



# SLUDGE TECHNOLOGIES

SLUDGE DRYING TECHNOLOGIES  
SLUDGE FEEDING SYSTEMS  
WET AND DRY SCRUBBER TECHNOLOGIES

REDCO PROCESS ENVIRONMENTAL AND ENERGY TECHNOLOGIES

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## General Description

REDCO offers solutions for sludge drying process after dewatering of municipal or industrial sludge under most feasible solutions. Natural energy sources such as solar energy is used in the process. The sun is a natural resource that can always be used to evaporate water with its unlimited energy. The process evaporates water, reducing sludge in mass and volume. Under normal conditions, 720 kWh of thermal energy is needed to evaporate 1000 liters of water.

REDCO Technology provides an economic contribution while providing efficient and modern facilities in the drying process, which is the next step in sludge disposal after dewatering. REDCO sludge mixing machine is the main equipment of the solar drying plant. It consists of two main parts, a movable steel bridge and a height-adjustable, rotating drum.

## Process Description

The sludge laid on the ground in a greenhouse surrounded by a polycarbonate sheet, which ensures the best use of solar energy, is exposed to direct solar radiation. The sludge laid on the floor with a maximum thickness of 50cm is mixed with mixer machine. In this way, the moist part at the bottom is placed on top and the dried part on the bottom is placed.

The water in the sludge evaporates under the influence of solar energy, and the moisture layer caused by evaporation on the sludge surface spreads away from here with the help of circulation fans placed at optimum intervals on the greenhouse halls. The water-saturated steam is spread away from top of the sludge with the circulation fans, removed of the greenhouse hall with exhaust fans at the outlets. Fresh air is supplied to the system again from openings at the side along length.

The sludge that reaches the desired dryness is removed from the system by the loader or automatically. The system is constantly controlled via remote communication.



### Advantages

- Reduction of cost for transportation and disposal of sludge
- Minimum operational and maintenance cost
- Manually or automatically wet sludge feeding and dry sludge transferring
- The sludge can be transported continuously throughout the drying hall during drying. It is also possible to dry the wastewater treatment sludge in batch systems.
- The sludge is continuously mixed homogeneously to avoid odor.
- High standards of occupational safety are ensured. The whole drying plant is automatically controlled by PLC, including the REDCO system and ventilation.
- Personnel requirement will not exceed 20-30 minutes per day.
- All relevant climate data are evaluated and processed for the controlling

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## General Description

Rotary Belt Dryers; In a drying system consisting of steel pallets bedded on chains and insulated cabinets, the product is transported horizontally and dried with the help of fans. Rotary Belt Dryers are mainly used for wastewater treatment sludge, fertilizer, sawdust, bark, etc. in the biomass industry. It is a type of dryer preferred in drying processes for products.

Thanks to the Rotary Belt Dryers, 25% dry matter ratios in wastewater treatment sludge can be drawn up to 90% dry matter ratios. The reasons for drying the sludge include reducing the amount of water in the sludge and thus the amount of sludge, increasing the calorific value of the sludge and thus facilitating the combustion of the sludge without using additional fuel, cleaning the sludge, stabilizing the sludge, obtaining a fertilizer and sludge with high market value.

## Process Description

- ❶ The dehydrated sludge with a DS content of about 20-30% is fed to the dryer.
- ❷ The moist sludge cake is pressurized up to 15-16 bar by means of a pump and fed to the granulation unit placed in the feed section.
- ❸ The granulation unit ensures that the sludge is distributed evenly on the belt in the form of thin long strips with a diameter of 9-11 mm.
- ❹ A special cutting mechanism ensures that the thin long strips are of equal length and that the nozzles are constantly clean. The belt carries the dispersed sludge cake to the drying chamber .
- ❺ The air, whose temperature is increased to 90 - 150°C with the heater, is fed into the drying tunnel and passed through the sludge bed.
- ❻ 90% of the hot air is reused after condensation.
- ❼ Since the fans that provide air transfer are placed on the outlet side, the plant is operated under low pressure (in suction mode).
- ❽ Fans and conveyors are controlled by frequency inverter. It is possible to adjust the plant parameters according to the operating conditions and to obtain the best drying efficiency.
- ❾ In two-belt systems, the sludge passes through the drying tunnel twice, thanks to two belt conveyors placed one above the other.
- ❿ In order to obtain a homogeneous final product structure, when the sludge pile reaches the middle of the lower belt, it is inverted and mixed with a mixing device.
- ⓫ The product that has passed through the drying chamber is transferred to a conveyor at the end of the belt, ready to be transferred to other stages of the process.
- ⓬ At the end of the process, dried sludge with 65-95% DM content can be obtained.



