mercury porosimetry or density measurements) is presented to support these claims.

The **Conclusion (lines 378–396)** summarizes the findings appropriately and emphasizes the environmental and energy benefits of alkaline activation. Nevertheless, some claims are broad and not fully supported by quantitative data within the manuscript, particularly regarding reduced firing temperature and environmental footprint.

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Finally, the **bibliographic references (lines 400–448)** contain formatting inconsistencies and incomplete citations. Several references lack full publication details (e.g., missing journal names, volume numbers, or DOI). Some entries appear duplicated or improperly formatted (e.g., references [6], [8], and [15]). The reference list must be carefully revised according to the journal's formatting guidelines.

Overall Recommendation:
The manuscript addresses a relevant and timely topic with practical implications for sustainable cooking technologies. However, significant revisions are required. Major corrections include: clarification of NaOH calculations, inclusion of quantitative granulometric parameters, improvement of methodological rigor, elimination of duplicated text, strengthening of statistical analysis, and complete standardization of references. I therefore recommend **major revision** before reconsideration for publication.