Performance of Hardened Cement Mortars Prepared With Waste Glass and Brick

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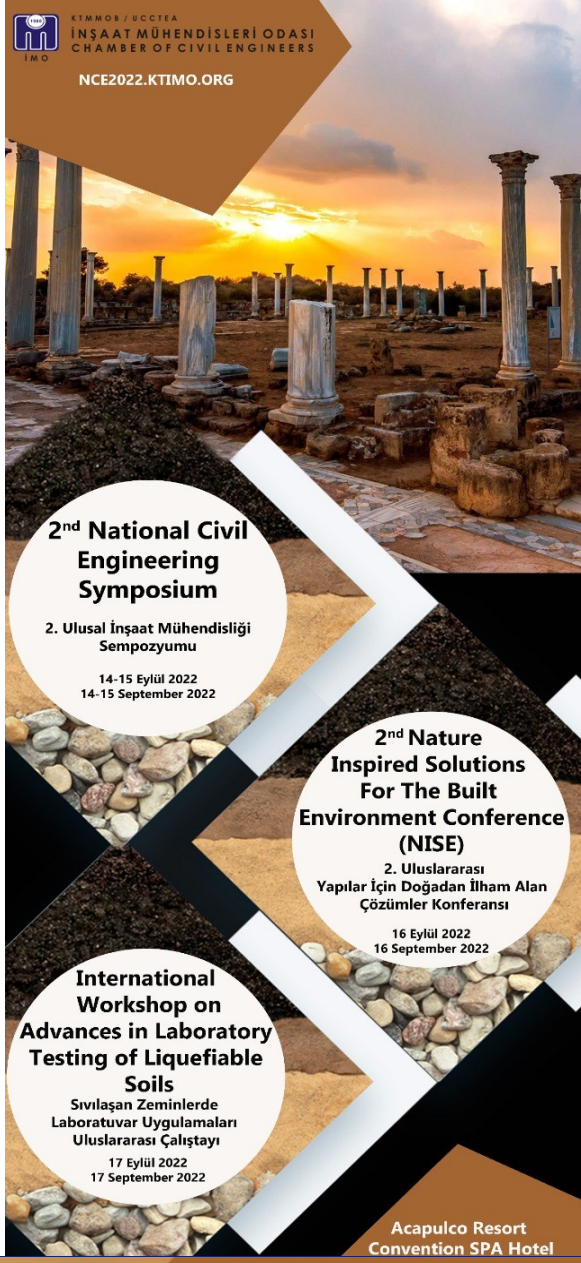


Outline:

- Introduction:
    - General Aspects & Definition of Problem
    - Objectives and Scope
- Methodology:
    - Materials Used and Sample Preparation
    - Testing of Mortars in Hardened State
- Results and Discussions
    - Compressive Strength Test Results for Hardened Mortars
    - Flexural Strength Test Results Hardened Mortars
- Conclusive Remarks
- References

Introduction: General Aspects

- Concrete is the most popular material for construction.
- Approximately 75% of volume of concrete is formed from aggregates.
- Quarries on Beşparmak mountains in T.R.N.C are not operated in an environmentally friendly manner.
- Natural resources are depleted because of excessive, uncontrolled and mis-managed excavation.

Halkın Sesi(2017)

Introduction: General Aspects

- Additionally, disposal of waste materials to nature is an another environmental problem for T.R.NC.

- Like concrete, cement mortar is also an extensively used construction material. Possibility of using recycled materials in mortars can be also considered.

- *Lack of experimental information on the performance of cement mortars produced with the use of different recycled materials* ***(waste brick, and waste glass)*** *has been detected in the literature.*

Introduction:
Objectives and Scope

- Carrying out experimental studies to investigate performance of mortars produced with;
  - Powdered glass (RGA)
  - Powdered brick (RBA)

  as a replacement to natural sand.

- Performance of waste-containing cement mortars is investigated :
  - Compressive strength (7 and 28 days)
  - Flexural strength (7 and 28 days)

Methodology: General Aspects

Mix Name	Natural *(Quarried)* Aggregate (NA)	Recycled Brick Aggregate (RBA)	Recycled Glass Aggregate (RGA)
Mix 1 (Control Set)	100%	0	0
Mix 2a	50%	50%	0
Mix 2b	0	100%	0
Mix 3a	50%	0	50%
Mix3b	0	0	100%

- All mortar mixes were produced to have the same flow characteristics.