## Advantages

- ❶ Efficient drying even at high sludge feeding capacities
- ❷ Drying of granular products of 20 mm and above or products with sludge consistency with pasta form
- ❸ Maximum efficiency with long oven residence time for products containing high humidity and difficult to dry
- ❹ Different drying times with adjustable belt system
- ❺ Belt system made of special steel
- ❻ High flow circulation fans
- ❼ Insulated cabins
- ❽ Compact and robust stainless steel design
- ❾ Low maintenance and long life

## General Description & Process Description

Paddle dryers are high speed indirect paddle dryers/coolers suitable for drying and heating filter press outlet mine waste, sludge liquids, filter sludge, pastes, powders and granules. It has a jet rotor design that allows gas or liquid to be injected through the paddles into the thin layer of material while spiraling by the cylindrical wall of the unit. It is designed for the use of various heat sources and has many applications. It is extremely fast and effective. Paddle dryers also process heat-sensitive materials that transform them from freely flowing solids into wet cakes and slurries.



### Advantages

- High Thermal Efficiency
- Precise Temperature Control
- Homogeneous Product Quality
- High Heat Transfer Area
- Easy Operation
- Simple and durable design for easy and low maintenance

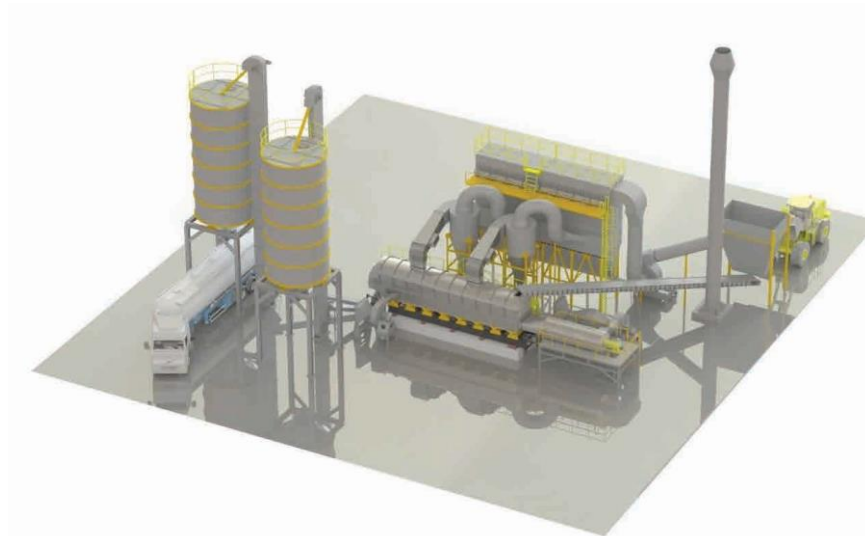
## General Description

Fluidization process; is the suspension of the particles by passing the pressurized air through the fan through the solid particles to be fluidized at high speed against the gravitational force acting on the product. A homogeneous structure occurs in the suspended product. This ensures maximum efficiency in the product to be dried. Fluid bed dryers and coolers are an ideal solution for the aggregate and mineral industry. Drying systems for minerals and aggregate consume a lot of energy leading to high operating costs and low margins. Abrasion and aging due to the abrasive properties of the processed materials also means frequent maintenance and repair or replacement costs. These costs have been reduced to minimum levels thanks to the Fluid Bed Dryers. Fluid bed dryers offer 25-30% energy cost reduction compared to other dryers due to their working principles. Together with the heat recovery systems, they play an important role in energy efficiency by recovering the hot air they expel from the chimney.

