ETiMADEN İŞLETMELERİ GENEL MÜDÜRLÜĞÜ

PRODUCT TECHNICAL DATA SHEET

BORIC ACID

ETIBORIC ACID

ETiMADEN

Boric Acid (H_3BO_3)

CAS Number: 10043-35-3

Technical Grade: Granular and Powder

Packaging: 25 kg, 50 kg, 1000 kg

(with or without pallet)

General Information:

Boric acid (also known as boracic acid or ortoboric acid) is a mild acid of boron. Its chemical formula is written as H_3BO_3 (or $B(OH)_3$ and it is available as a white, water-soluble powder. Boric acid is obtained by the reaction of colemanite ore with sulfuric acid or borax and a mineral acid.

The reaction of colemanite ($Ca_2B_6O_{11}.5H_2O$) in the sulfuric acid (H_2SO_4) solution results in boric acid (H_3BO_3)and gypsum ($CaSO_4.2H_2O$). Gypsum crystals are precipitated and boric acid is produced by crystallization.

Usage and Benefits:

Glass: Boric acid is used in the production of special type glasses (oven glasses, glass laboratory materials, etc.) and glass fiber. It prevents devitrification in glass production. It increases the resistance of glass against heat, chemicals and mechanical impacts. Boric acid is used in the production of single-filament fiberglass (textile-grade glass fiber). Higher and more consistent B_2O_3 levels when compared to colemanite, which is another material used for producing textile grade

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glass fiber; lack or refractory mineral content (such as Mg, Si, Al, Fe, St, S and As) and low melting point make boric acid more useful. It increases fiberizing in isolation and reinforcement fiber glasses by reducing viscosity. Moreover, it increases the physical and humidity resistance of fibers by reducing their tendency to crystallize.

Ceramics: Boric acid is used as a binder in ceramics. As a result of the addition of boric acid, melting and adhesion occur at lower temperatures. It enhances the resistance of ceramic products to breakage and scratches in the face of physical impacts, and strengthens their chemical resistance. It is used in glazing and enamel coating where sodium is not desired in the formulations. Furthermore, it is used as a reinforce in the production of ceramic wet tiles. It improves condensation properties in porcelain tiles by increasing the vitrification temperature. It is one of the materials used in the production of ceramic and porcelain enamel frit.

Detergent: Boric acid is used as a germicide and bleaching agent. It can be added to soap and detergents due to its water-softening and germicide properties. It has the effect of reducing the washing time and temperature.

Agriculture: Boron is one of the nutrients required by plants. It plays an important role in plant yield, flowering and pollen production and seed development. Boric acid can be used alone or in combination with standard fertilizers in soils with low boron content. It is used in the production of disodium octaborate tetrahydrate, which is used as a boron fertilizer in agriculture, and in the production of herbicides.

Fire retardant: Boric acid is the basic form of borate-based fire retardants which are used to reduce the kindling rate of burning substances. In the recent years, it has become important for giving fire retardant properties to resin-based wooden composite panels and for being used as a protective materials in timber and solid wooden products. It can be used together with disodium octaborate tetrahydrate as flame retardant material in wooden composite materials, marine, yacht and aviation coatings. It is added to fire bricks and mortars to provide resistance against heat or corrosion.

Nuclear energy: It is used for neutron retention in nuclear power plants for reducing the rate of neutron fission generation. Natural boron contains 20% ^{10}B and approximately 80% ^{11}B. ^{10}B has a high cross-sectional area for the retention of low-energy neutrons. When more boric acid is added to the reactor cooler and is allowed to circulate inside the reactor, the probability of neutron fission is reduced. Therefore, boric acid can effectively control the fission rate

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inside the reactor. This method is utilized in Pressurized Water Reactors. Boric acid is also used for keeping the neutron multiplication under control in spent fuel pools containing uranium rods.

Wood protection: Boric acid is used as a protective agent against rotting on dry or wet wooden surfaces. It can also be applied as gel or solution on wooden surfaces. Protective agents with borate compounds are successfully used in marine industry against factors such as moss, fungi and ooze.

Medicine: Boric acid can be used as an antiseptic. Dilute solutions of boric acid can be used as eye-washing solutions. Dilute boric acid solution is also used as an anti-bacterial agent. It can be used for the treatment of external otitis in solution form.

