

# Cyclone Dryer Introduction Location in Japan

Nearly 500 cyclone  
dryers are in operation  
throughout Japan!



- ① A社  
北海道稚内市  
用途 ホタテウロ飼料化 設置時期 平成9年 能力 20t/日
- ② B社  
北海道雄勝町  
用途 ホタテウロ飼料化 設置時期 平成24年 能力 7t/日
- ③ C社  
北海道安平町  
用途 豚血液肥料原料化 設置時期 平成14年 能力 3t/日
- ④ D社  
北海道長万部町  
用途 ホタテウロ飼料化 設置時期 平成16年 能力 10t/日
- ⑤ E社  
北海道北見市  
用途 イカゴロ ホタテウロ飼料化 設置時期 平成19年 能力 60t/日
- ⑥ F社  
青森県上北郡東北町  
用途 下水汚泥減容化 設置時期 平成12年 能力 4t/日
- ⑦ G社  
福島県相馬市  
用途 バルブ汚泥水イライラ燃料 設置時期 平成7年 能力 15t/日
- ⑧ H社  
茨城県神栖市  
用途 汚泥減容化 設置時期 平成15年 能力 50t/日
- ⑨ I社  
群馬県伊勢崎市  
用途 汚泥減容化 設置時期 平成12年 能力 6t/日
- ⑩ J社  
栃木県真岡市  
用途 汚泥減容化 設置時期 平成27年更新(H10) 能力 7t/日
- ⑪ K社  
東京都千代田区  
用途 ホテル厨房肥料原料化 設置時期 平成11年 能力 6t/日
- ⑫ L社  
神奈川県厚木市  
用途 茶葉粉肥料原料化 設置時期 平成25年 能力 2t/日
- ⑬ M社  
神奈川県横浜市長野区  
用途 オイルスラッジ減容化 設置時期 平成11年 能力 20t/日
- ⑭ N社  
千葉県旭市  
用途 豚血液肥料原料化 設置時期 令和3年 能力 5t/日
- ⑮ O社  
新潟県新潟市  
用途 発酵残渣飼料化 設置時期 平成21年 能力 10t/日
- ⑯ P社  
長野県長野市  
用途 生ごみ 肥肥料原料化 設置時期 平成18年 能力 10t/日
- ⑰ Q社  
愛知県安城市  
用途 無機スラッジ減容化 設置時期 平成18年 能力 8t/日
- ⑱ R社  
愛知県みよし市  
用途 下水汚泥減容化 設置時期 平成22年 能力 5t/日
- ⑲ S社  
岐阜県神戸町  
用途 農集汚泥減容化 設置時期 平成22年 能力 2t/日
- ⑳ T社  
大阪府河内町  
用途 汚泥・糞液肥料原料化 設置時期 平成15年 能力 50t/日
- ㉑ U社  
熊本県水俣市  
用途 下水汚泥有機肥料化 設置時期 平成29年更新(H41) 能力 10t/日
- ㉒ V社  
広島県三次市  
用途 汚泥・糞液肥料原料化 設置時期 平成25年 能力 5t/日
- ㉓ W社  
山口県下関市  
用途 ロストミール飼料化 設置時期 平成24年更新(H3) 能力 10t/日
- ㉔ X社  
高知県土佐清水市  
用途 魚残滓フィッシュミール化 設置時期 令和3年 能力 5t/日
- ㉕ Y社  
鳥取県西伯郡大山町  
用途 木くず乾燥燃料化 設置時期 平成25年 能力 10t/日
- ㉖ Z社  
熊本県水俣市  
用途 下水汚泥有機肥料化 設置時期 平成29年更新(H41) 能力 10t/日
- ㉗ AA社  
沖縄県糸満市  
用途 生ごみ 肥料原料化 設置時期 平成30年 能力 3t/日

QR code to view  
the video.



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The moment the horizontal type was changed to vertical,  
the history of dryer changed dramatically.