## Process Description

Basically, a fluid bed dryer is a combination of a perforated plate and a drying chamber. Wet material is fed onto a perforated plate at a controlled bed depth. The hot air used as the drying medium is blown into the dryer from the bottom of the perforated plate, passing through precision holes at high speed to the material bed with fluidizing effect. Wet material particles are mixed thoroughly by turbulence in the dryer and high level of heat exchange is ensured.

The vibrating fluidized bed dryer is equipped with a high frequency vibration motor. This motor increases the efficiency of the heat exchange between the hot air and the wet product and carries the wet product to the outlet during drying. In addition, this vibration can be used to control the holding time of the product in the dryer and this time may vary depending on the physical properties of the dried product.



## Advantages

- ☞ Very high thermal efficiency thanks to the fluidized bed and large heat exchange surface
- ☞ More energy efficient than other dryers
- ☞ Different products can be used in the same drying
- ☞ Takes up less space
- ☞ Cooling possibility on the same body
- ☞ There is no friction or wear between the dryer part and the product.
- ☞ Fast and uniform heat transfer
- ☞ Short drying time
- ☞ Low temperature drying
- ☞ Drying of products in sizes between 50 microns-5mm
- ☞ It requires easy maintenance due to the low number of parts.
- ☞ Effective process control

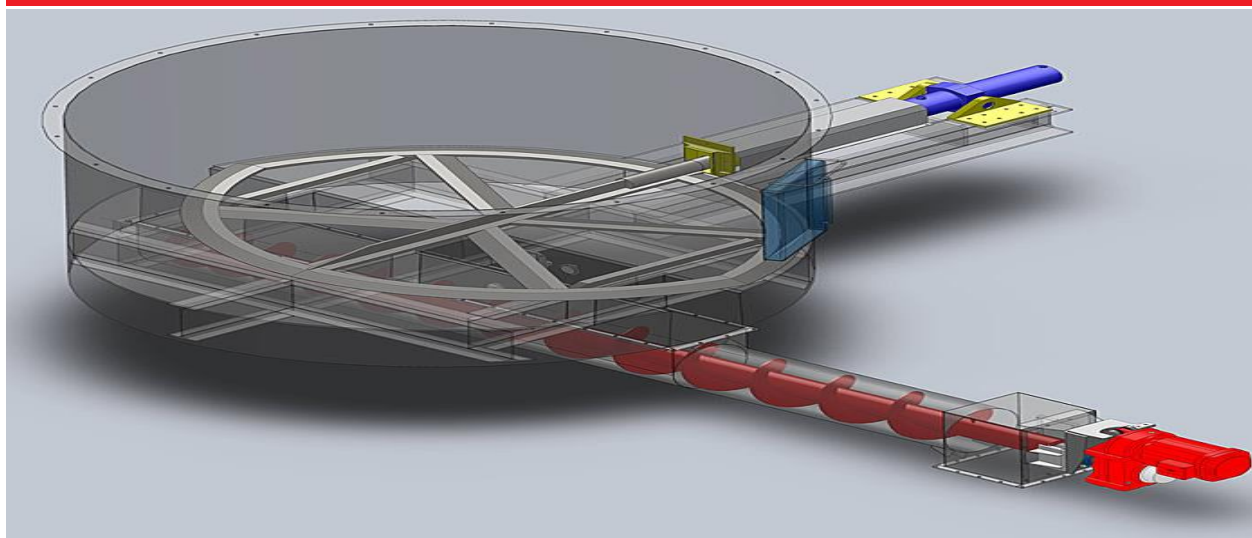
## SLIDING-FRAME SILOS

An incredibly effective extraction technique that makes it possible to discharge non-free-flowing material from a flat bottom silo is a sliding-frame. By creating a bridge of material, it prevents heavy objects from obstructing the bottom of the silo.

In order to facilitate material discharge, the sliding-frame fractures any bridges that may form across the extraction screw and pushes and pulls the material towards the silo's center.

An appropriate silo for non-free-flowing products including dewatered sewage sludge, wood chips, cellulose, gypsum, and garbage is a sliding-frame silo.