Anti-bacterial agent and for cleaning: In industry, it is used as an anti-corrosive and anti-bacterial material in metal coating processes. It is also used in the production of boron-based herbicide and artificial fertilizer. Sodium perborate, which is used as an oxidizing and bleaching material in cleaning products, is obtained from boric acid.

Lubrication: The colloidal suspensions of boric acid form a good lubricant for ceramic and metal surfaces when they are added to petroleum and vegetable oils and they significantly reduce the friction coefficient.

Various industrial productions: In the petrochemical industry, it catalyzes the oxidation of hydrocarbons in the production of Nylon 66 and increases the efficiency of the conversion of hydroxyl groups into alcohols with further oxidation. It is used in the production of ferro-boron which is used in the production of steel, casting, neodymium-iron-boron magnets and amorphous metals. In metallurgical operations, it reduces the energy consumption by having a positive effect on the fusing temperature; enables the durability of steel to increase and has a plasticizing function when used as a slag-former. It provides support and extra bonding to strength in the steel, glass, cement and aluminum industries. Adding boric acid to papier-mache increases the strength of papier-mache panels, reduces their weight and prevent wrinkling on their surfaces. It plays a role as an enzyme stabilizer in liquid laundry detergents. Boric acid is used as a peptizer in the production of adhesives containing casein and dextrin based starch.

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Physical Properties:

Specific weight	: 1.51 g/cm^3 (20°C)
Pour (bulk) density[a]	: 0.892 g/cm^3 (Granular)
Molecular weight	: 61.83 g/mol
Melting point	: 450°C
Boiling point	: 1860°C
Heat capacity	: 24.7 J/g°C
Thermal conductivity	: 0.407 W/mK
Specific surface area	: <1 m^2/g
Diffusion coefficient	: 1.1x10^{-5} cm^2/s
Surface tension	: 63.83 mN/m (1.0% aqueous solution by weight)
Colorimetry test	: 94.52 (average L value)

[a] Applies to a representative sample.

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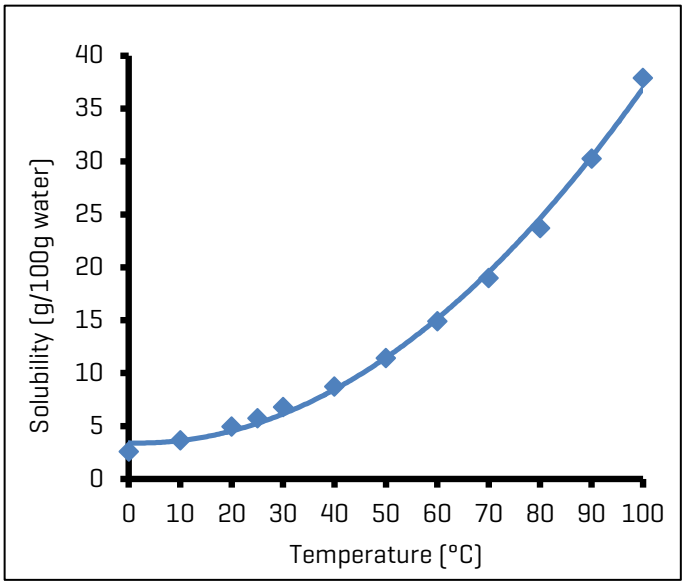
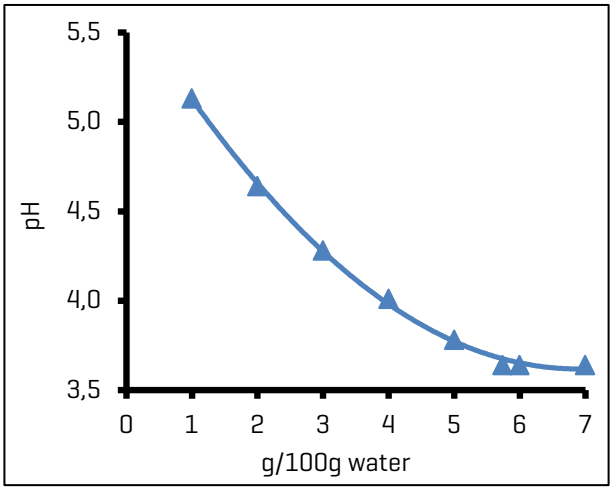
Solubility[b,c]:



Temperature (°C)	Solubility (g/100g water)
0	2.59
10	3.64
20	4.94
25	5.74
30	6.78
40	8.73
50	11.41
60	14.90
70	18.97
80	23.70
90	30.26
100	37.90

Solution pH values:



Solution (g/100g water)	pH (±0.03 / 25°C)
1	5.13
2	4.64
3	4.28
4	4.01
5	3.78
5.74[c]	3.64
6	3.64
7	3.64

[b] Factors affecting the dissolution rate, such as the particle size of material to be dissolved, the mixing speed of the solution are effective on the time to reach the saturation point. The values on the table should be evaluated by taking this into account.