# Okadora Cyclone Dryer Sludge treatment system



The Okadra Cyclone Dryer is a revolutionary  
vertical, completely pollution-free drying  
system that breaks the mold of conventional  
technology. It is the world's first innovative  
dryer capable of drying both solids and  
liquids, such as food waste, seafood  
products, and industrial sludge.

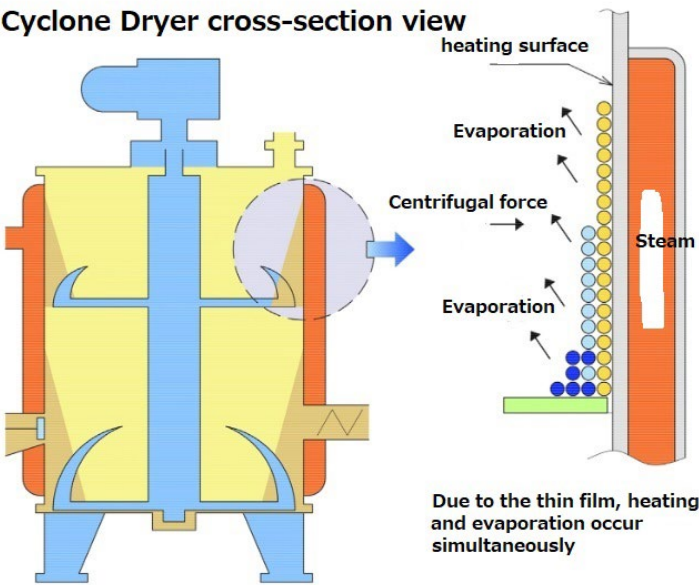




The Okadora Cyclone Dryer was developed by petroleum refinery plant design engineer. It is a revolutionary vertical, completely pollution-free drying system that breaks with conventional technology concepts, producing no wastewater and no odor. With nearly 500 units installed in factories, hotels, shopping centers, local governments, and other facilities of major Japanese manufacturers, it is the most reliable dryer in Japan. It is the world's first groundbreaking drying system capable of drying both solid and liquid materials, including food waste, seafood, and sludge discharged from factories.

Cyclone dryer with outstanding thermal efficiency

The most distinctive feature of the Okadora Cyclone Dryer is the cyclone fin, a blade attached to the lower center of the main unit. As the fins rotate, the material to be dried is simultaneously scraped up onto the vertical heating surface and pushed into a thin film on the wall surface. In this process, heavier materials, i.e., those with higher moisture content, are preferentially pushed to the heating surface by the action of centrifugal force. Then, the heated material with lower moisture content moves to the evaporation surface, further promoting moisture evaporation. This process is repeated as needed. The heating surface and the evaporation surface become infinitely equal as the dried material becomes a thin film and contacts the heating surface, and the contact speed with the heating surface is fast, causing turbulent contact at the thin film boundary. The cyclone fins, as the name implies, can also scrape up slurries and other fluid materials and bring them into thin-film contact with the heated surface.