	Volume	Outloading Capacity
<b>Round Sliding-Frame Silos</b>	<b>38 - 405 m3</b>	<b>0 - 230 m3/h</b>
<b>Rectangular Sliding-Frame Silos</b>	<b>38 - 994 m3</b>	<b>0 - 230 m3/h</b>



Multiple spiral screws (usually 2-8) form a rectangular layer of moving screws to eliminate bridging or clogging of the stickiest sludge.

Large diameter, high pitch volutes can provide high torque and fast but controllable unloading speeds, or very low pump discharge unloading speeds.

Very low speed minimizes trough lining wear.

Basic operation, lineal drive and few moving parts ensure almost no maintenance. The inside of these silos should be inspected every 5 to 10 years.

Sludge is pulled or pushed toward a central extraction screw by a steel frame that slowly reciprocates and is hydraulically powered.

Controlled outloading rates are provided to enable quick truck filling down to pump feed.

Allows the construction of vertical walls and cylindrical silos, optimizing volumetric use with the possibility of reducing height or usable area.

Removes any possibility of bridging, arching or suspending - the flow is first in, first out.

Trustworthy, silent and easy operation

Also applicable to rectangular silos, concrete bunkers, and truck receiving bunkers.

## General Description & Process Description

Scrubbers can be either “dry” or “wet.” Dry scrubbers use solid materials for pollutant removal, while wet scrubbers use liquid solvents. Both remove gas pollutants and related odors from industrial exhaust streams. In general, wet scrubbers achieve a higher level of pollutant removal than dry scrubbers.

Scrubbers are vital for industrial manufacturing or wastewater treatment facilities, as they keep pollutants from contaminating outside air. Any industries that produce air pollutants might use wet air scrubbers of various designs and construction.

### Working Principle of Wet Scrubbers

Wet scrubbers work by absorbing pollutants with water or a water-based solvent. In the wet scrubber, the contaminated gas enters at the bottom and passes upward through the packed bed and downward-flowing solvent sprays.

The pollutants are collected in the solvent droplets, and before the gas leaves the scrubber, it passes through a mist eliminator to capture any droplets. The liquid solvent sits in a metal or composite container. Contaminated gas moves through the solvent. As it does, the solvent absorbs the contaminants, and the scrubber releases clean gas.





## Wet Scrubbers Control Parameters

Wet scrubbers can control airborne pollutants. Industries or plants that produce such pollutants should consider using wet scrubbers to minimize environmental impact and human safety risks. Wet scrubbers can help reduce any of the following air pollutants.

