# SLUDGE TECHNOLOGIES

## SLUDGE DRYING TECHNOLOGIES
## SLUDGE FEEDING AND TRANSFERRING SYSTEMS

REDCO PROCESS ENVIRONMENTAL AND ENERGY TECHNOLOGIES INC. CO.
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SLUDGE TECHNOLOGIES

# SLUDGE DRYING TECHNOLOGIES

## SOLAR SLUDGE DRYING SYSTEMS

## General Description

REDCO offers solutions for sludge drying process after dewatering of municipial or industrial sludge under most feasable 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. Theoretically, 720 kWh of thermal energy is needed to evaporate 1000 liters of water.

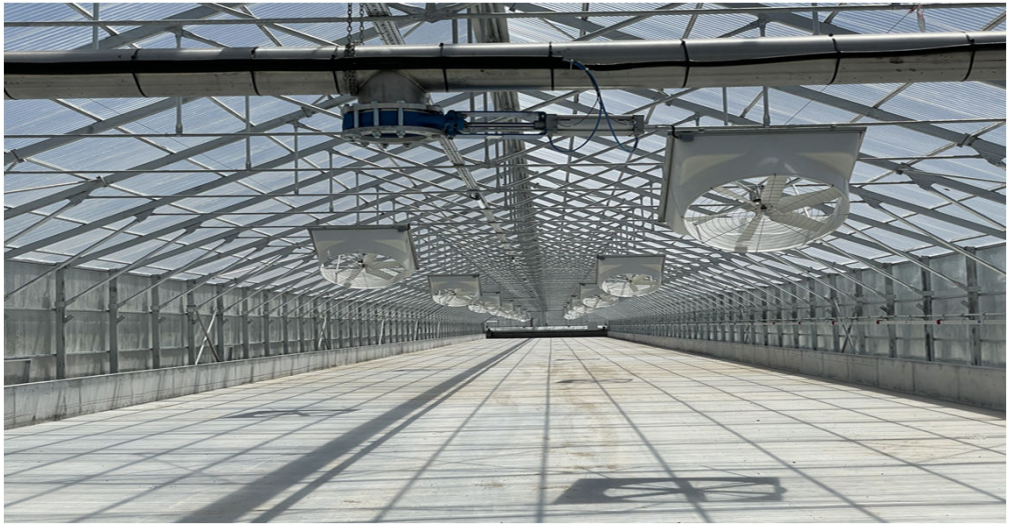
REDCO Technology provides an economic contribution to solar drying by providing efficient and modern facilities in the drying process, which is the next step in sludge disposal after dewatering. REDCO sludge turning machine is the main equipment of the solar drying plant consisting of two main parts,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

## Process Description

The sludge laid on the ground in a greenhouse covered by a polycarbonate sheet (or tempered glass), 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 50 cm is mixed with the turner machine along the drying halls. In this way, the wet/ moist part at the bottom is moved on top, while the dried part is moved to the bottom, allowing a continuous and homogenous mixture.

The water in the sludge evaporates with solar radiation, and the moisture layer caused by evaporation on the sludge surface is dispersed by circulation fans mounted at optimum intervals on the greenhouse halls. The water-saturated steam is spread away from top of the sludge with the circulation fans, and discharged off the greenhouse hall with exhaust fans installed at the outlets. Fresh air is continuously supplied to the system again from openings at the side along lhe ength of the halls.

The sludge that reaches the desired dryness is removed from the system manually by a loader or automatically. The system is constantly monitored by PLC and controlled with remote communication.