- Targetted slump: 260-270mm
  (based on the results of previous studies)

Methodology:

- Distribution and amount of specimens for each mix at every testing age:

Mix No	Mix definition	W/C ratio required for targeted slump	No of prisms produced for strength testing	
			7 days	28 days
1	Control Set with 100% Natural Sand	0.6	3	3
2a	50% Natural Aggregate and 50% Waste Brick Aggregate	0.73	3	3
2b	100% Waste Brick Aggregate	0.75	3	3
3a	50%Natural Aggregate and 50% Waste Glass Aggregate	0.65	3	3
3b	100% Waste Glass Aggregate	0.6	3	3
			Total	30

Methodology:
Selected Starting Criteria

- Exact amount of used cement, water and aggregate;

Mix Name	Material Content of Used Sample									
	Water (gr)	Cement (gr)	Fine Aggregates (gr)							
	Potable Water	CEM I Type	Natural Aggregates (Quarry Sand)				Waste Aggregates (Waste Brick or Glass)			
			0.15 mm	0.3 mm	0.6 mm	1.18 mm	0.15 mm	0.3 mm	0.6 mm	1.18 mm
Mix 1 (Control Set)	2017	3361	672	1344	2017	2689	0	0	0	0
Mix 2a	2914	3993	260	512	779	1038	260	512	779	1038
Mix 2b	2975	3967	0	0	0	0	516	1031	1547	2063
Mix 3a	2155	3315	332	663	995	1326	332	663	995	1326
Mix 3b	2017	3361	0	0	0	0	672	1344	2017	2689

Methodology: Materials Used

- Waste materials were used as aggregates in the study;

Waste Brick

Waste Glass

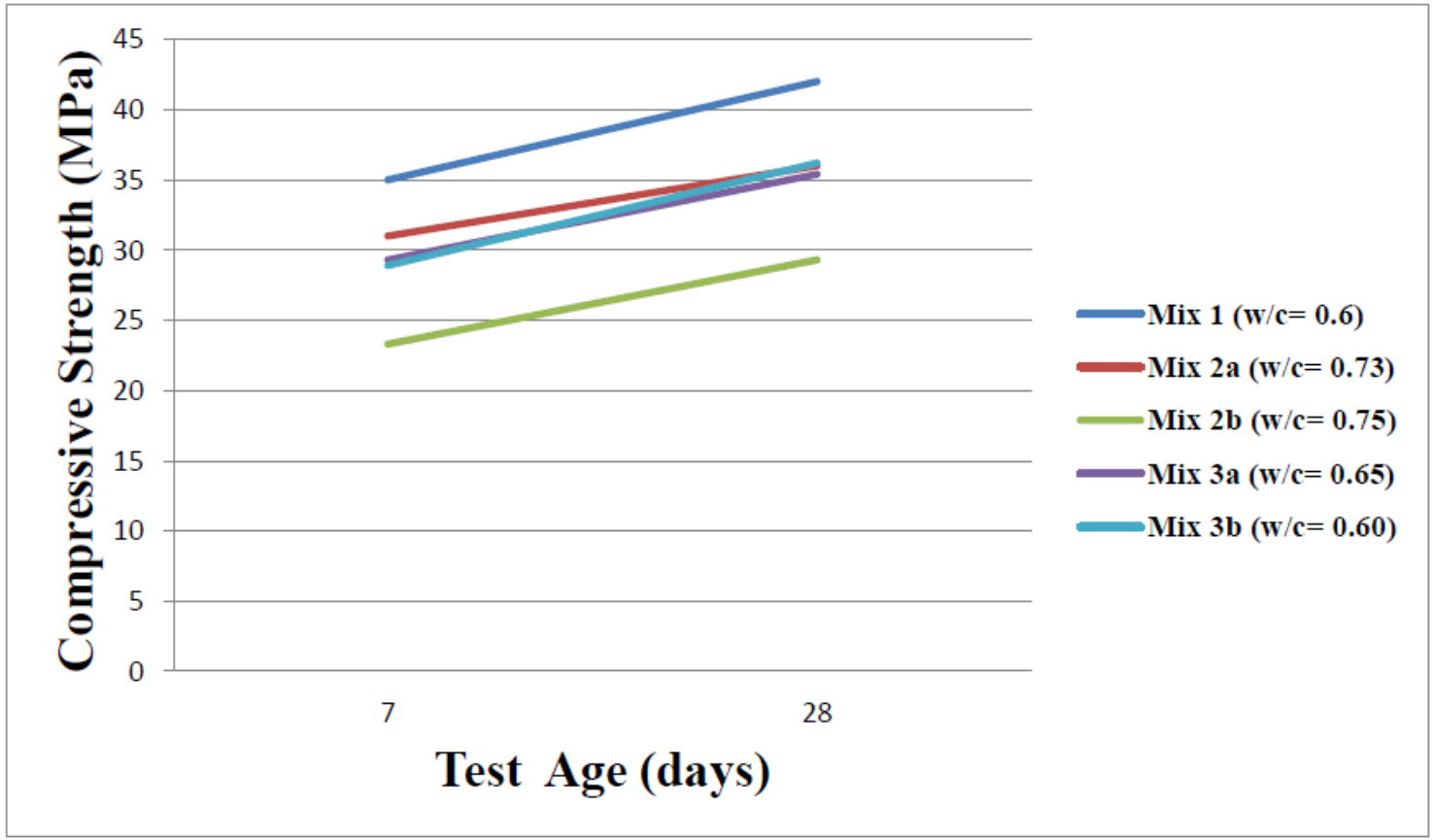
Methodology:
Strength Testing for Hardened Mortars

