Effect of CTAB on Gelling Time of Acrylamide Grout

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Abstract: The effect of Adding a cationic surfactant (Cetyl trimethyl ammonium bromide (CTAB)) upto 4% concentration on the gelling time and curing temperature of an acrylamide chemical grout was investigated in this study. Addition of 4% CTAB increased the gelling time and decreased the curing temperature of the grout.

1 Introduction

Grouting is used to fill the voids in the ground and modify the in-situ properties of soils to achieve the strength and/ or permeability. Of the Chemical grouts, sodium silicate was the first chemical grout that was used to stabilize the soil (Karol, 2003). Chemical grouting is used for other important applications such as leak control and concrete repair as a preventive measure for problems such as landslides, water or liquid leakages in underground.

2 Objectives

The main objective of this study was to investigate the effect of a cationic surfactant on the gelling (setting time) property and curing temperature of an Acrylamide chemical grout (AV-100).

3 Materials

White crystalline form of AV-100 was used for the study. AV-100 is a blend of acrylamide monomer ($-CH_2CHCONH_2-$) and methylene bisacryl amide ($C_7H_{10}N_2O_2$). The catalyst used was ammonium per sulfate ($(NH_4)_2S_2O_8$). It is a white crystalline solid. Catalyst is also termed as initiator. The main role of the catalyst was to accelerate the chemical reaction to form the gel. The CTAB was a white powdered cationic surfactant with a molecular formula of $C_{19}H_{42}BrN$.

4 Procedure

Study was done on 100 g of the grout samples that were prepared.

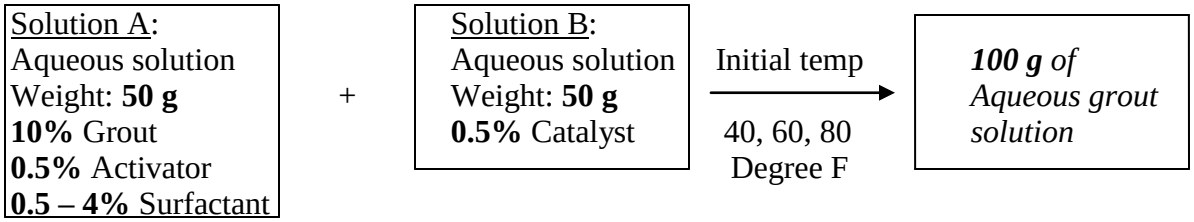

Fig 1: Schematic representation of preparation of samples

These samples were brought to the initial temperature of 40˚F, 60˚F and 80˚F to study the effect of initial temperature on the gelling time and curing temperatures.

5 Results and Analyses

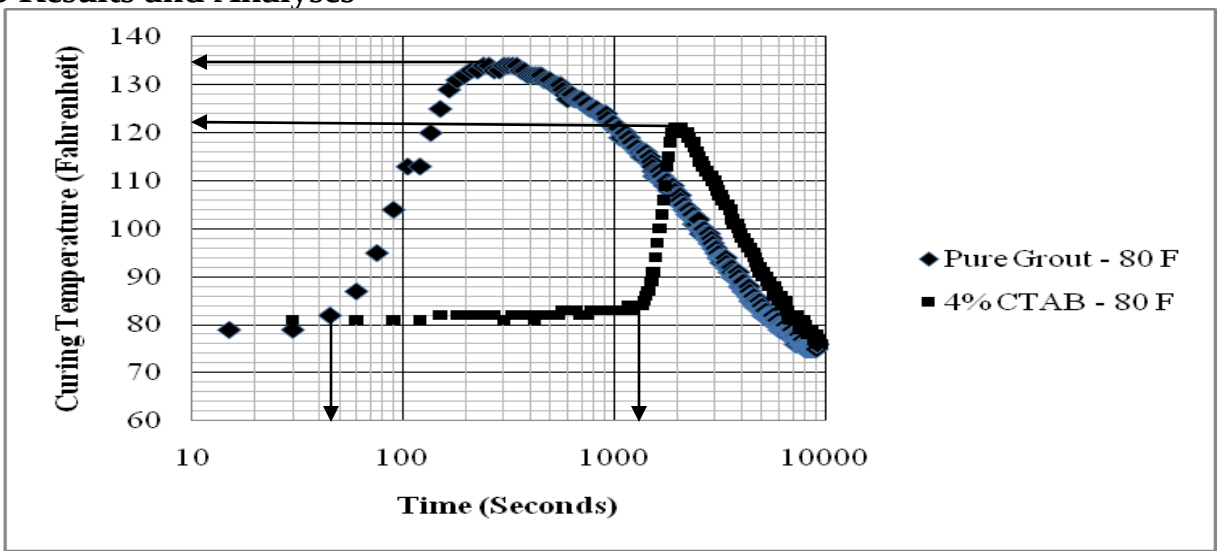

Fig 2: Typical Gelling Time Test Curves of Pure Grout and Surfactant Added Grout

Table 1: Table Showing the Gelling Time and Reaction Temperature

	40 F		60 F		80 F	
specimen	**time (s)**	**temp (˚F)**	**time (s)**	**temp (˚F)**	**time (s)**	**temp (˚F)**
Pure Grout	615	92	165	114	45	134
CTAB - 0.5%	675	101	240	104	60	129
CTAB - 4%	17400	70	5880	104	1380	121

From the test results, it was found that addition of 0.5% of CTAB increased the gelling time by 60, 75 and 15 seconds at 40˚F, 60˚F and 80˚F respectively. It was also observed that addition of 4% CTAB increases the gelling time by nearly 16785, 5715 and 1335 seconds at 40˚F, 60˚F and 80˚Ft. Increase in the curing temperature by 9˚F was observed on addition of 0.5% CTAB at 40˚F but in all other cases the curing temperature was found to be decreasing. Significant decrease of 22 degree and 13˚F was observed on addition of 4% CTAB at 40˚F and 80˚F respectively.

6 Conclusions

Addition of CTAB to the grout solution increased the gelling time and decreased the curing temperature of the grout. The change in gelling time and curing temperature also depended on the initial grout temperature.

7 Acknowledgements

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8 References

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