## Advantages

- Reduction of cost for transportation and disposal of sludge
- Minimum operational and maintenance cost with 20-30 min per day of personnel intervention and low power consumption
- Manually or automatically wet sludge feeding and dry sludge transferring
- Flexibility to operate both as continuous or batch depending on the operational requirements
- Elimination of odor generation by continuous mixing resulting in homogenous sludge.
- Ensurance of high standards of occupational safety. The whole drying plant is automatically controlled by PLC, including the REDCO system and ventilation.
- Possibility of using dried sludge as fertilizer or soil conditioner depending on the characteristics of the raw sludge .
- Optimized process control by real time evaluation of climate data



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# SLUDGE DRYING TECHNOLOGIES
## THERMAL DRYING SYSTEMS/BELT DRYER

## 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, 18-25% dry solids content in wastewater treatment sludge can be drawn up to 90% dry solids. 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

- The dehydrated sludge with a dry solids content of about 18-30% is fed to the dryer.
- 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.
- 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.
- 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 .
- 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.
- 90% of the hot air is reused after condensation.
- Since the fans that provide air transfer are placed on the outlet side, the plant is operated under low pressure (in suction mode).
- 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.
- In two-belt systems, the sludge passes through the drying tunnel twice, thanks to two belt conveyors placed one above the other.
- 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.
- 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.
- At the end of the process, dried sludge with 65-95% DM content can be obtained.

## Advantages

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



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## 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.

| Type | Volume | Outloading Capacity |
|---|---|---|
| **Round Sliding-Frame Silos** | **38 - 405 $m^3$** | **0 - 230 $m^3/h$** |
| **Rectangular Sliding-Frame Silos** | **38 - 994 $m^3$** | **0 - 230 $m^3/h$** |

- 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.



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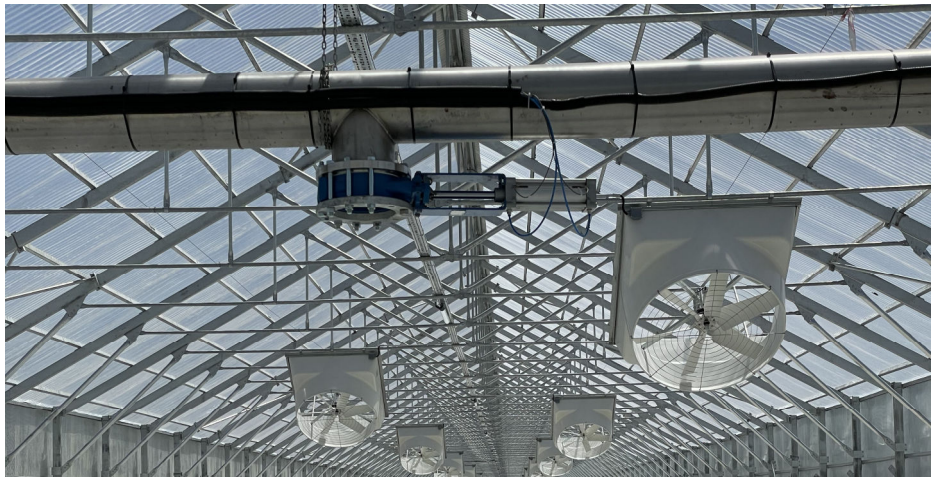
# SLUDGE DRYING TECHNOLOGIES

## WET SLUDGE FEEDING & DRY SLUDGE TRANSFERRING SYSTEM

## Wet Sludge Feeding Systems

The dewatered sludge is feed from the decanter is pumped directly to the greenhouse with a special sludge pump and pneumatic valves. These valves and feeding system were controlled by scada panel. The pump and valves are connected to the automation system and the opening of the desired valve can be adjusted from the automation.

The transfer of wet sludge from the sludge dewatering unit to the solar drying unit and the feeding of the sludge to the halls can be provided completely automatically with screw conveyors. The pneumatic valves of the screw conveyors and feeding pump are controlled by automation. Sludge cake is feed and distributed homogeneously to the solar drying halls.





## Dry Sludge Transferring Systems

Treatment sludge processed in solar drying will be accumulated in an area of 2.5 meters reserved at the end of the drying hall. For unloading, the mixer machine will be switched to unloading mode from PLC and the dried sludge will be fed to the chain conveyor. The chain conveyor will transmit the sludge on the ground to the screw conveyor bunker at the end of the halls by sweeping method.

Dried sludge that collected by chain conveyor is transferred to the truck by vertical screw conveyor.

