THE EFFECT OF DIFFERENT MINERAL WATER USED AS CURE AND MIX WATER ON THE BENDING AND COMPRESSIVE STRENGTH OF CEMENT MORTAR

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As it is known, concrete mix and contact water shall not show acid reaction, it shall be equal to and above PH 7. In this study, the effect of using mineral waters of different structures in Kırklareli Province and surrounding area as mix water and cure water on the bending compressive strength of cement mortar was researched. Kırklareli municipal drinking water, Kırklareli spring water, Kırklareli Şeytan Deresi water, natural mineral water and prepared water were used. A total of 20 specimens were prepared for each mixture from 40 × 40 × 160 mm mortar samples replaced mix waters for 7 and 28 days: half of the samples were stored in cistern water and the other half were kept in their mix water. The pH values of the mix and contact waters used in the samples were measured and bending-compressive experiments were performed on samples 7 and 28 days.

In this experimental study, it is aimed to increase the compressive strength of mortars by using mineral waters as cure water and mix water to the concrete.

Keywords: Cement Mortar, Concrete Mix And Contact Water, pH.

1. INTRODUCTION

Mineral water is formed by the penetration of snow and rain water into the depths of the earth and incorporating some minerals in rocks in the depths during infiltration. The mineral enriched water then emerges from the cracks that it finds and forms the mineral water resources.

Na +, K + and OH- ions in pore water keep the pH value of the concrete in the range of 12.5-13.5. The corollary that can be drawn here is that the concrete will lose its chemical stability when faced with an acidic environment. Theoretically, waters with low pH leads to dissolution of cement hydrate components. When considered from this point of view, many industrial wastes and natural water can be considered aggressive for concrete. However, the severity of the chemical attack is the function of the pH value of the liquid and the permeability of the concrete. In the event that the pH value of the liquid is above 6.5 and the permeability of the concrete is too small, the chemical attack develops very slowly and the result can remain at ignorable levels. If the pH is under 5.5, the attack will be severe, and if it is below 4.5, the attack will be extremely severe. However, the transport speed of liquid in concrete is also an important factor [1].

pH is a measure parameter that expresses the degree of acidity of the product. pH expression stands for "power of hydrogen." pH is the activity of hydrogen ions. It is a logarithmic expression of H + or OH- concentrations in aqueous solutions [2]. The pH concentration in water is measured from 1 to 14 in numbers. At pH 7, hydrogen and hydroxyl ion levels are equal. Water is neuter at pH 7. If the hydrogen ions increase, the pH value of water decreases and the water becomes acidic. On the contrary, when the hydrogen ions are increased, the pH value rises and the water becomes alkaline. Therefore, if the pH in water is below 7, it is acidic water, and if the pH is over 7 it is basic water [2].

In their study, Çelik et al. (2005) investigated the effect of different types of mineral waters on concrete compressive strength as concrete curing water. 10x10x10 cm. 18 cubic samples of BS20 concrete grade were prepared. As a result of the experiment, they have stated that the concrete samples kept in the natural mineral water of Beypazarı exhibited high values in terms of 7 and 28 day compressive strengths compared to the samples kept in other curing waters [3].

P. Kumar Mehta and Paulo J. M. Monteiro, point that the pH function will be effective in permeability of concrete and chemical attack rate in aggressive conditions. They have elucidated that because the chemical attacks have too little effect when the pH value of the chemical attacks is over 6 and in low aggressive environments, the permeability of concrete will not pose serious damages [4].

2. MATERIAL AND METHODS

Portland cement (PC 42.5) to be used in the study has been produced by Limaş Cement Factory in Kırklareli. Physical and chemical properties of Portland cements have been determined in the laboratories of Kırklareli Limak Cement Factory.

Table 1. Chemical properties of cement and rice husk ash

Chemical composition	Cement (%)	Rice husk Ash (%)
SiO_2	20.35	91.15
Al_2O_3	5.98	3.84
Fe_2O_3	3.06	1.87
CaO	63.35	0.81
MgO	1.89	0.59
SO_3	2.71	-
Na_2O	0.58	0.17
K_2O	0.88	0.21

Cement mortar mixtures; standard sand, cement and water ratios have been prepared to be 3: 1: 0.5, respectively. Mortar samples shall be obtained by using mortar moulds of 40 * 40 * 160 mm size according to TS-EN 196-1 [2].

Table 2. Mixture Ratio

Mixture water	Cement	Sand	Water
Network Water	450	1350	225
Bottled Water	450	1350	225
Stream Water	450	1350	225
Spring Water	450	1350	225
Mineral Water	450	1350	225

The produced mortar samples will be removed from the mould and put into curing water after being kept at 20^{o}C room temperature for 24 hours.

3. RESULTS AND DISCUSSION

In the measurements of mixture and curing waters, the values have been found as 8.01 for Kırklareli network water, 7.52 for bottled water, 6.80 for mineral water, 8.18 for Seytan Deresi stream water and 7.38 for Kırklareli Spring water.

As is seen in Table 3, the bottled water and the Şeytan Deresi stream water used as mixture water give values close to the reference sample. Looking at the 28-day strength of the bottled water, it is seen that it has the same 46.1 MPa as the reference sample and the Seytan Deresi stream water has 45.8 MPa. The lowest 28-day strength is observed in samples in which mineral water with the lowest pH value is used as 35.3 Mpa.

When the 28-day bending strengths are considered, the lowest strength is found as 8.927 MPa in the samples in which the Seytan Deresi stream water is used as the mixing water. Values close to each other have been obtained for bending strengths in all samples.

