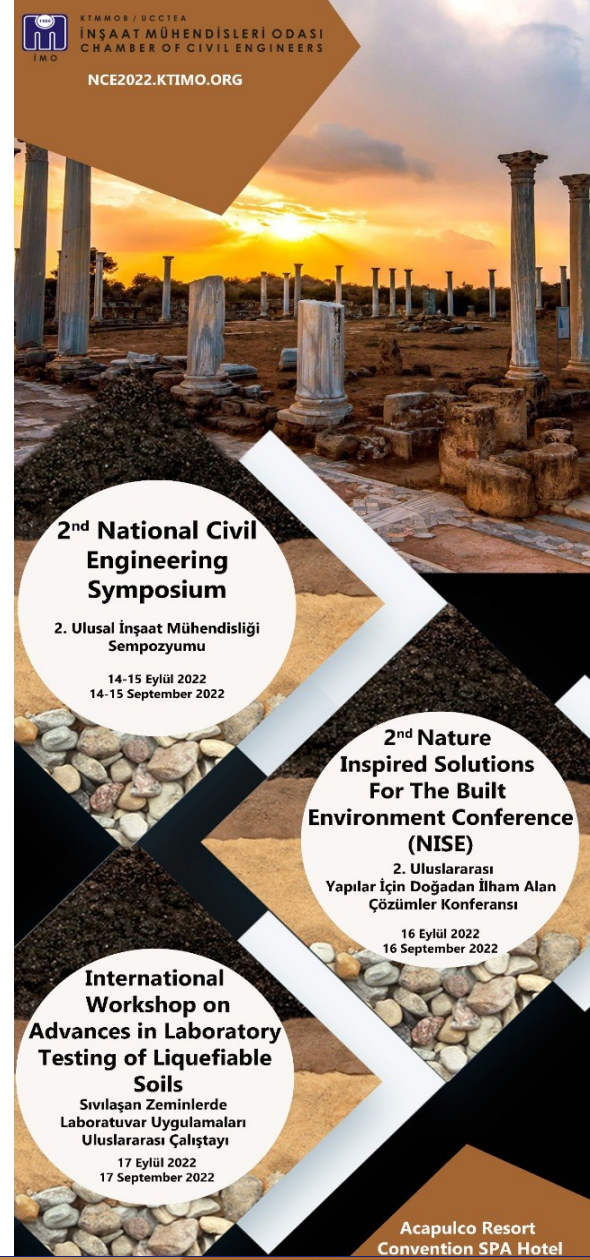


Alternative Approaches For Sustainable Concrete Construction

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Sustainability

- It is well known that use of cement in concrete production contributes considerably to global green house gas emissions
- 1 t of Portland cement produces approx. 1 t CO₂
- With the objective of improving sustainability of the building construction industry, various waste materials are under consideration to replace or partially replace the cement component in concrete formulations

Aim of this Research work

- The current study focuses on the performance of pure cement paste composites.
- Physical, mechanical and durability properties were examined
- A high amount of bottom ash, eggshell and basalt fibers were used as replacements in cement compositions to manufacture sustainable construction materials.

Composite preparation

- ❖ Ordinary Portland cement (Type I)
- ❖ Bottom ash was obtained from the local brick factory plant.
- ❖ Eggshell were collected from a bakery in Lefkoşa
- ❖ Basalt fibers were taken from Dost Kimya LTD., İstanbul.



Mixtures Groups

Grp. no	BA (%)	Cement (%)	Eggshell (%)	Additional (%)	W/C
1	40	60	-	5	0.33
2	30	60	10		0.33
3	40	60	-	10	0.33
4	40	50	10		0.33
5	50	50	-	10	0.33

Phase 1

Phase 2

Grp no	BA(%)	Cement (%)	Eggshell(%)	Additional(%)	BF (%)	W/C
5-1	50	50	-	10	0.3	0.33
5-2	50	50	-	10	0.75	0.33
3-1	40	60	-	10	0.3	0.33
3-2	40	60	-	10	0.75	0.33

Laboratory samples

- 50 mm cubic moulds
- 40 mmx40mmx160mm mortar prism moulds
- 7, 28, 56 and 90 days

Tests

- Mini slump
- Flow Table
- Water Absorption
- Porosity
- Compressive strength
- Flexural Strength
- Weight loss due to sulphate attack and sea water

Mini slump & Flow Table tests result

- the sample's workability decreased as the amount of bottom ash increased when w/c is constant.
- coarser character of the bottom ash particles was one of reason
- Eggshell increased workability, no need more water
- Due to addition of basalt fibers increased the pore connection at high volume fraction, decreased the workability when w/c is constant.

Water Absorption test result

- Bottom ash absorbed more water based on the test result, all groups also showed an increase for %WA values at 56 and 90 days. Bottom ash absorbs water more slowly
- Eggshell did not affect WA%. Actually, it is interesting to reach such a result since eggshell contain large amount of calcium oxide. This shows that egg shell is not act as a chemical stabilizer but shows a filler effect.
- Basalt fiber was an impermeable material; it absorbed water and trapped it within.

Compressive strength test result

- As the percentage of bottom ash increased, CS increased after 28 days
- Eggshell was used in addition to cement paste in increased CS
- The more amount used basalt fiber showed less increase in CS in cement pastes.

Flexural Strength test result

- The results showed that the behavior of base ash composites is more sensitive to bending. Despite bottom ash, egg shells increased FS.
- FS increased as amount of basalt fibers increased and strengthened the bonds of the cement paste
- it is observed that a good bond can be formed between basalt fiber and cement, especially higher amount of cement

Weight loss due to sulphate attack and sea water test result

- Weight loss was greater in the bottom ash. At 90 days, there was a decrease %45-88 in all weight loss. This reduction is due to the slow reaction of the BA and better hydration at 90 days.
- BF reduces the penetrability of salt when compare with the cement paste with only contains cement
- The pores formed by BF expanded in the seawater and BF's excessive water absorption capacity also observed that it expelled expansion.
- The high amount of BF used resulted in poor binding.

Conclusions

- In the research, the maximum amount of waste material was used.
- It is believed to be an important factor in reducing production costs for sustainable concrete.
- The effects of the waste materials were observed.

Conclusions

- These wastes can also be an alternative binder for the concrete industry.
- Tests can be further developed in these waste materials.
- Sustainable concrete studies will yield positive results.

Thank you!



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