## REDCO REFERENCES IN TURKEY


## REDCO REFERENCES and ON-GOING PROJECTS IN TURKEY & WORLD



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## SOLAR SLUDGE DRYER

| End-User / Project | Capacity (ton/day) | Wet Sludge DS Content | Dry Sludge DS Content | Start up Date |
|---|---|---|---|---|
| **COMPLETED PROJECTS** | | | | |
| AKHİSAR MUNICIPALITY WWTP | 24 | 22 % | 50 % | 2012 |
| ÇERKEZKÖY OIZ- PILOT PLANT | 3 | 22 % | 50 % | 2012 |
| MASKI TURGUTLU MUNICIPALITY WWTP | 19 | 25 % | 70 % | 2012 |
| İZSU HAVZA MUNICIPALITY WWTP | 5.5 | 20 % | 80 % | 2014 |
| İZBAŞ FREE ZONE WWTP | 15 | 20 % | 80 % | 2015 |
| ANTALYA OIZ WWTP | 10 | 45 % | 90 % | 2015 |
| MASKİ MUNICIPALITY WWTP | 20 | 25 % | 90 % | 2018 |
| ŞUSKİ MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 120 | 25 % | 90 % | 2018 |
| ISPARTA OIZ WWTP | 10 | 25% | 90% | 2018 |
| KİLİS MUNICIPALITY WWTP - UNDP FINANCED PROJECT | 24 | 22 % | 90 % | 2019 |
| UŞAK IOZ WWTP | 30 | 25 % | 50 % | 2019 |
| UNILEVER HPC KONYA WWTP | 10 | 22 % | 80-90 % | 2021 |

| End-User / Project | Capacity (ton/day) | Wet Sludge DS Content | Dry Sludge DS Content | Start up Date |
|---|---|---|---|---|
| **COMPLETED PROJECTS** | | | | |
| ALAŞEHİR MUNICIPALITY WWTP | 10 | 22 % | 90 % | 2021 |
| DAKHLA MUNICIPALITY WWTP | 20 | 22 % | 60-80 % | 2022 |
| KASTAMONU MUNICIPALITY WWTP- EU FINANCED IPA PROJECT | 30 | 25 % | 90 % | 2022 |
| HAD SOUALEM WWTP | 20 | 22 % | 60-80 % | 2022 |
| IĞDIR MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 31 | 25% | 85 % | 2022 |
| BİSMİL MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 14 | 22 % | 85 % | 2022 |
| SORGUN MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 13 | 22 % | 50% | 2023 |
| PLOVDIV MUNICIPALITY WWTP | 12,3 | 20 % | 70 % | 2023 |
| SLIVEN MUNICIPALITY WWTP - EU FINANCED | 27.4 | 25 % | 70 % | 2022 |
| YÜKSEKOVA MUNICIPALITY WWTP- EU FINANCED IPA PROJECT | 15.5 | 22 % | 50 % | 2023 |
| NİKSAR MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 15.1 | 22 % | 90 % | 2024 |
| NADOR MOROCCO WWTP | 30 | 18% | 60-80 % | 2024 |


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## SOLAR SLUDGE DRYER

| End-User / Project | Capacity (ton/day) | Wet Sludge DS Content | Dry Sludge DS Content | Start up Date |
|---|---|---|---|---|
| **ON-GOING PROJECTS** | | | | |
| ZAPRESIC MUNICIPALITY WWTP | 14,7 | 25 % | 60 % | --- |
| NEW DELHI OKHLA WWTP | 630 | 25 % | 55 % | --- |
| BELI MANASTIR MUNICIPALITY WWTP - EU FINANCED | 5 | 22 % | 80 % | --- |
| ÇANKIRI MUNICIPALITY WWTP - EU FINANCED IPA PROJECT | 20.2 | 22 % | 90 % | --- |
| SIBENIK MUNICIPALITY WWTP - EU FINANCED | 45 | 23 % | 75 % | --- |

