# INFLUENCE OF MANUFACTURED WASTE QUALITY ON THE STRENGTH OF EMPTY WALL STONE

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**Abstract.** Currently, the business community is very interested in the technological process of production of construction products using waste from industrial enterprises of Pavlodar region, which ensures a reduction in the cost of manufactured products, solving environmental problems of the region, creating new building materials and saving traditional raw materials. Unfortunately, the quality of man-made waste does not always allow us to make good quality construction products. One of the parameters affecting the strength of a hollow wall stone is the moisture content of industrial waste. The article presents practical studies that allow assessing the risks arising from the use of industrial waste with different moisture content and the resulting strength of a hollow wall stone. To assess the quality of man-made waste, statistical methods of analysis were used.

***Keywords***: Technogenic waste, strength, moisture content, hollow wall stone, flown ash, bauxite sludge, class, parameter,. statistical method.

## 1. INTRODUCTION

Often in practice, when delivering raw materials (industrial waste) to production, suppliers do not comply with the requirements for the quality of fillers for concrete mixtures. This may be a discrepancy between the granular composition, the presence of impurities, high humidity, and more. Not all enterprises carry out input quality control of raw materials, which entails an increase in the number of rejects, a decrease in the quality characteristics of products [1-2].

## 2. MATERIALS AND METHODS

Man-made wastes used to replace traditional raw materials in the production of hollow wall stone are presented in Fig, 1-2 are by-products of the production of thermal stations and metallurgical enterprises of Pavlodar region.


Figure 1. Flown ash


Figure 2. Bauxite sludge

Ekostroynii-PV LLP produces construction products, including hollow wall stone with the addition of the above presented man-made waste into concrete mixtures as fillers Fig. 3.

Figure 3. Hollow wall stone

In the research, moisture content was taken as the main parameter of the quality of industrial waste. Incoming control of the moisture content of man-made waste supplied to the enterprise is carried out on the basis of TU 34 4014-74 and recommendations for the use of bauxite slimes in concrete solutions [3-4]. The technological line for the production of construction products presented in Fig.4 allows the production of products of various construction assortments. Produced with the use of man-made waste with different moisture content, hollow wall stones were subjected to compression tests after 28 days, Fig.5 (as a traditional raw material used

Figure 4.Technological waste production line for construction products

cement grade M400, river sand, crushed stone of fraction 10-20) in each batch of 6 samples. The produced products, every other day, are stored on pallets and stored in the open air. The values of the readings for the humidity of man-made waste and the strength of the hollow wall stone are included in Table 1.


Figure 5. Compression test of hollow wall stone

Table1.The values of the moisture content of man-made waste and the strength of the hollow wall stone

| № batch | Technogenic waste name | W Moisture content(%) | M Mass of stone hollow (kg) | R (MPA) | Raverage (MPA) |
|---|---|---|---|---|---|
| 1 | Flown ash | 8 | 18 | 4.01 | 4,09 |
| | | 8 | 18.3 | 4.1 | |
| | | 8 | 18.5 | 4.12 | |
| | | 8 | 18.45 | 4.07 | |
| | | 8 | 18.43 | 4.15 | |
| | | 8 | 18.55 | 4.13 | |
| 2 | Flown ash | 10 | 18.9 | 3.9 | 3.71 |
| | | 10 | 19.01 | 3.7 | |
| | | 10 | 19.2 | 3.67 | |
| | | 10 | 19.15 | 3.7 | |
| | | 10 | 19.12 | 3.69 | |
| | | 10 | 19.27 | 3.71 | |
| 3 | Flownash | 13 | 20.9 | 3.5 | 3.515 |
| | | 13 | 21 | 3.4 | |
| | | 13 | 21.1 | 3.42 | |
| | | 13 | 21.2 | 3.7 | |
| | | 13 | 21.25 | 3.25 | |