1. Inorganic Fumes, Vapors and Gases
2. Volatile Organic Compounds
3. Particulate Matter
4. Hazardous Air Pollutants



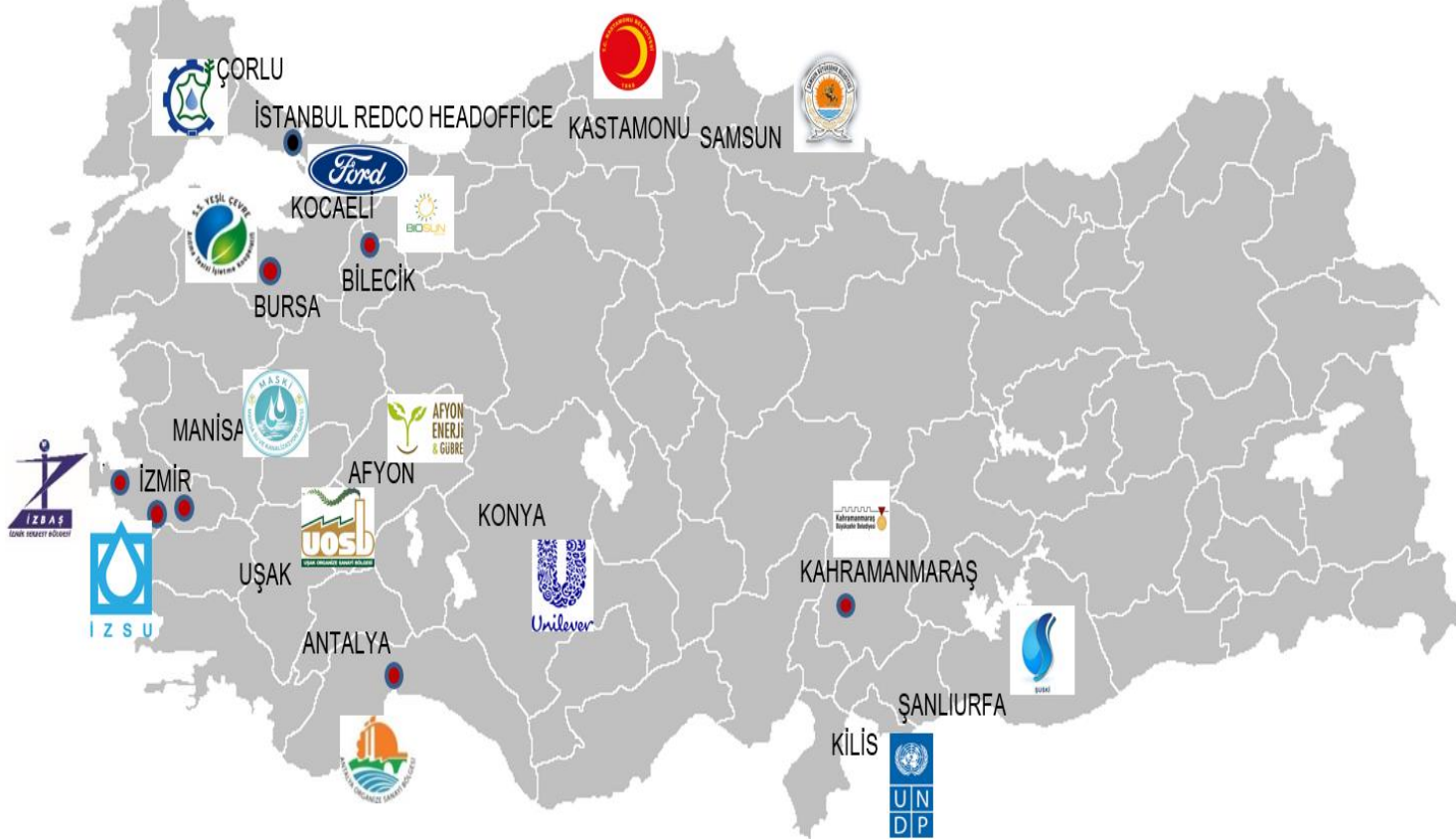
## Advantages of Wet Scrubbers

Wet scrubbers are advantageous for many reasons. Efficient wet scrubbers use the best construction materials and designs to create a cost-effective and successful system.



- ✓ High Mass-Transfer Efficiencies
- ✓ Packing Height or Type Adjustments
- ✓ Relatively Low Capital Cost
- ✓ Relatively Low Pressure Drop
- ✓ Small Space Requirements
- ✓ Collects Particulate Matter as Well as Gases

**REDCO REFERENCES IN TURKEY**



**REDCO ON-GOING PROJECTS IN TURKEY & EUROPE**



**BELT TYPE SLUDGE DRYER  
COMPLETED PROJECTS**



End User	Capacity
<b>ÇORLU DERİ OIZ (Leather Industry Sludge)</b>	<b>80 tons/day</b>
<b>İZSU ÇİĞLİ WWTP (Digested Sludge)</b>	<b>800 tons/day</b>
<b>HEXAGON BIOSUN (Biomass)</b>	<b>78 tons/day</b>
<b>AFYON ENERJİ (Manure)</b>	<b>75 tons/day</b>
<b>SAMSUN MUN. (Municipal Sludge)</b>	<b>144 tons/day</b>
<b>KAHRAMANMARAŞ MUN. (Municipal Sludge)</b>	<b>160 tons/day</b>

Wet Sludge Inlet DS rate	Dry Sludge Outlet DS rate	Commissioning Date
<b>22 %</b>	<b>50 %</b>	<b>2015</b>
<b>22 %</b>	<b>90 %</b>	<b>2013</b>
<b>45 %</b>	<b>65 %</b>	<b>2014</b>
<b>25 %</b>	<b>70 %</b>	<b>2016</b>
<b>30 %</b>	<b>90 %</b>	<b>2017</b>
<b>25 %</b>	<b>90 %</b>	<b>2018</b>