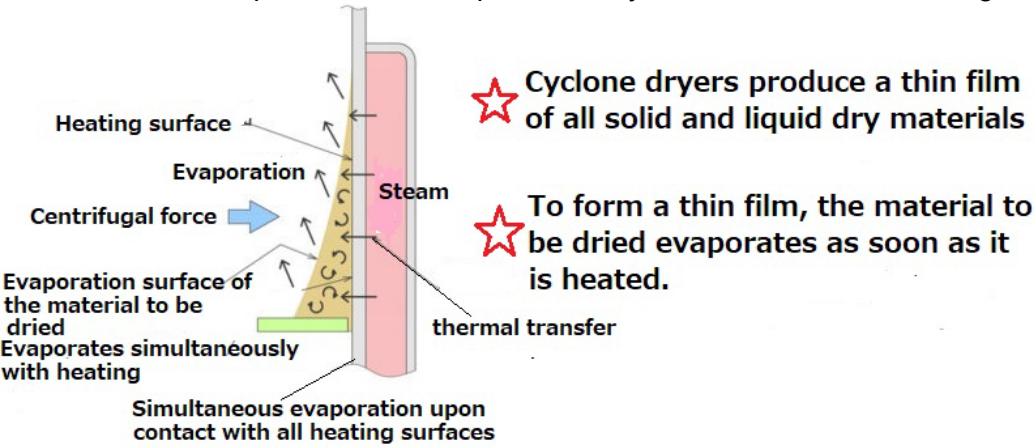
Features of Cyclone dryer

- No waste gas
- No dust
- Very low energy loss
- Converts less than 1/4 of conventional dryers
- Thermal efficiency is 4 times higher than conventional dryers
- No need for sorting or separating foreign materials
- Capable of drying evenly with ultra-low moisture content from 10 to 0.1%.
- Dried material with the required moisture content can be extracted.
- Dried products can be made into high-quality fertilizers and feeds
- High yield of dried products such as food and feed
- Low equipment cost
- Can be installed in any location
- Very easy to maintain and manage
- Easy operation and unmanned operation
- One Okadora dryer can handle all dried products, both liquid and solid

Boil drying is Okadora's patented technology that can simultaneously perform boiling, concentration, drying, and sterilization.

All raw foods such as meat, fish, and vegetables contain cells. If you simply dry these foods, the water will be removed from the cells but they will return to their original raw state. If this dried product is used as fertilizer, it will cause the roots of vegetables in the fields to rot. Traditionally, to produce animal feed or fertilizer, complex processes such as boiling, concentration, and drying had to be carried out in separate machines to destroy the cells in the raw foods. The Okadora Cyclone Dryer has thermal efficiency more than four times that of conventional dryers, so the raw materials fed into it immediately rise to nearly 100° C and boiling begins. This destroys the cells in the raw foods, and they are then simultaneously concentrated, dried, and sterilized inside the cyclone dryer.

In the Okadora dryer, the material to be dried comes into contact with the heating surface at an extremely fast speed of 10 to 30 m/s or more, resulting in a rapid temperature rise rate. However, if the heat transfer is fast but the evaporation rate is slow, the material will simply retain the heat and will not be able to dry. In the Okadora dryer, the material to be dried comes into contact with the heating surface in a thin film as shown in the diagram below, so the evaporation area of the material to be dried is the same as or slightly wider than the heating area. Since evaporation occurs at the same time as heating, the given heat is evaporated and dissipated at the same time, achieving a balance between the heat transfer rate and the heat evaporation and dissipation rate, resulting in extremely efficient drying. With conventional dryers, there is a time lag between heating and evaporation, and the heat retained in the material is not evaporated and dissipated evenly at the same time, resulting in very poor drying efficiency.



In conventional horizontal dryers, the material to be dried is filled up to about half its length, but in horizontal paddle dryers and horizontal disk dryers, water cannot evaporate from the filled area at all, and the material to be dried is only heated and stirred. With a horizontal paddle dryer, only the material to be dried that has been stirred up by the stirrer blades evaporates and dissipates, and evaporation occurs only in the very small surface area where the material is heated and stirred. With a horizontal disk dryer, the heating area is large and so there is good heating power, but the amount of evaporation per surface area of the material to be dried is very small, and the amount of evaporation from stirring is also small, unlike with a paddle dryer. However, with a paddle dryer, the heating area is small, so the drying efficiency is poor no matter how well the evaporation from stirring is. And the biggest drawback of a horizontal dryer is that there is a time lag between heating and evaporation, resulting in very poor drying efficiency.