According to EN 196-1:2005

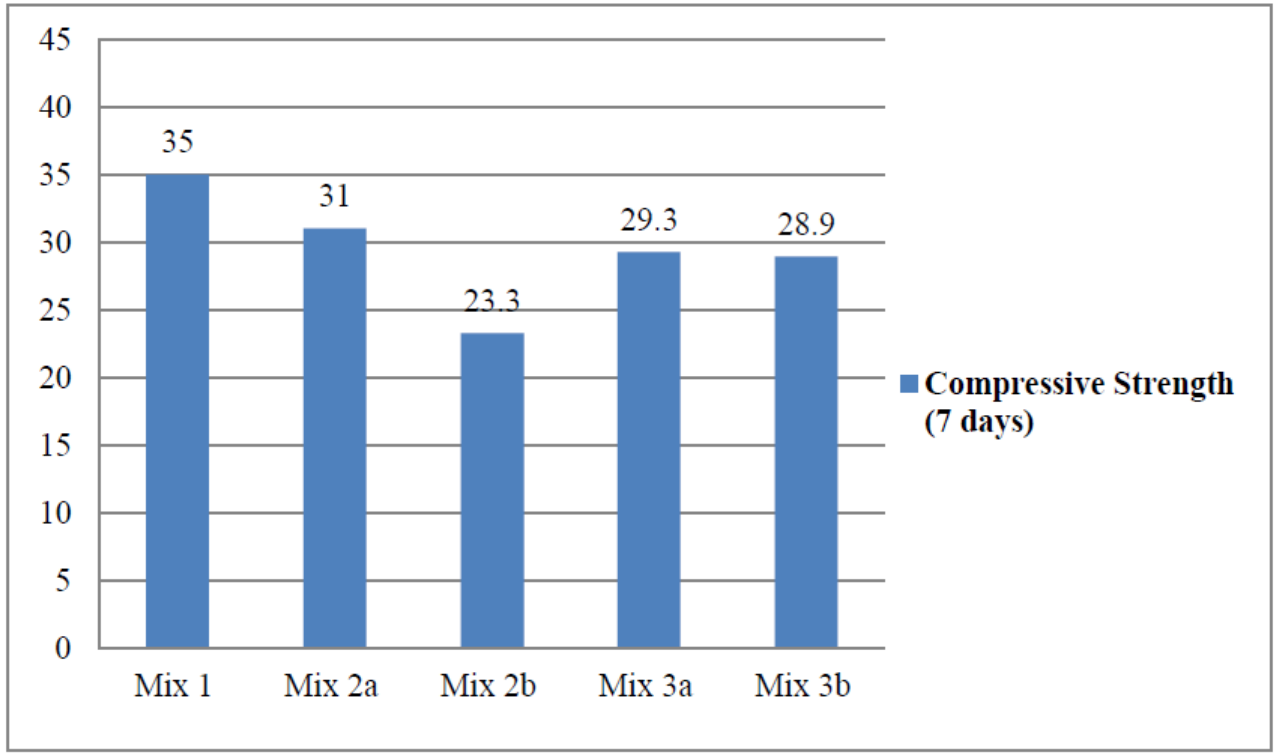
Compressive Strength Testing

Flexural Strength Testing

