POLYTRADE NATURAL RESINS
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CARBOFEN ® 6060

Air-Entraining Agent

PRODUCT DESCRIPTION

Carbofen 6060 is a natural resin with specific properties for air entrainment in cement, concrete and mortar. Derived from a renewable natural source, a special resinous part of the *Araucaria angustifolia* (Parana Pine), Carbofen 6060 has a complex chemical composition like oxidized colophony. After being neutralized, our product acquires excellent properties as an air-entraining agent for microcellular concrete.

SPECIFICATIONS

Acid Number, ASTM D-465 (mg KOH/g)	80 – 105
Softening point, ASTM E-28 (B&R ºC)	95 – 120

ADVANTAGES OF CARBOFEN 6060 AS AN AIR ENTRAINING AGENT:

- Improves strength, plasticity and freeze-thaw resistance of cement, which avoids shrinkage cracking;
- Better workability and use of less mixing water;
- Grants concrete better resistance to sulfate and chloride;
- It does not provoke volume changes in concrete;
- Good stability of viscosity;
- Easy preparation of the admixture.
- Increases de longevity of structures made with it

APPLICATIONS

The air entraining agents have broad use in foundations of concrete, slabs, dikes, tunnels, canals, bridges, concrete highways projects, and others. Carbofen 6060 produces a content of air of 3% to 6% in concrete with dosages of 0.02% to 0.06% of our product. To increase these properties, one can increase the above-mentioned quantities once experimental tests take place.

DIRECTIONS FOR USE:

Before Carbofen 6060 can be added into the cement mixture, it must be neutralized. The following table displays the ingredients and quantities achieve a neutralized solution:

Product	Weight (%)
Carbofen 6060	8.33%
Water	88.34%
NaOH 50% aq.	3.33%

The neutralization process is as follows: add the water into a batch reactor, heat it up to 80 ºC (176ºF), then slowly add the soda solution. Afterwards, pour Carbofen 6060 while constantly stirring. After dissolution stir the solution for 30 minutes and let it cool.

The Carbofen 6060 Solution may be stored at 2º C (35ºF) or higher. If it freezes, thaw and reconstitute by mild mechanical agitation. Dispersion by aeration should be avoided to prevent foaming.

A dosage of 30-50 ml per 50 kg (110 lbs) of cement is enough to incorporate 3-6% of air in the concrete admixture. The above-mentioned range of air incorporation can vary depending on the raw materials used in the admixture. Only by performing tests with the specific admixture the exact dosage can be determined.

Important: The quantity of neutralized solution varies according to the proprieties of the concrete being used. Experimental tests must be performed to find the exact amount of the air entraining agent used.

WHAT ARE AIR ENTRAINING AGENTS?

Retention of air in concrete consists in the mechanic entraining of a large and well distributed number of minuscule air bubbles during the mixing of the cement. This retention can be obtained by adding the appropriate air entraining agent, like Carbofen 6060, to the cement mix. The entrainment of air in the concrete is very important, since the float of these minuscule air bubbles are distributed in the mixture and the sedimentation of the solid particles is delayed.

Consequently, the "bleeding" is reduced, providing an overall better quality of concrete, better resistance to freeze-thaw cycles as well as better plasticity, uniformity, and cohesion characteristics. The honeycomb-like areas (areas of great space), which are caused by bad consolidation after the placement of concrete, are reduced and sometimes eliminated with the entraining of the air.

There are several items that have influence on the quality of the entrained air, such as: composition of the mixture, consistency of the concrete, temperature, vibration, classification of the type and size of the agglomerate, among others. Therefore, one must plan for the best conditions and utilize an additive that aids the air entraining of concrete, like Carbofen 6060.

PACKAGING

- Paper bags of 25 kg (55 lbs)
- Big Bags of 840 kg (1900 lbs)
- We recommend storage in dry and fresh places

PRODUCT INFORMATION AND SAFETY

Please read our Safety Data Sheet (SDS) and our Material Safety Data Sheet (MSDS) for detailed information.

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EFFICIENCY OF CARBOFEN 6060 AS AN AIR ENTRAINER FOR CONCRETE

Test performed at "Laboratório de Materiais de Construção do CEFET-Pr", Brazil. The test was performed using a compressive machine EMIC with capacity of 200 tf and registered the necessary force to reach the fracture at all four corps tested: two at the 7th day and the other two at the 28th day after preparation of the concrete following the NBR-5739 guidelines. In this manner, Table 1 displays the above described test, using concrete mixed with Carbofen 6060 in four different water to cement ratios to observe the resulting incorporation of air in concrete.

Raw materials utilized:

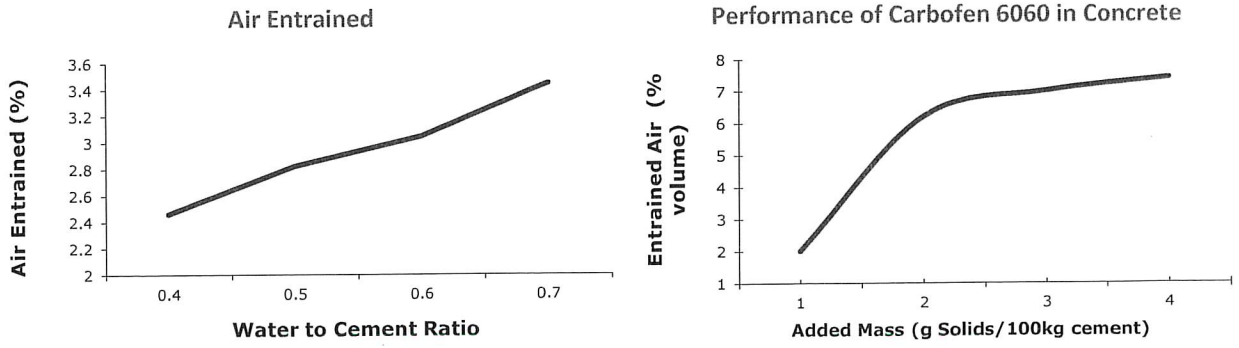
- Portland Cement – CP V – ARI –RS
- Quartz sand - 9 mm maximum
- Solution of Carbofen 6060
- Aggregate 2 –19 mm maximum
- Mixture 1: 2.62 : 2.98

Table 1: Concrete Compressive Strength Using Carbofen 6060 with Different Water to Cement Ratios

Water to Cement Ratio	Air Incorporated (%) into Cement Mix	Specific Weight (g/cm³) of Prepared Concrete	Concrete Compressive Strength (MPa) after 7 days	Concrete Compressive Strength (MPa) after 28 days
0.4	2.456	2.427	30.00	36.82
0.5	2.819	2.344	18.63	24.23
0.6	3.044	2.293	12.00	16.60
0.7	3.445	2.242	9.00	12.22

Following below is Graph 1, displaying the air incorporation test, which was performed according to NBR-13278/1995 guidelines.

Graph 1: The Incorporation of Air with Four Different Water to Cement Ratios Using Carbofen 6060 in Concrete



As stated in the table and graph above, it is clear that concrete becomes lighter as more air is incorporated in its mix and at the same time, its compressive strength decreases. So, the end user should choose the best condition that fits their particular needs. We also encourage our clients to conduct their own tests to determine the optimal added amount of Carbofen 6060 into the cement mix.

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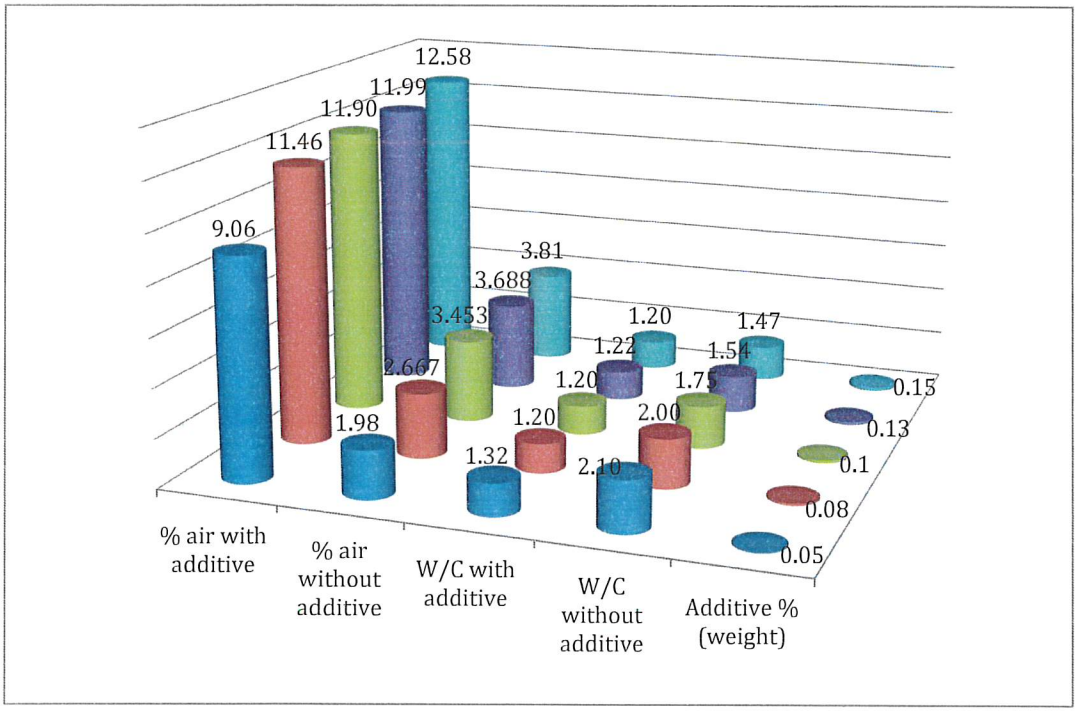
EFFICIENCY OF CARBOFEN 6060 AS AN AIR ENTRAINER FOR MORTAR

Below is Graph 2, which displays a test performed at "Laboratório de Materiais de Construção do CEFET-Pr", Brazil of the air incorporated in mortar with and without adding our additive, Carbofen 6060, to the mortar mix. The data shows that the use of our product improves the incorporation of air in the mortar mix comparatively than without the use of Carbofen 6060, since it is possible to observe the increased air content in the mortar mix. In addition, by using our product, one can work with less water, as shown by the water to cement ratio statistics.

Raw materials utilized:

- Portland cement – CP II – F32
- Hydrated Cal CH III type
- Quartz sand – "2 zone" classified following NBR-7211 guidelines.
  Maximum characteristic dimension: 2.4 mm.
  Specific mass: 2.66 g/cm3
  Absorption: 0.88 %

Graph 2: The Incorporation of Air and the Use of Water in Mortar with and without Adding Carbofen 6060



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