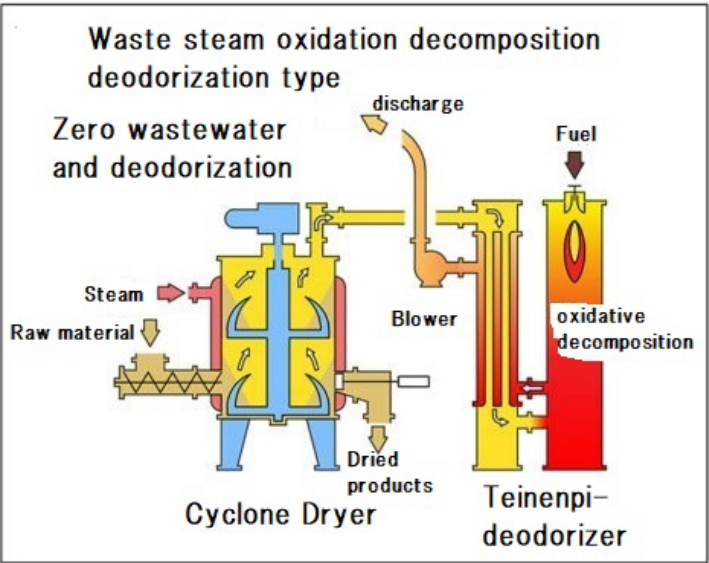
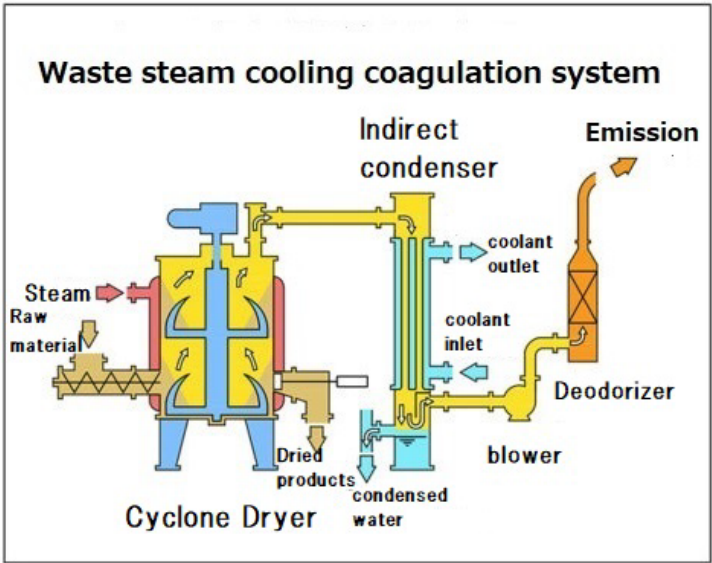
**Paddle shape model**

There is a time lag between heating and dissipation. Heating is uneven and not uniform throughout.

**Disc shape model**

Evaporation area is very small and there is a time lag between heating and evaporation. The part filled with heating agitation does not evaporate, only heated.

Heating area is large but contact heating area is small





# Okadora Cyclone dryer line-ups



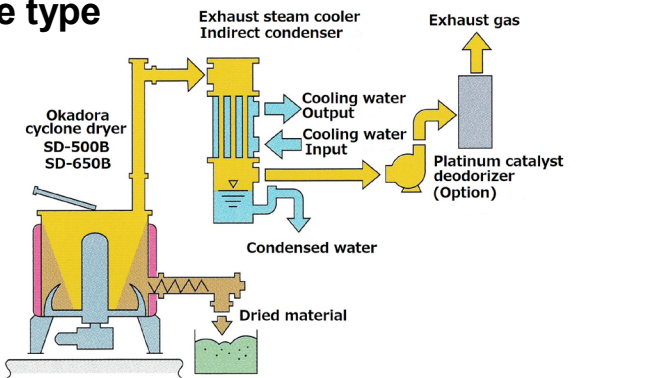
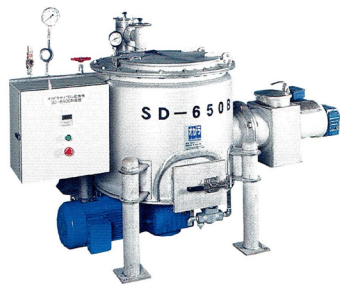
## Tei-Nenpi can treat wastewater and odors completely pollution-free



