Comparison of mechanical properties of geopolymers from different raw materials with addition of waste glass.

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Introduction

• At present most of the worldwide production of energy is made in heating plants by using combustion of fossil fuels, most of its coal.

• Fly ash and slag can be used as alkali activated materials and utilized in synthesis of geopolymers.

• Geopolymers are materials with many excellent properties such as high mechanical strength, resistance to low and high temperatures, resistance to aggressive environments or flame resistance.
## Materials and Methods

<table>
<thead>
<tr>
<th>Material</th>
<th>SiO$_2$</th>
<th>CaO</th>
<th>MgO</th>
<th>Al$_2$O$_3$</th>
<th>Fe$_2$O$_3$</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>BFS [%]</td>
<td>40.3</td>
<td>37.01</td>
<td>12.1</td>
<td>8.51</td>
<td>0.3</td>
<td>1.78</td>
</tr>
<tr>
<td>FA [%]</td>
<td>32.1</td>
<td>1.75</td>
<td>0.23</td>
<td>14.55</td>
<td>7.55</td>
<td>24.8</td>
</tr>
</tbody>
</table>
Materials and Methods
Results

![GGBFS Results](chart1)

- **GGBFS**
  - 7 days
  - 28 days
  - 90 days

![FA Results](chart2)

- **FA**
  - 7 days
  - 28 days
  - 90 days
Results

**GGBFS**

- **RS**: 42.1 MPa, 35.9 MPa, 35.1 MPa, 35.4 MPa
- **10%**: 45.2 MPa, 37.8 MPa, 41.3 MPa, 38.3 MPa
- **20%**: 51.5 MPa, 35.7 MPa, 41.7 MPa, 35.4 MPa
- **30%**: 44 MPa, 35.7 MPa, 41.3 MPa, 38.3 MPa

**FA**

- **RS**: 35.7 MPa, 42.8 MPa, 47.6 MPa, 55.4 MPa
- **10%**: 37.8 MPa, 35.7 MPa, 46.9 MPa, 58.9 MPa
- **20%**: 39.4 MPa, 37.8 MPa, 48.2 MPa
- **30%**: 42.1 MPa, 35.9 MPa, 32.1 MPa

**Note:** The graphs show compressive strength (MPa) at 7 days, 28 days, and 90 days for different percentages (0%, 10%, 20%, 30%) of GGBFS and FA.
Results

**BFS**

![Graph showing water absorption over time for BFS with different percentages.]

**FA**

![Graph showing water absorption over time for FA with different percentages.]

Water Absorption [%] vs. Time [min]

- **BFS**
  - RS
  - 10%
  - 20%
  - 30%

- **FA**
  - RS
  - 10%
  - 20%
  - 30%
Conclusions

- The alkali activated materials – geopolymers, are a new generation of inorganic binders. Any aluminosilicate materials can be used to prepare the geopolymers, including the slag.
- A laboratory investigation was performed with aim to study the effects of WG addition and its influence on mechanical properties such as compressive and flexural strengths of geopolymers.
- The results shown, that WG has not always positive effect on strengths of the produced material (GGBFS) but in case of fly ash there is a limited potential of WG addition which can be useful for further investigation.
THANK YOU FOR YOUR ATTENTION!