

# DUSTEX

## METHODS FOR TREATMENT OF SAND DUNES



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## **INTRODUCTION**

Borregaard LignoTech's products are based on lignin, one of nature's most abundant substances.

Lignin, a natural polymer, is a major component of wood. It imparts rigidity to the cell walls and acts as a binder between the wood cells, creating a composite material that is outstandingly resistant to impact, compression and bending.

A majority of Borregaard LignoTech's products are sulphonated lignin products, called lignosulphonates. They are used in applications such as dispersants in pesticides and dyes, oil well and concrete additives, animal feed and dust binder.

An important property of lignosulphonates is their ability to act as binders.

The absorption of adhesive is both chemical and physical in nature. The absorption is caused by intermolecular forces between the sulphonated lignin molecules and the molecules on the surface of the particles to be bonded.

The size of the adhesive molecules is important for the formation of the cohesive bond and is also partly responsible for the strength of the cohesion.

Lignosulphonates have been found to be effective binders for different types of sand and soils.

# **DUSTEX**

**DUSTEX** is one of Borregaard LignoTech's lignosulphonate products.

**DUSTEX** is an organic, non-toxic sand and soil stabiliser with the properties required of a good binder to prevent wind erosion. The powder is hygroscopic and absorbs moisture from the atmosphere and binds the water in the ground.

**DUSTEX** is an excellent binder for most types of minerals and humus materials. It acts as a binder and glues the particles together. When used in a top layer this becomes so stiff that individual particle movement is eliminated.

A **DUSTEX**-bounded surface is hard and presents resistance against winds up to gale force.

The use of **DUSTEX** as a binder reduces unpleasant dust and disturbing sand blast.

When the **DUSTEX** solution is sucked into the top layer it makes an effective adhesive bond between the sand particles and a hard crust is formed when the surface dries.

Wet sand resists very high wind velocities, but dry sand shifts readily at a wind velocity of 2 – 3 m/s. According to our tests a **DUSTEX** treatment of 0,05-0, 15kg/m<sup>2</sup> is sufficient for dry sand surfaces to withstand wind velocities up to 40 m/s.

## **HOW AND WHEN TO USE DUSTEX ON SAND DUNES**

There are two main reasons why **DUSTEX** is used.

1. Health - To suppress unhealthy and unpleasant dust
2. Technical - To avoid damage and disturbance from blowing sand

**DUSTEX** is preferably used on sandy areas which should be kept in place for one or several reasons e.g.

- prevent wind erosion and facilitate growth of new vegetation
- reduce unpleasant dust around settlements, office and quarters
- prevent sand drifting over roads, air-fields, parking places, gardens and farmlands
- stabilise road shoulders

The aim is to bind the particles to form a strong surface withstanding high wind velocities.

## **METHOD FOR SAND DUNES STABILISATION**

There are several ways to achieve the required result. The application method depends on

- the area to treat
- available equipment
- expected mechanical loads and wear after treatment

Regardless of the method used, the principle is:

1. To get the DUSTEX powder spread and dissolved in such a way that it can penetrate and be spread throughout the particle layer to be stabilised.
2. To adjust the amount of DUSTEX powder in accordance with the amount of material to be bound, the exposure to mechanical stress and air void in the layer.
3. After distribution the layer shall dry out so the DUSTEX bond can glue the individual particles and form a strong rigid layer.

DUSTEX can be spread as powder or solution. However, the best effect is achieved when DUSTEX is spread as a solution.

When spread as powder only the surface will be bound. In this case a good protection against wind erosion is obtained but it will have a limit resistance to mechanical stresses.

Type of aggregate to be bound:

Most types of minerals and humus materials can be bound. The technique used in each case depends on the ability to absorb moisture and the porosity of the material, compacted as well as non-compacted.

The methods described in the following refer to “sandy” materials, e.g. the majority of the particles (40-70%) is within the range of 0,2-2 mm and particles below 0.074 mm is between 5-10%. No single particles should be larger than half of the thickness to be bound.

**PLEASE REMEMBER:** It should be possible for the dissolved DUSTEX to penetrate the whole layer that shall be bound.

The more compact the layer, the stronger it will be.

A thicker DUSTEX bound layer is stronger than a thinner.



## SPREADING OF DUSTEX

DUSTEX can easily be applied as solution or powder. No special type of equipment is required. Almost everything from a bucket or shovel up to modern agricultural machinery for fertilisers or pesticides can be used. If large areas are to be covered, air planes adapted for agricultural applications can be used.