## BELT TYPE SLUDGE DRYER

| End-User / Project | Capacity (ton/day) | Wet Sludge DS Content | Dry Sludge DS Content | Start up Date |
|---|---|---|---|---|
| **COMPLETED PROJECTS** | | | | |
| ÇORLU LEATHER OIZ WWTP | 10 | 22 % | 90 % | 2021 |
| İZSU ÇİĞLİ MUNICIPALITY WWTP | 20 | 22 % | 60-80 % | 2022 |
| HEXAGON BIOSUN RDF | 30 | 25 % | 90 % | 2022 |
| AFYON ENERJİ | 20 | 22 % | 60-80 % | 2022 |
| SAMSUN MUNICIPALITY WWTP | 31 | 25% | 85 % | 2022 |
| KAHRAMANMARAŞ MUNICIPALITY WWTP | 14 | 22 % | 85 % | 2022 |
| YALKİM OIZ YALOVA | 13 | 22 % | 50 % | 2023 |
| YEŞİL ÇEVRE OIZ WWTP | 12.3 | 20 % | 70 % | 2023 |
| PLOVDIV MUNICIPALITY WWTP - EU FINANCED | 27.4 | 25 % | 70 % | 2022 |
| **ON-GOING PROJECT** | | | | |
| SLATINA MUNICIPALITY WWTP | 3 | 20 % | 80 % | --- |



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# SLUDGE DRYING TECHNOLOGIES

## REFERENCES

KILIS MUNICIPALITY, TURKEY

NADOR WWTP, MOROCCO

KASTAMONU MUNICIPALITY, TURKEY



PLOVDIV MUNICIPALITY, BULGARIA

DAKHLA MUNICIPALITY, MOROCCO

İZBAŞ FREE ZONE WWTP, TURKEY


FACTORY, İZMİR /TURKEY

FACTORY, İZMİR /TURKEY

FAT, İZMİR /TURKEY

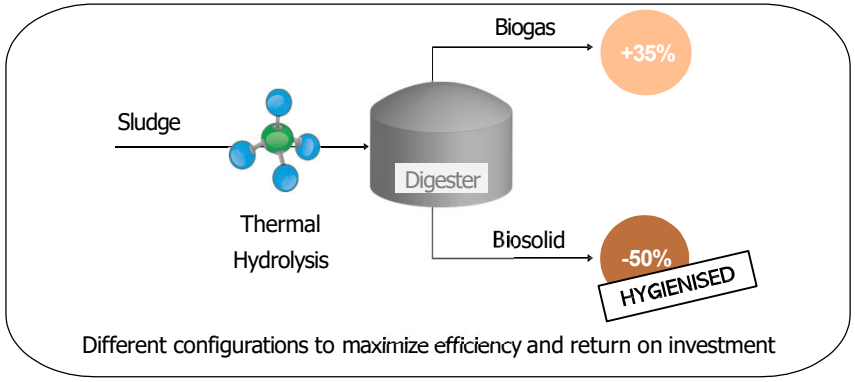
## THERMAL HYDROLYSIS: Advanced Anaerobic Digestion

**Conventional Digestion**

- Kinetics limited by the hydrolysis (solubilization) step
- Low biogas yields
- Greater biosolid volumes
- Biosolid (digestate) not hygienised, requires management

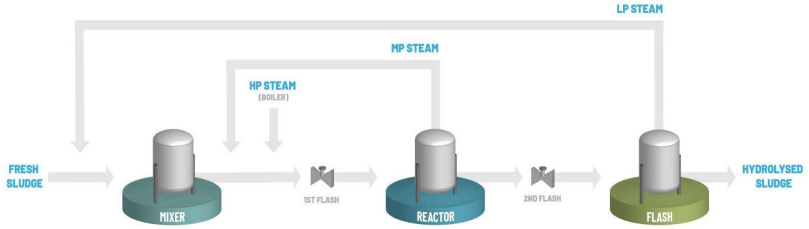
**Advanced Digestion**

- Thermal hydrolysis pre-treatment
- Higher biogas yields
- Lower biosolid volumes
- Hygienised biosolid apt for agricultural application




Different configurations to maximize efficiency and return on investment

## Polanco Process




- Continuos process
- Lower % DS
- Double flash
- Lower energy use
- Patented



## REFERENCES OF THERMAL HYDROLYSIS PROCESS

DEMO PLANT, TURKEY

PINEDO I, SPAIN

COPERO II, SPAIN

RANILLA, SPAIN

# SLUDGE TECHNOLOGIES

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