## SOLAR SLUDGE DRYER COMPLETED PROJECTS

End-User	Capacity
<b>COMPLETED PROJECTS</b>	
AKHİSAR MUNICIPALITY	24 tons/day
ÇERKEZKÖY OIZ (Pilot Plant)	3 tons/day
MASKI TURGUTLU MUNICIPALITY (Turgutlu WWTP)	19 tons/day
İZSU HAVZA WWTP	5,5 tons/day
İZBAŞ FREE ZONE	15 tons/day
ANTALYA OIZ	10 tons/day
MASKİ (Manisa WWTP)	20 tons/day
ŞANLIURFA MUNICIPALITY ŞUSKİ (WABAG)	120 tons/day
KİLİS MUNICIPALITY (UNDP)	24 tons/day
UŞAK IOZ	30 tons/day
UNILEVER KONYA FACTORY WWTP (REMONDIS)	10 tons/day
ALAŞEHİR MUNICIPALITY	10 tons/day
MOROCCO DAKHLA WWTP (BIWATER)	20 tons/day
KASTAMONU MUNICIPALITY WWTP (IPA EBRD PROJECT)	30 tons/day
ISPARTA OIZ	10 tons/day

Wet Sludge Inlet DS	Dry Sludge Outlet DS	Comissioning Date
22 %	50 %	2012
22 %	50 %	2012
25 %	70 %	2012
20 %	80 %	2014
20 %	80 %	2015
45 %	90 %	2015
25 %	90 %	2018
25 %	90 %	2018
22 %	90 %	2019
25 %	50 %	2019
22 %	80-90 %	2021
22 %	90 %	2021
22 %	60-80 %	2022
25 %	90 %	2022
25%	90%	2018

### SANLIURFA MUNICIPALITY / TURKEY

It is one of the largest solar drying facilities in the Middle East. It is supported by the European Union IPA Projects.



### KİLİS MUNICIPALITY, TURKEY

It is supported by the United Nations Development Programme.



### UNILEVER HPC FACTORY, TURKEY Industrial Sludge



**SOLAR SLUDGE DRYER ON-GOING PROJECTS**

End-User	Capacity
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**ONGOING PROJECTS**

MOROCCO-HAD SOUALEM WWTP (PWT)	20 tons/day
IĞDIR MUNICIPALITY WWTP (IPA EBRD PROJECT) (MASS GEZER)	31 tons/day
BİSMİL MUNICIPALITY WWTP (IPA EBRD PROJECT) (ISTANBUL CEVRE)	14 tons/day
SORGUN WWTP (IPA EBRD WWTP)	13 tons/day
PLOVDIV WWTP (BULGARIA/ KWI INT.)	4500 tons/year
SLIVEN WWTP (BULGARIA/KWI INT. )	27,4 tons/day
ZAPRESIC WWTP (CROATIA) (RIKO d.d.o)	14,7 tons/day
YÜKSEKOVA WWTP (ARBİOGAZ ÇEVRE TEKNOLOJİLERİ)	15,5 tons/day
NIKSAR WWTP (ÇEVTAŞ)	15,1 tons/day

Wet Sludge Inlet DS	Dry Sludge Outlet DS	Comissioning Date
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22 %	60-80 %	---
25 %	85 %	---
22 %	85 %	---
22 %	50 %	---
20 %	70 %	---
25 %	70 %	---
25 %	60 %	---
22 %	50 %	---
22 %	90 %	---







## SLUDGE TECHNOLOGIES

### **REDCO PROCESS ENVIRONMENTAL AND ENERGY TECHNOLOGIES**

Cevizli Mahallesi, Zuhal Caddesi, Füsün Sokak,  
Ritim İstanbul Projesi A3 BLOK 39

Maltepe / İstanbul, Turkey 34846

Phone : +90 (216) 510 60 84

Fax : +90 (216) 510 60 99

E-Mail : [info@redco.com.tr](mailto:info@redco.com.tr)

Web : [www.redco.com.tr](http://www.redco.com.tr)