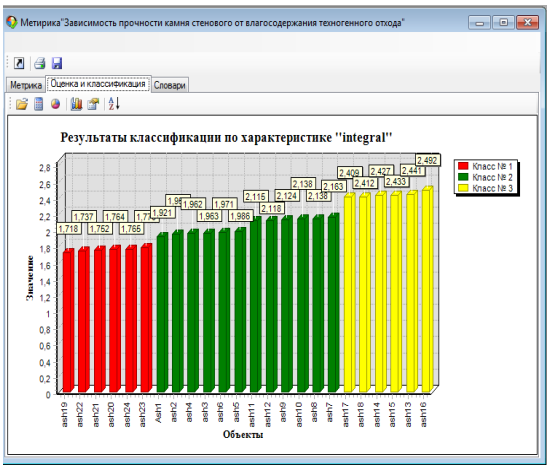
| | | | | | |
|---|---|---|---|---|---|
| | | 13 | 21.01 | 3.32 | |
| 4 | Flown ash | 5 | 18 | 4.45 | 4.65 |
| | | 5 | 17.98 | 4.7 | |
| | | 5 | 17.87 | 4.66 | |
| | | 5 | 17.91 | 4.57 | |
| | | 5 | 17.86 | 4.8 | |
| | | 5 | 17.90 | 4.72 | |
| 5 | Bauxite sludge | 13 | 19.1 | 3.59 | 3.55 |
| | | 13 | 19,15 | 3.51 | |
| | | 13 | 19.2 | 3.53 | |
| | | 13 | 19.19 | 3.57 | |
| | | 13 | 19.12 | 3.52 | |
| | | 13 | 19.09 | 3.58 | |
| 6 | Bauxite sludge | 15 | 19.5 | 3.41 | 3.44 |
| | | 15 | 19.52 | 3.4 | |
| | | 15 | 19.49 | 3.45 | |
| | | 15 | 19.55 | 3.49 | |
| | | 15 | 19.47 | 3.43 | |
| | | 15 | 19.41 | 3.46 | |
| 7 | Bauxite sludge | 9 | 18.2 | 4.01 | 4.04 |
| | | 9 | 18.4 | 4.05 | |
| | | 9 | 18.33 | 4.09 | |
| | | 9 | 18.37 | 4.07 | |
| | | 9 | 18.44 | 4.01 | |
| | | 9 | 18.49 | 4.03 | |
| 8 | Bauxite sludge | 4.5 | 17.03 | 4.65 | 4.66 |
| | | 4.5 | 17.21 | 4.6 | |
| | | 4.5 | 16.99 | 4.61 | |
| | | 4.5 | 17.24 | 4.7 | |
| | | 4.5 | 17.19 | 4.68 | |
| | | 4.5 | 17.26 | 4.72 | |

## 3. RESULT AND DISCUSSION

In practice, non-compliance with the quality parameters of the raw materials used in the technological process of manufacturing construction products increases the decrease in the

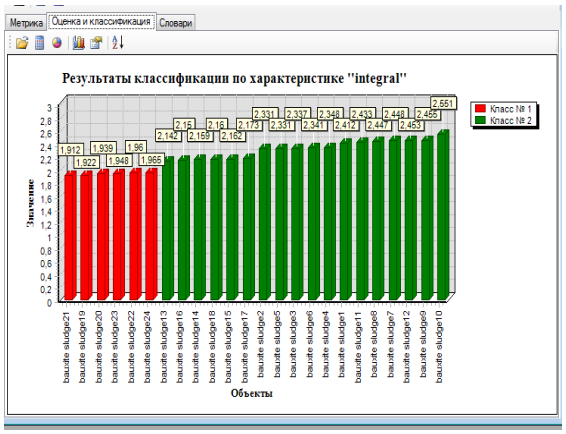
number of manufacturing defects, which in turn causes non-fulfillment of the production plan and disruptions in the supply of products to potential customers [5-6].

We will use the software product [7] and with the help of statistical methods of analysis (Ward, average connection) of the connection, we will classify the strength indicators of a hollow wall stone, depending on the moisture content of man-made waste. Picture 6 shows the classification of the strength indicators of a hollow wall stone from the values of the moisture content of flown ash. According to the results of the classification, 3 classes are identified, the most qualitative parameters are presented in 1 cluster (red) where the hollow wall stone has the highest strength indicators. The second grade shows a decrease in strength by over 20%. The lowest indicators of strength of the stone of the hollow wall in the 3 cluster.




Picture 6. Classification of indicators of strength of hollow wall stone, for flown ash

Picture 7 shows the classification of indicators of the strength of a hollow wall stone, depending on the moisture content of bauxite sludge. According to the results of the classification, 2 classes were produced. Class 1 corresponds to the indicators of the highest strength and the lowest moisture content of bauxite sludge. In the second class, the characteristics of indicators are located quite close to each other, which ensured the distribution into one class. The Euclidean distance was chosen as the measure of proximity in the classification of the quality indicators of technogenic waste.




Picture 7. Classification of strength indicators of hollow wall stone for bauxite sludge

## 4. CONCLUSION

· Increased moisture content leads to a decrease in the strength of the hollow wall stone to 25% and more.

· The increased moisture content leads to an increase in the weight of the hollow wall stone by 18%.

· Increased moisture content causes additional consumption of traditional raw materials, which in turn increases the cost of finished products.

· Increased moisture content of man-made waste can cause downtime of technological equipment due to sticking of molds, inability to press and reduce the efficiency of production of construction products.

· It is not recommended to use man-made waste with a moisture content of more than 5% in the manufacture of construction products.

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