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# Compressive Strength and Thickening Time of Cement in Oil Well

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***Abstract :*** *Proper slurry design is critical to the success of a cementing job. The best method to obtain a good slurry design with desired compressive strength is by laboratory experiments which involve experimenting different formulations and selecting the best composition for the specific cementing operation.*
***Keywords:*** *Compressive strength test machine, Atmospheric cosistometer ,Additives.*

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## I. Introduction

1.1In well cementing, Portland cement systems are designed for temperatures ranges from below **freezing** in permafrost zones to 662°F (350°C) in thermal recovery and geothermal wells .They also encounter pressures ranging from ambient to 30,000 psi (200 MPa) in deep wells. Accommodation of such variations in conditions was only possible through the development of cement additives .According to American Petroleum Institute Recommended Practice 10B, additives are materials added to cement slurry to modify or enhance desired property Anon .**Cement additives** selected for cementing operations are an integral part of sound well design, construction and well integrity .**Additives** are available to enhance the properties of oil well slurries and achieve successful placement between the casing and the geological formation, rapid compressive strength development and adequate zonal isolation during the lifetime of the well

1.2 Compressive strength test machine:
-Compressive strength is the maximum compressive stress that, under a gradually applied load, a given solid material can sustain without fracture.
-Compressive strength is calculated by dividing the maximum load by the original cross-sectional area of a specimen in a compression test.They have the ability to supply the temperature range from 9°C to -69°C.
-Compressive Strength Testing Equipment to test cement, brick and cement offered by us.

**Compressive Srength Test machine**

1.3 Atmospheric cosistometer:

**-consistometer can be used to obtain a thickening time for low-temperature cement systems.**
**- it is typically used for the conditioning of slurries before rheology, fluid-loss, or free-fluid tests.**
**- The consistency of the slurry is measured in Bearden units (Bc).**
**- A maximum temperature of 250F (121C) is achieveded by utilizing a circulating oil bath to distribute heat around the rotating cups.**


**Atmospheric consistometer**

## II. Procedure

- The Cement is being prepared to a test at temperature of at least 25°C about approximate point.
- Then the cement which we use is protland cement
- Then There are nine classes of cementing oil well we have chosen glass G for all depths.
- Adjust the ratios of the ADDITIVES for each Factor like Accelater ,Retarder, weighting agents, etc.
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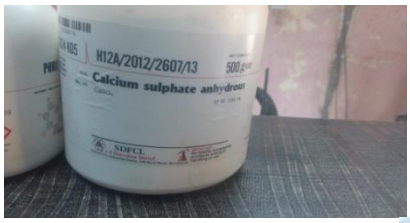



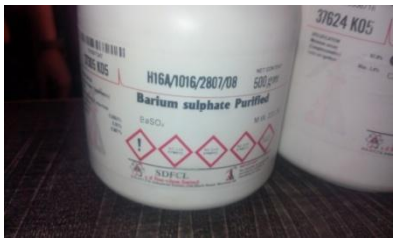



- After that we mix the cement by the mixing blender machine.

- As the mixing finished we filled themixed cement in cylindrical mole ,150mmdia ×300mm height

- Then the mole should be kept for 48 hours minimum to be tested for compressive strength.
- After 48 hour the compressive strength can be Tested.

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- The process is being further continued until the cement reaches a stage such that the cement loses the ability to stand the compression , which is said to be its compressive strength .
- The procedure is being repeated three times, Accelater, Retarder, weighting agents and the values are tabulated .
- The testing of cement slurries requires the measurement of thickening time, free water content, viscosity, rheological properties, fluid loss and various other properties.
- The thickening time measuring which measure the early age compressive strength .
- The same procedure on both but the only different that we measure the thickening time while mixing **,but the compressive strength after two days.**

| | |
|---|---|
| Maximum Temperature | 200° F (93° C) |
| Maximum Pressure | Atmospheric pressure only |
| Slurry Cup Rotational Speed | 150 rpm |
| Consistency Range | 0 to 100 Bearden Units (Bc) |
| Slurry Container Volume | 28 cu in (470 ml) |
| Input Voltage | 115 or 220 VAC 15%; 50/60 Hz 10% |
| Input Power | 2 KVA |
| Heater | 1,500 watts |

## I.TABLES

| **Table1,** RangeofData | | | |
|---|---|---|---|
| Bentonite/Cement ratio,dimensionless | 2/98 | to | 12/88 |
| Water/Solid ratio, dimensionless | 0.4 | to | 1.05 |
| Water/Cement ratio, dimensionless | 0.408 | to | 1.136 |
| Apparent viscosity, C.P | 9.5 | to | 138 |
| Slurrydensity,gm./cc | 1.49 | to | 1.94 |
| Thickeningtime, minutes | 51 | to | 430 |
| Compressivestrength, PSI | 420 | to | 2530 |
| Freewater content, % | Nil | to | 19 |

**2-TABLES**

| Factor | ms | m | Ú (at80$^{o}$)C.P | ρ gm/cc | ThickeningTime (at 125$^{o}$F,5200psi) minutes | F.W% |
|---|---|---|---|---|---|---|
| Accelater | 0.50 | 0.510 | 80.0 | 1.83 | 94 | 0.6 |
| Retarder | 0.60 | 0.612 | 56.0 | 1.74 | 109 | 1.8 |
| Weighting Agent | 0.70 | 0.714 | 36.0 | 1.67 | 123 | 2.3 |

**TABLE 3**

| Factor | m/s | m | ú (at 80 F) C.P | P (m/cc) | Thickening Time (at125F, 5200 psi) minutes | compressiveStrength (at 140 F and 24hures)psi | F.W% |
|---|---|---|---|---|---|---|---|
| Acceleter | 0.50 | 0.510 | 80.0 | 1.83 | 94 | 2530 | 0.6 |
| Retarder | 0.60 | 0.612 | 56.0 | 1.74 | 109 | 2187 | 1.8 |
| Weighting Agents | 0.70 | 0.714 | 36.0 | 1.67 | 123 | 1600 | 2.3 |

## III. Result

According to our experiment we have got values of compressive strength and thickening time for each Factor had the specific data and result, additives rule the future to be desired . Since its average cloud formation when mixed cement with additives were at -37.3°C .

## IV. Conclusion

Our hypothesis was to prove the mean function of the adding additives to the cement with specific ratios . Our results do support my hypothesis. The test we did went on very smoothly only place where we struggled was in finding the best equipment to perform the experiment, since the rate of temperature has to be constant for the mixing.Thickening timeandcompressive strengthcorrelations for Portland – class "G" cement slurries have been estimated.The test further went on ahead to come to conclusion that the additives effect the compressive strengthand the thickening time of class G of cementing oil well.

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