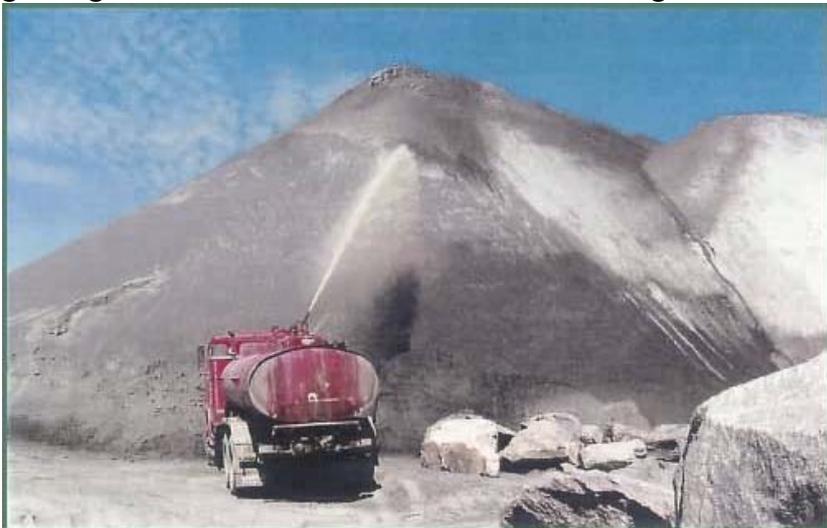
The strength of a DUSTEX crust is, however, as strong as the thinnest part of the layer. Therefore, please consider how evenly the product is spread with the equipment when calculating the dosage. Generally, to obtain a determined degree of protection a good sprinkling or spraying system for solutions requires less DUSTEX than an ineffective spraying system or the powder method.

### As solution:

The durability of a crust is dependent on the quantity of DUSTEX used and the thickness of the layer. A general rule how to optimise the combination quantity and thickness cannot be given. It is dependent on both the constitution of the sand to be bound and types of stresses involved.

The concentration of a DUSTEX solution and the constitution of the sand to be bound influence the penetration and hereby the thickness of the layer. The more dilute the solution is, the thicker the layer will be.

DUSTEX is easily soluble in water and to prepare a solution add powder slowly to water with good agitation. A detailed instruction for dissolving of DUSTEX is enclosed.



If a solution should be stored for a period of time, a preservative or fungicide should be added, e.g. 1% (calculated by volume) of formalin.

When sprinkler or spraying equipment is used, all fine meshed sieves, if any, have to be removed before spreading.

The best result is obtained if the solution is spread on by rain or dew wet surface. After spreading, the equipment used should be cleaned with water.

### As powder:

To reach the binding properties of DUSTEX the powder has to be dissolved, because first when moistened it gives tack and adhesiveness. As the product is hygroscopic, this can be obtained by the absorption of moisture from the atmosphere, which takes place when the relative humidity is high. Naturally, it is more rapidly dissolved in rain or in dew. It is recommended to apply powder when the relative humidity is high and there is a big difference between day and night temperature. The powder is then best spread either early in the morning on a ground wet by dew or late in the afternoon just before the dew falls. After use the equipment should be cleaned with water.

### The area to be treated:

Areas which should be prepared with DUSTEX ought to have locations where they are protected from drifting sand eroded from untreated zones. Best result can therefore be expected to be obtained if a large continuous area is prepared. The area ought to have its biggest extension in the pre-dominant wind direction and, if possible, be protected in the windward, e.g. by vegetation, mountains or ridges.

### Period of spreading:

The period of time to spread DUSTEX should be chosen with consideration to the local climatic conditions.

If the region has a relatively fixed rain period and as DUSTEX is water soluble leaching cannot be avoided at a large rainfall. Therefore it is recommended to spread DUSTEX at the end of that period.

For the best result it is recommended to apply DUSTEX on a moist surface. In regions with high relative humidity the best period might be in the morning or in the evening when the dew has wet the ground.



## HOW MUCH DUSTEX SHOULD BE USED:

DUSTEX is a glue and the water is used as solvent so the glue (DUSTEX) can be spread as uniform as possible. The water also lubricates the particles and facilitate the compaction of the aggregates.

The amount of DUSTEX, the dosage, to be used is related to the amount of material to be bound and the active surface area of this material. Generally, between 1 and 3% dry matter of DUSTEX is needed, calculated by weight on dry material to be bound.

The amount of water to be used, the concentration, is related to the actual moisture content of the aggregate and the efficiency of the spreader equipment. Dry aggregate and “splashing” require more water than moist aggregate and accurate spraying with good spreader equipment.

For efficient protections of sand dunes against wind erosion a dosage of 0,05-0,15 kg DUSTEX powder per square metre is recommended. If the sand dunes has to withstand mechanical loads and wear the dosage should be increased. With an application rate of 0,15 – 0,5 kg DUSTEX powder per square metre the surface will have a very good mechanical resistance. The more compacted the sand is the higher load it will be able to withstand.

With a perfect compaction and a dosage of 0,3 kg DUSTEX powder per square metre the surface can withstand heavy lorry transport over a period of several months.