Results and Discussions: Compressive Strength Test



Results and Discussion: Compressive Strength Test



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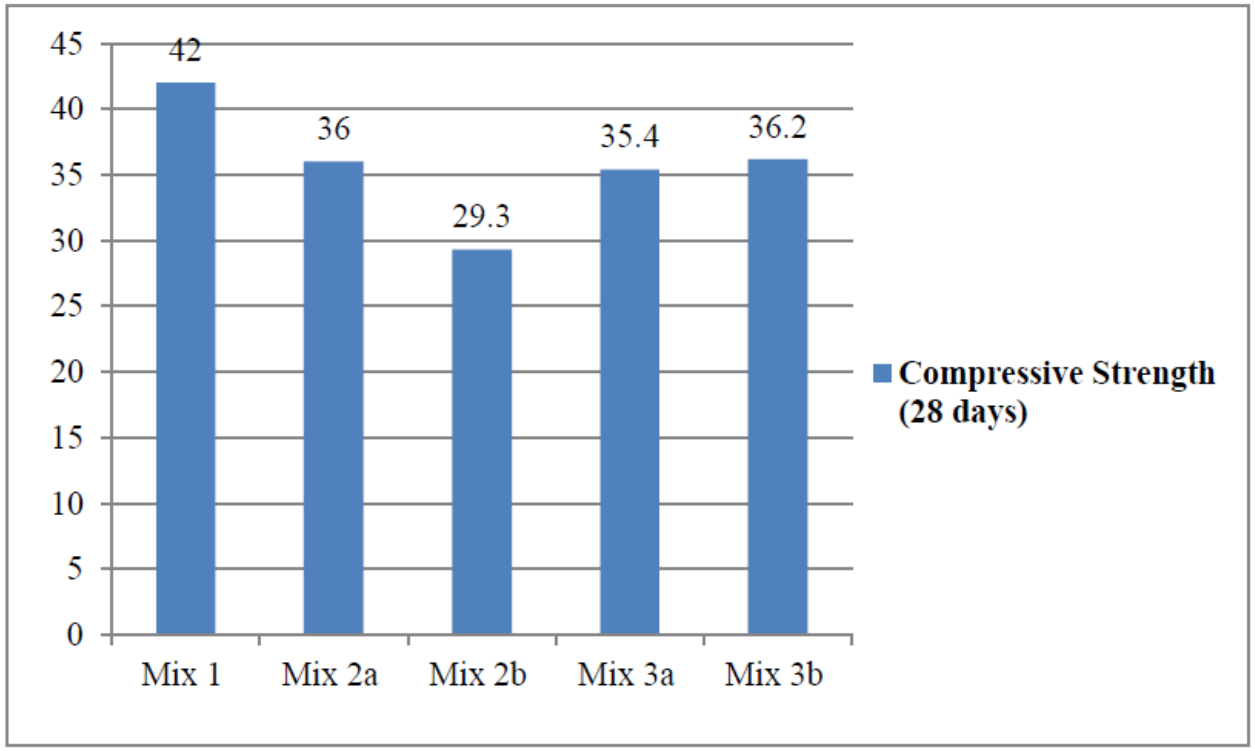
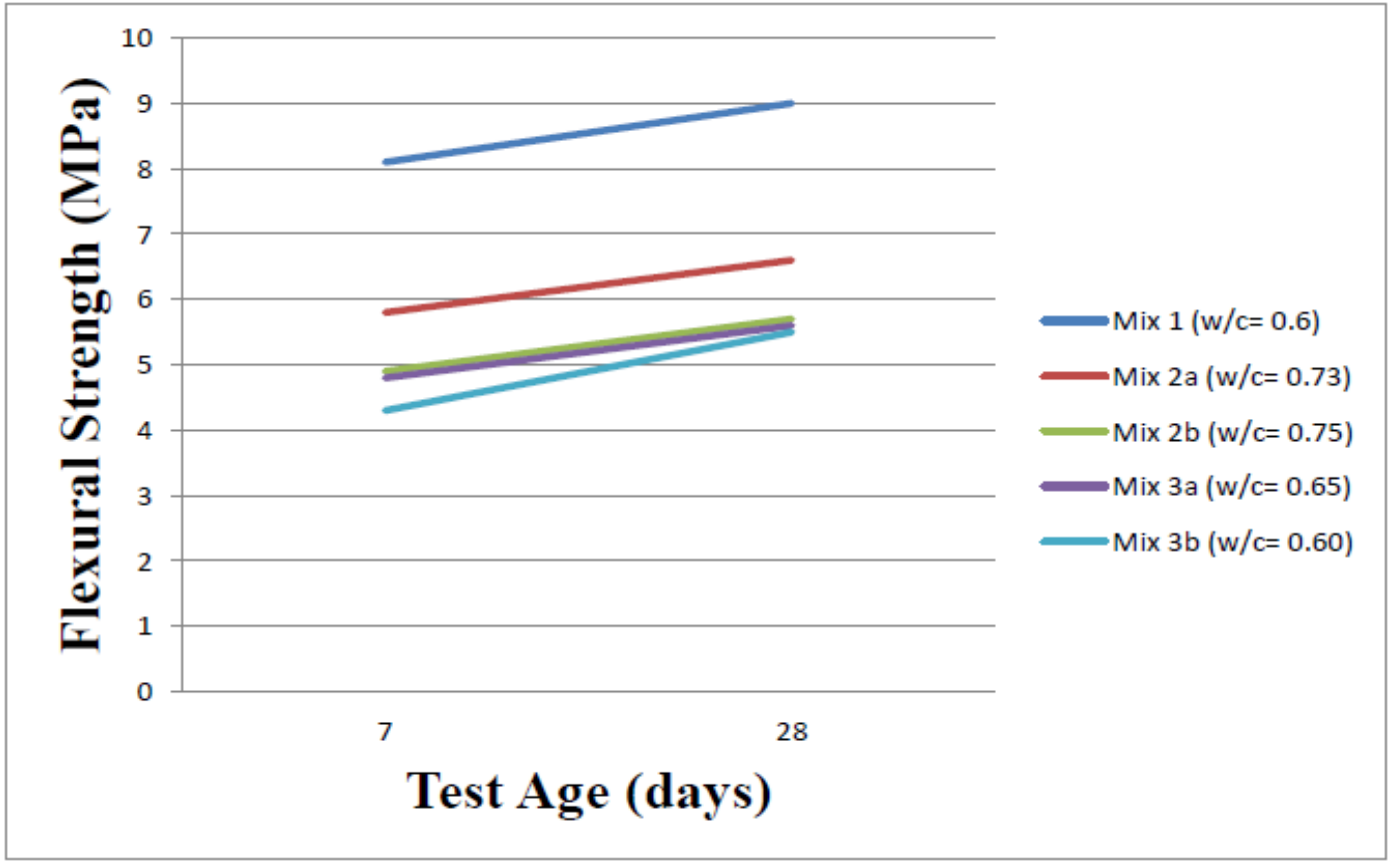
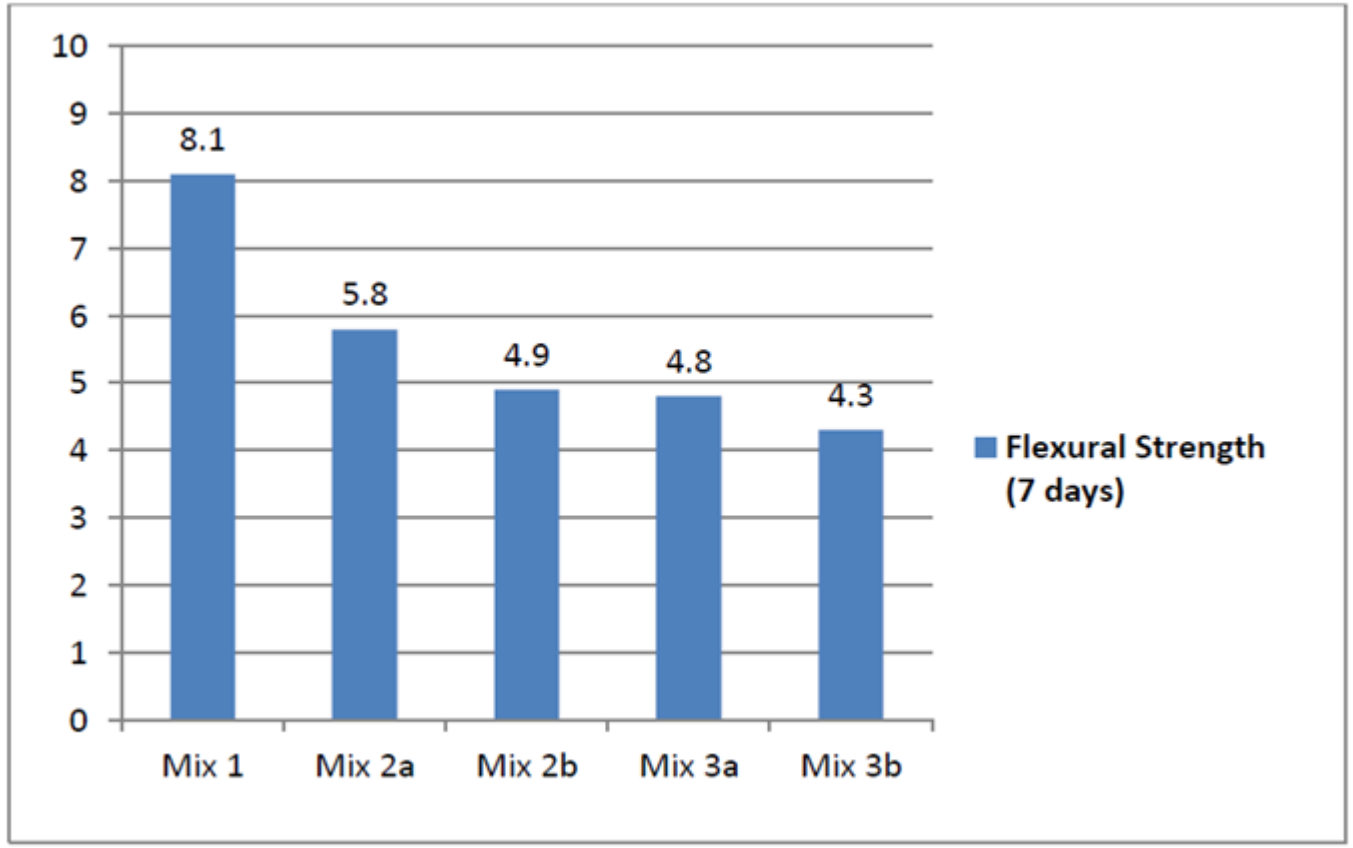


