FEASIBILITY OF RECYCLING FIRED TILE WASTE

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1. ABSTRACT

The present study addressed the technical and economic feasibility of recycling fired tile waste arising in ceramic redware tile manufacture, by adding the fired tile scrap to the body composition. In the Spanish industry this waste mainly goes to disposal sites, however the study shows that under current conditions recycling is a very interesting option.

2. TECHNICAL FEASIBILITY OF RECYCLING

The study was conducted using fired stoneware (G) and wall tile (A) scrap prepared by crushing and dry milling the industrial products. Both types of scrap were respectively added to a stoneware and wall tile composition. The effect of these additions on composition behaviour during the various manufacturing process stages and on certain finished product characteristics was then studied.

Composition behaviour was studied:

- In the composition preparation stage (deflocculation)
- In the green body (compaction diagrams and mechanical strength)
- In the firing stage (evolution of linear shrinkage, water absorption and bulk density with firing temperature)
- In the fired product (fired mechanical strength)

The methods used in preparing the compositions and testing are given in the references [3-4].

3. ECONOMIC FEASIBILITY OF FIRED TILE SCRAP RECYCLING VERSUS DISPOSAL

The economic feasibility of reusing fired tile scrap by incorporating it into the body depends on the relative cost of the various alternative disposal routes.

The following factors were included in the economic evaluation:

i) **Crushing and grinding**. To enable the fired tile scrap to be used in wet milling processes it needs to be crushed and ground beforehand to a suitable size, which involves important costs. Crushing and grinding can be carried out at the spray-dried powder production plant or at an outside company.

ii) **Transport.** Except when the fired tile scrap is crushed and ground at the same factory that produces it, the material will always need to be transported, either to a crushing and grinding facility or to a disposal site, etc. Transport costs will basically vary depending on the distance involved.

iii) **Disposal at an authorised site**. Disposal at controlled sites involves a cost usually established per unit waste mass or volume.

iv) **Valorisation as a raw material.** Fired tile scrap reuse produces scrap valorisation.

v) **Modification of the receiving process**. Fired tile scrap reuse can entail additional investment on having to proportion another raw material in the milling operation.

Taking these economic points into account, the costs of four alternatives were evaluated:

- **A1: Disposal at a controlled disposal site.**
- **A2: Recycling of the fired tile scrap with crushing and grinding at an external facility.**
- **A3: Recycling of the fired tile scrap with crushing and grinding at the receiving facility (spray-drying plant).** In this alternative, the tile producer sends the fired tile scrap to the spray-drying plant, where the fired tile scrap is crushed and ground, and suitably proportioned.
- **A4: Recycling of the fired tile scrap with crushing and grinding in the same factory (only valid for companies with a complete cycle).** In the case of companies that have a complete manufacturing process, producing spray-dried powder and tiles, fired tile scrap recycling can be carried out by crushing and grinding in plant.

4. CONCLUSIONS

From a technical point of view, the main effect of adding fired tile scrap to red body compositions is a change in compactness, which may require altering pressing pressure slightly to hold bulk density. On the other hand, adding about 4 wt% to the stoneware composition slightly increased meltability and fired mechanical strength.

The economic feasibility study shows that the option of adding fired tile scrap to the body compositions entails lower processing costs than removal to controlled disposal sites, as the crushing and grinding costs of these materials are compensated by the saving in raw materials.

Summing up, recycling fired redware tile scrap is feasible from a technical as well as economic point of view, and is the most appropriate option for disposing of this waste.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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