The best way to apply DUSTEX is as a solution. It is recommended to adjust the concentration so the solution penetrates the layer to a thickness of:

- A. Minimum 3 –5 mm and maximum 10 mm for protection against wind erosion.
- B. Minimum 10 – 15 mm and maximum 35 mm for protection against wind erosion and moderate dynamic loads.

For further details compare figures in the enclosed “Ready Reckoner Table for Stabilisation of Sand Dunes with DUSTEX”.

When DUSTEX is applied as powder it is more difficult to spread an equally thick layer. Therefore, a treatment with powder requires around 50% more material than if spread as solution.

DUSTEX is water soluble and in case of heavy rain after the spreading the crust runs the risk of being attenuated. Before the surface has dried up it is therefore recommended to remedy the crust with half the used dosage.

The small amount of binder can be used if the surface is moist, even and compacted. Then the best result is achieved. However, it is almost impossible to have an even surface, which means that more DUSTEX has to be applied to get a good coverage of both “ridges and valleys”.

Also, if the surface is loose more DUSTEX has to be spread as the material has to be bound to a thicker depth. (A well compacted surface is better bounded by itself). If the surface is dry

more water is required to moist the surface so DUSTEX really is spread over the entire area. On a dry area the solution tends to be concentrated on the spots where it first hits.

Sharp edges needs more binder than plane surface.

Areas exposed to wind needs more than areas in wind shadows.

If the treated area is exposed to rain the DUSTEX treatment will last longer if the rain could be rinsed away, e.g. smooth declined surfaces.

If the treated area is compacted it should be protected from exposure from mechanical stresses. A smaller wound can rapidly grow and the wind erosion protection jeopardized.

The sooner a wound in a bounded surface could be healed by an additional DUSTEX treatment the better it is and the less of material have to be used.

We reserve the right to change given data without prior notice.

# Ready Reckoner Table for Stabilization of Sand Dunes with DUSTEX

**This table gives the correlation between Powder, Dissolving-Water and Dosage per sq m.**

DUSTEX is a glue and the water is used as solvent so the glue (DUSTEX) can be spread as uniform as possible. The water also lubricates the particles and facilitate the packing of the aggregates.

The amount of DUSTEX, the dosage, to be used is related to the amount of material to be bound and the active surface area of this material. Generally, between 1 and 3% dry matter of DUSTEX is needed, calculated by weight on dry material to be bound.

The amount of water to be used, the concentration, is related to the actual moisture content of the aggregate and the efficiency of the spreader equipment. Dry aggregate and “splashing” require more water than moist aggregate and accurate spraying with good spreader equipment.

The concentration shall be chosen so that the solution can penetrate down through the material till the desired thickness of the bound layer.

				Litres of solution per square meter for desired dosage for protection against						
				Wind erosion and moderate dynamic loads						
				Wind erosion						
				Dosage in kg DS per square metres						
				0,06	0,08	0,125	0,15	0,2	0,3	0,5
A	25 kg	750	3	1,6	2,6	4,1	4,9	6,6	9,9	
B	25 kg	450	5	1,0	1,6	2,5	3,0	4,0	5,9	9,9
C	25 kg	270	8	0,6	1,0	1,5	1,8	2,4	3,6	6,1
D	25 kg	210	10	0,5	0,8	1,2	1,4	1,9	2,9	4,8
E	25 kg	170	12	0,4	0,6	1,0	1,2	1,6	2,4	3,9
F	25 kg	130	15		0,5	0,8	0,9	1,2	1,9	3,1
G	25 kg	100	19		0,4	0,6	0,7	1,0	1,5	2,5
H	25 kg	70	25			0,5	0,5	0,7	1,1	1,8
I	25 kg	50	31			0,3	0,4	0,6	0,8	1,4
J	25 kg	40	36				0,4	0,5	0,7	1,2
K	25 kg	35	39					0,4	0,6	1,1
L	25 kg	30	43					0,4	0,6	1,0
Thickness of the layer to be bound: Minimum				3 – 5 mm				10 – 15 mm		
Maximum				10 mm				35 mm		

### **Instructions for dissolving of DUSTEX**

The following procedure may be used irrespective of the type of tank and method of agitation

1. Fill about 50-60% of tank volume with water.
2. Start the agitation, mechanically by stirring with a paddle or a propeller-agitator. Another alternative is to use a pump and circulate the water.
3. Add powder slowly. The addition should be carried out continuously with a fine and even powder stream, so the formation of lumps is avoided. (If this circulated water (solution) is sprayed in a fine mist, in which the powder is poured, the best and quickest dissolving is achieved.
4. When all powder has been added, check if the solution is free from lumps.
5. Add water to calculated volume.

Dissolving is facilitated by using warm water. However, the water should not be steaming, which case the powder turns sticky.