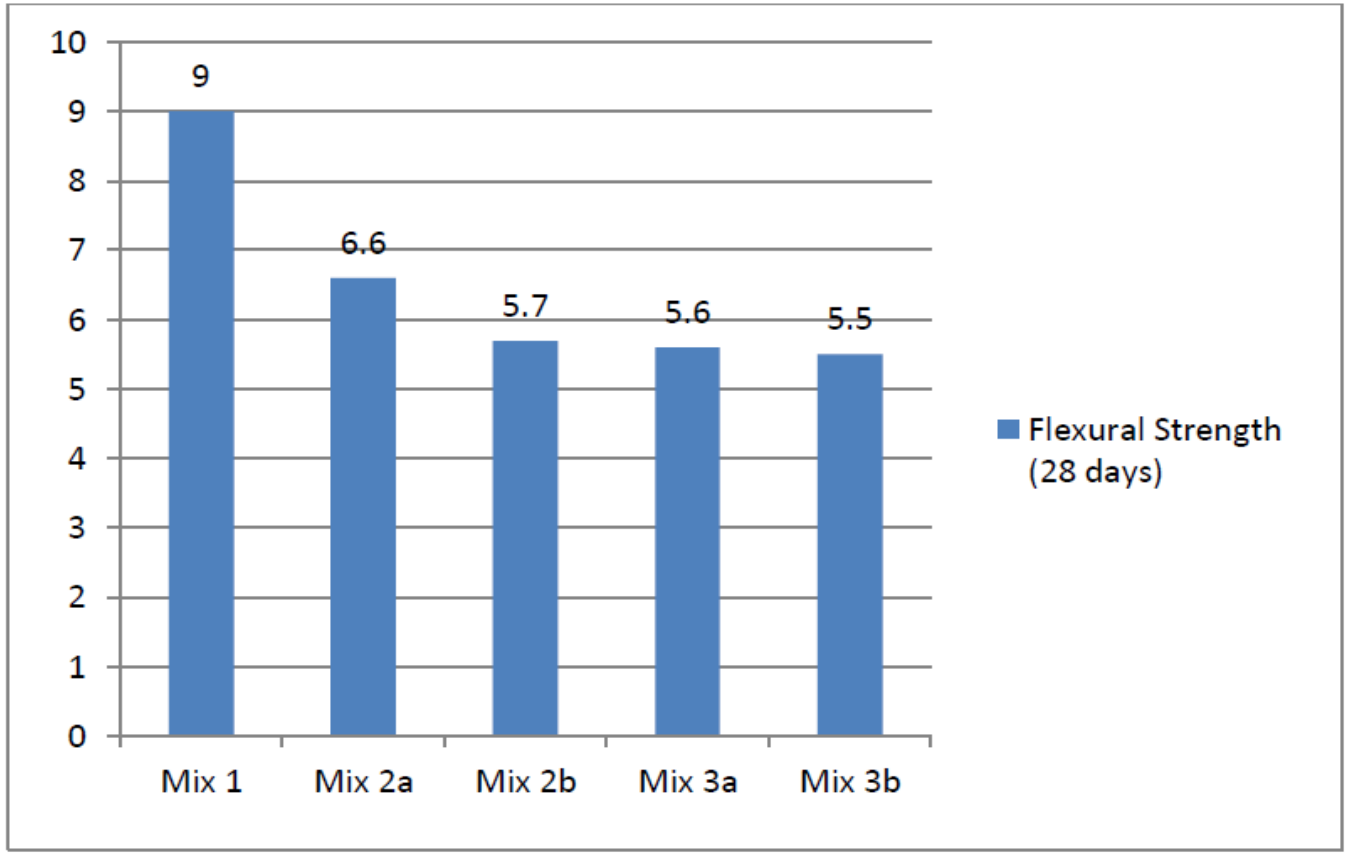
Results and Discussion: Flexural Strength Test