[c] Saturation value of boric acid at 25°C in 100g water is 5.74g.

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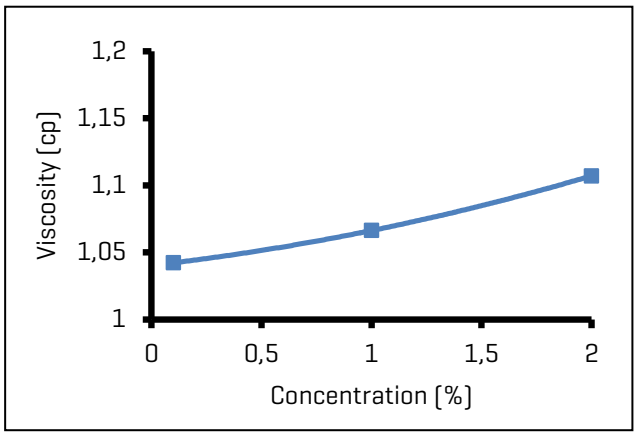
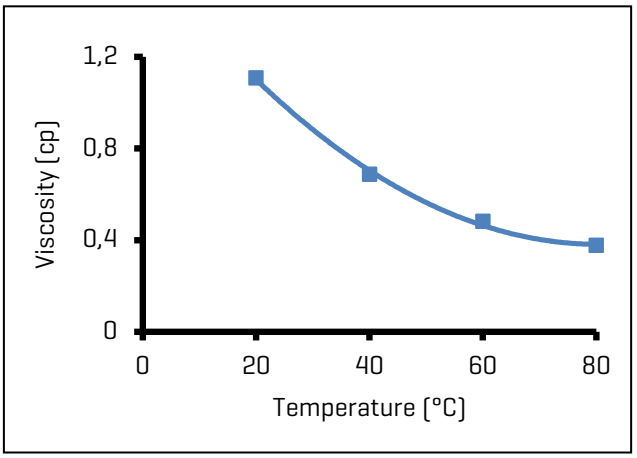
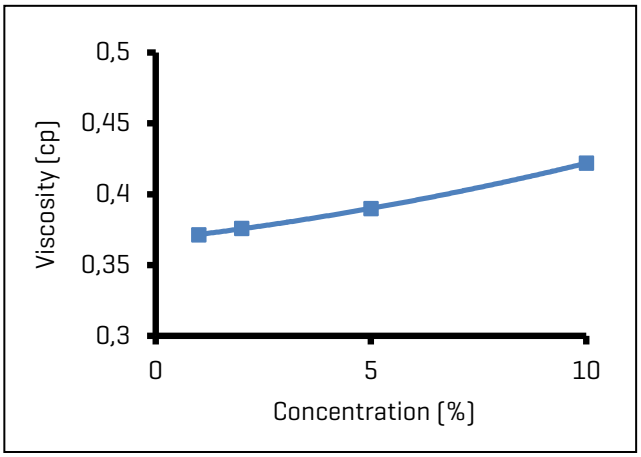
Solution viscosity values:



Temp. (°C)	Conc. (%)	Viscosity (cp)
20	0.1	1.04
20	1	1.07
20	2	1.11



Temp. (°C)	Conc. (%)	Viscosity (cp)
20	2	1.11
40	2	0.69
60	2	0.48
80	2	0.38



Temp. (°C)	Conc. (%)	Viscosity (cp)
80	1	0.37
80	2	0.38
80	5	0.39
80	10	0.42

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Chemical Content:

Component	Content				
	Granular			Powder	
	Normal Sulphate	Low Sulphate	Ultra Low Sulphate	Ultra Low Sulphate	Normal Sulphate
Equivalent H_3BO_3	99.92-101.07%	99.92-101.07%	99.92-101.07%	99.92-101.07%	99.92-100.89%
B_2O_3	56.25-56.90%	56.25-56.90%	56.25-56.90%	56.25-56.90%	56.25-56.80%
B	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.64%
Water-soluble B	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.67%	17.47 - 17.64%
SO_4	300 ppm max	130 ppm max	12 ppm max	12 ppm max	300 ppm max
Cl	5 ppm max	5 ppm max	3 ppm max	3 ppm max	5 ppm max
Fe	4 ppm max	4 ppm max	3 ppm max	3 ppm max	4 ppm max

Heavy metal content:

Component	Content (mg/kg)
As	0.450 max
Cd	<0.005
Pb	<0.010
Cr	<0.005
Hg	<0.010

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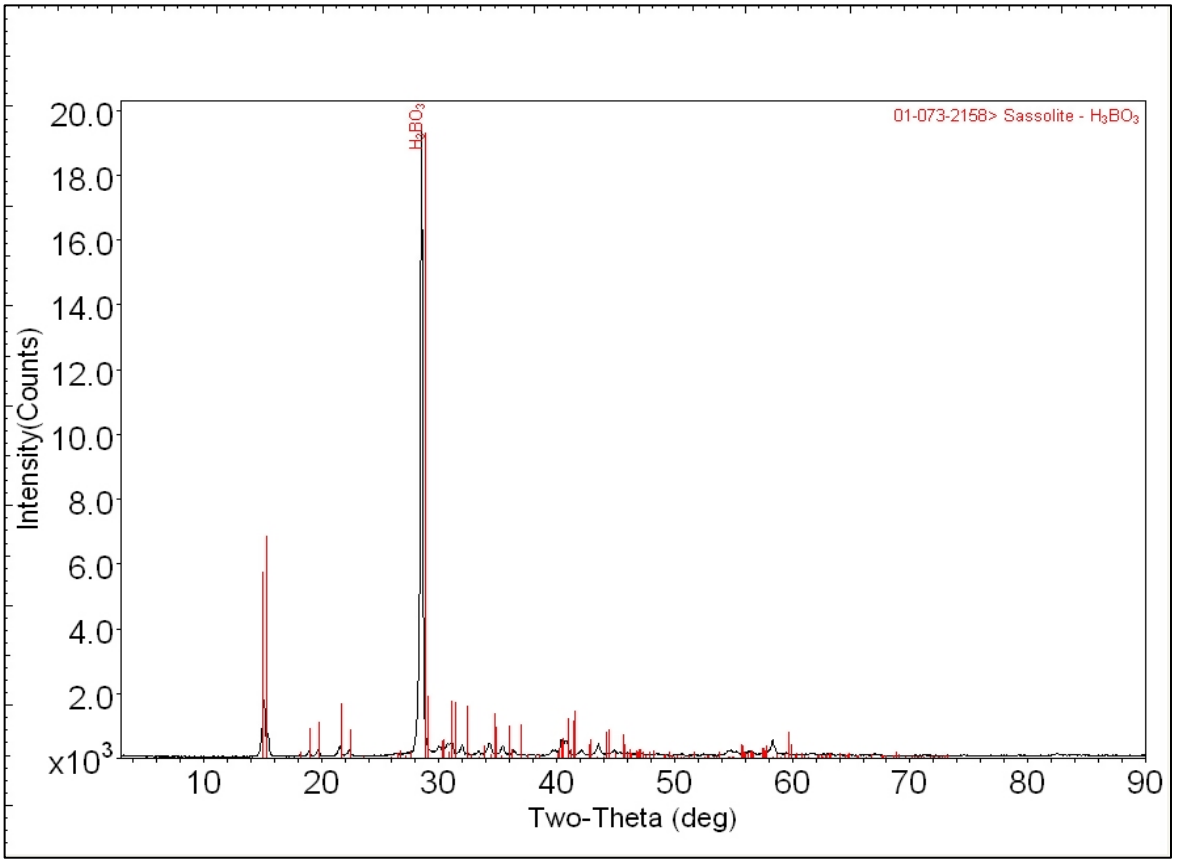
Particle size:

Size	Content				
	Granular, Normal sulphate	Granular, Low sulphate	Granular, Ultra Low sulphate	Powder	Powder, Ultra Low sulphate
+1.000mm	4% max	4% max	4% max	0% max	0% max
-0.063mm	4% max	4% max	4% max	-	
-0.125mm	-	-	-	45% max	45% max

X-Ray Diffraction Analysis:



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