# Using Carbohydrate (Sugar) as a Concrete Retarder

The use of sugar as concrete retarder was decided on 5-september-2015. That was due to the shortage of stock in our current raw material which was used as retarder. The currently used retarder belongs to the Hydroxycarboxylic acid (Sodium Gluconate).

From literature review, there are 3 types of commercial retarders for concrete:

1- Lignosulphonates (Also works as a plasticizer).
2- Hydroxycarboxylic Acid. (Currently used in our factory).
3- Carbohydrate (Sugar).

## Dosage for Sugar:

The dosage for sugar per kg cement was taken from literature review. It was experimented in several studies with a range of dosage between 0% to 1% sugar per cement content. Results were showing an increase in the strength of concrete after 28 days of cast when a dosage of sugar was added to concrete to up to 0.06% per cement content. Increasing the dosage slightly above 0.06% will cause excess retardation to concrete as well as slight decrease in the 28 days strength.

## Concrete Trails:

Concrete trails were made in our laboratory using the different formulations that we are using as concrete admixtures. Sodium Gluconate was replaced with sugar. The quantity of sugar used it the formulation of the concrete admixtures is the same as the quantity of the Sodium Gluconate, while keeping in mind the recommended dose of sugar.

## Slump Retention:

Slump retention noted in the concrete trails indicates that sugar is performing a good effect in retarding the initial setting time of the concrete. As slump loss after 40 minutes indicates the activation of the initial setting time, thus concrete will coagulate and considerably lose workability, especially when Sodium Sulphonates Naphthalene Formaldehyde is used as a superplasticizer and water reducer. But in this case when sugar was added with the dose of 0.043% of cement content, it was possible to retain the slump of 180mm after 90 minutes from the mixing time for the mix of 375kg cement, 1115 kg 20 mm natural aggregate and 710 fine aggregate (sand) and 200kg water.

## Cube Crushing Results:

Cubes were casted for each trail and crushed on 3 days, and 7 days. The result of the cubes crushing as follows.

Remarks: Raw materials quantities are in kg. Compressive results are in $N/mm^2$.

| | SP901 | SP911 | MP801 |
|---|---|---|---|
| Concrete Grade | C30 | C30 | C25 |
| Dose | 3 liters | 3 Liters | 2 Liters |
| Cement | 375 | 375 | 350 |
| Aggregate | 1115 | 1115 | 1130 |
| Sand | 710 | 710 | 720 |
| Water | 200 | 200 | 200 |
| Initial. Slump | Collapse | Collapse | Collapse |
| Slump 30m | 220 | 220 | 190 |
| Slump 60m | 210 | 210 | 140 |
| Slump 90m | 190 | 180 | - |
| Compressive result 3d | 28.4 | 27.8 | 26.6 (4d) |
| Compressive result 7d | 39.2 | 38.2 | - |

Hence, it was decided to use sugar as concrete retarder instead the sodium Gluconate until Sodium Gluconate reach from port, which is estimated on 16-sep-2015.