Results and Discussion: Flexural Strength Test



Results and Discussion: Flexural Strength Test



Conclusions

- The investigation contributed to the literature on performance of mortar produced with waste glass and waste brick in a systematical way.

- Mortars produced from waste brick and waste glass aggregates have high water demand to acquire the targeted flow compared to samples including same percentage of waste glass.

- Mortars produced from waste glass aggregates have similar water demand with control mixture.

Conclusions

- The highest flexural and compressive strength among mixes were acquired from control mix.

- Sample containing 50% brick and sample including 50% glass had 14.29% and 15.71% less compressive strength than control set at 28 days, respectively.

- Additionally, mortars including 100% brick and mortars containing 100% waste glass had 30.24% and 13.81% less compressive strength than control set at 28 days, respectively.

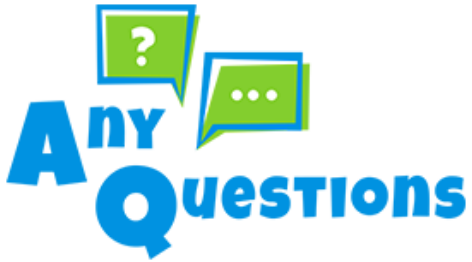
Conclusions

- Higher waste material content produces to lower flexural and compressive strength at 7 and 28 days.

- Moreover, Sample containing 50% brick and sample including 50% glass had 11.43% and 16.29% less compressive strength than control set at 7 days, respectively.

- Additionally, mortars including 100% brick and mortars containing 100% waste glass had 33.43% and 17.43% less compressive strength than control set at 7 days, respectively.

Thank You
For Your Attention...



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