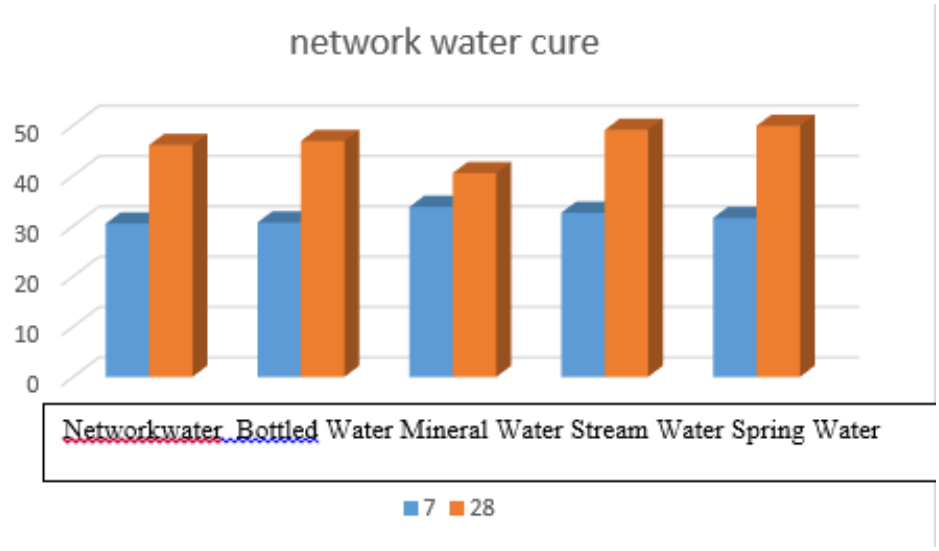

Figure 1. 7 and 28-day compressive strength of samples in water cure (Mpa).

Table 3. 7-and 28-day compression-bending strength of samples in water cure (Mpa).

		Compression Strengths				
	PH	**8,01**	**7,52**	**6,80**	**8.18**	**7.38**
	Day	**Kırklareli network water**	**Bottled water**	**Mineral water**	**Şeytan stream water**	**Kırklareli spring water**
Water Cure (Mpa)	**7**	30.5	38.1	36.2	34.7	31.6
	28	46.1	46.1	35.3	45.8	38.2
		Bending Strengths				
	7	7.453	7.516	7.336	8.242	8.292
	28	9.660	9.520	9.403	8.927	9.417

When the samples that are cured in the mixing water are examined, it is seen that the water with the highest resistance in the 28-day durations is given by the Seytan stream water. It is thought to be resulted from high pH value.

Table 4. 7 and 28-day compression-bending strengths of the samples cured in mixing water (Mpa).

		Compression Strengths				
	PH	**8,01**	**7,52**	**6,80**	**8.18**	**7.38**
	Day	**Kırklareli network water**	**Bottled water**	**Mineral water**	**Şeytan stream water**	**Kırklareli spring water**
Cure in mixing water	**7**	30.5	30.7	33.8	32.6	31.6
	28	46.1	45.9	40.5	49.1	49.9
		Bending Strengths				
	7	7.453	7.485	7.584	7.211	8.492
	28	9.660	9.587	8.320	9.940	9.985

As is seen in Table 4, the bottled water used as mixing water and curing water has given values close to the reference sample. When the 28-day strength of the bottled water is examined, it is observed to be 45.9 MPa. Lowest 28-day strength is observed in the samples in which mineral water with the lowest pH value is used as 40.5 MPa.

When 28-day bending strengths are considered, the lowest strength is observed as 8.320 Mpa in the samples in which Seytan stream water is used as mixing water. Values close to each other have been obtained for bending strengths in all samples.

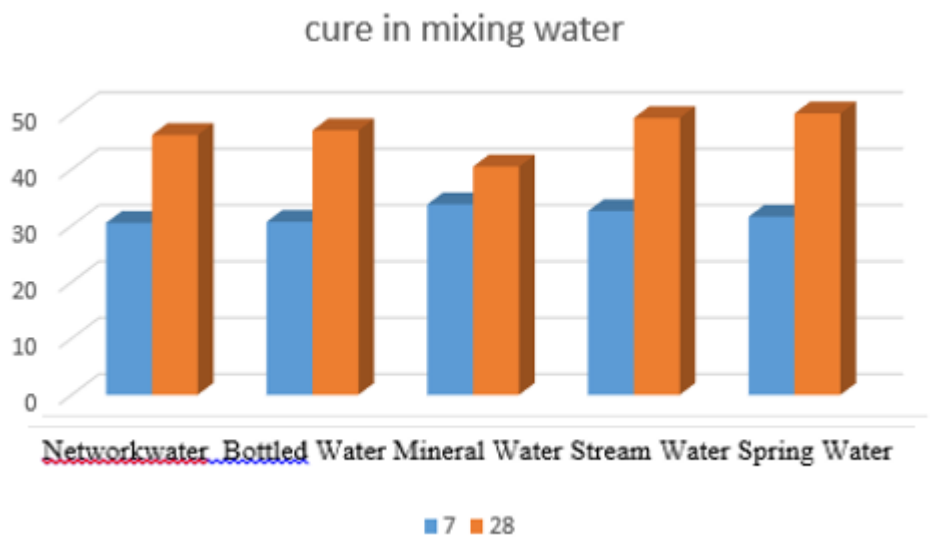

Figure 2. 7 and 28-day compressive strength of samples cured in mixing water (Mpa).

4. CONCLUSION

Values close to each other has been obtained in all samples for the bending strength of the samples used as mixture and curing waters.

The lowest 28-day strength has been observed in the samples in which mineral water with the lowest pH value is used.

The obtained experiment results will provide insight for discovery of alternative water resources when the concrete plants around Kırklareli fail to obtain mixing and curing waters.

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