The waste steam generated during drying contains odorous components and soluble nitrogen. This waste steam is sent to the Tei-Nenpi deodorizing furnace at nearly 100° C. Here, the direct-fire combustion method completely decomposes the odorous components, BOD, and COD components at a reaction temperature of over 650° C and a residence time of 0.3 seconds, and releases them into the atmosphere as non-polluting water vapor. The greatest feature of the Tei-Nenpi deodorizing furnace is that it fully recovers exhaust heat in three stages. The first is the recovery of the radiation heat of the reaction temperature, the second is the recovery of the radiant heat generated during the reaction, and the third is the indirect heat recovery of the waste heat. This makes it possible to raise the temperature of the waste steam from 500° C to 550° C before it enters the reaction chamber. In other words, the amount of hot oil required to reach a reaction temperature of 650° C only increases by 100° C to 150° C, achieving significant energy savings.

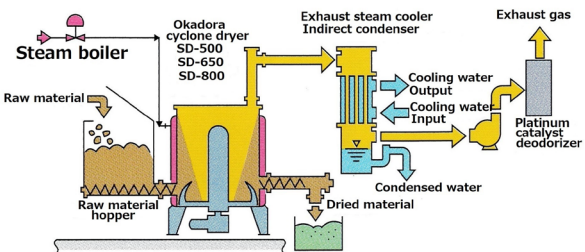
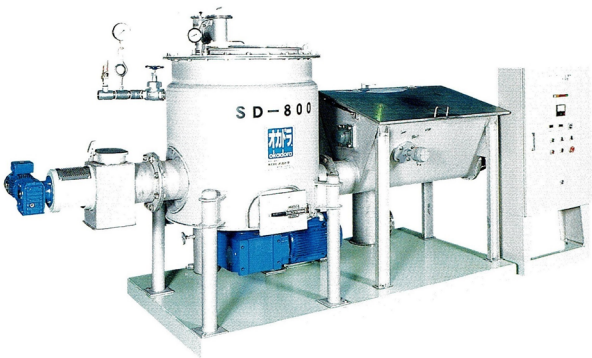
## Cyclone dryer compact multi-purpose general models

### Batch feeding automatic discharge type



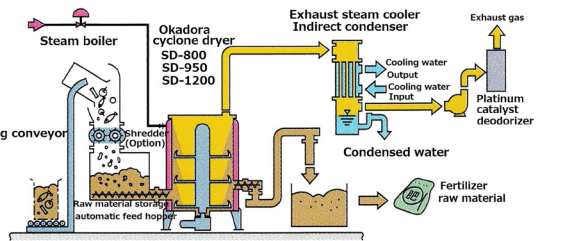
Model	Capacity (kg/day)	Capacity per hour (kg/h)	Fuel consumption	Equipment electricity consumption (Kw)	Power consumption
SD-500B	100	10	0.9	2.7	1.9
SD-650B	250	25	2.0	6.0	3.9

### Direct feed automatic continuous operation type



Model	Capacity (kg/day)	Capacity per hour (kg/h)	Fuel consumption (Litter/h)	Equipment electricity Consumption (Kw)	Power consumption (Kw/h)
SD-500	250	10	0.9	5.9	2.9
SD-650	500	25	2.0	10.5	5.7
SD-800	1,000	40	3.2	16.6	8.3

### Automatic continuous operation type with lift transport feeder



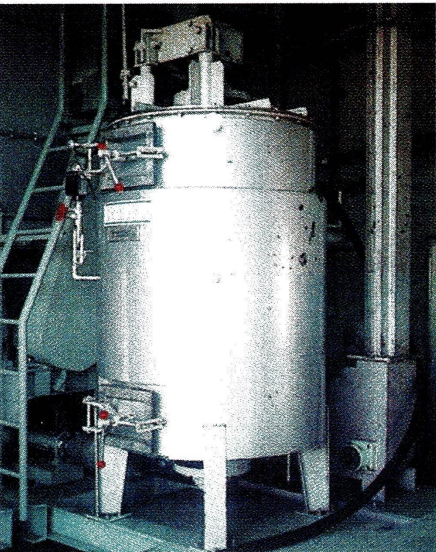
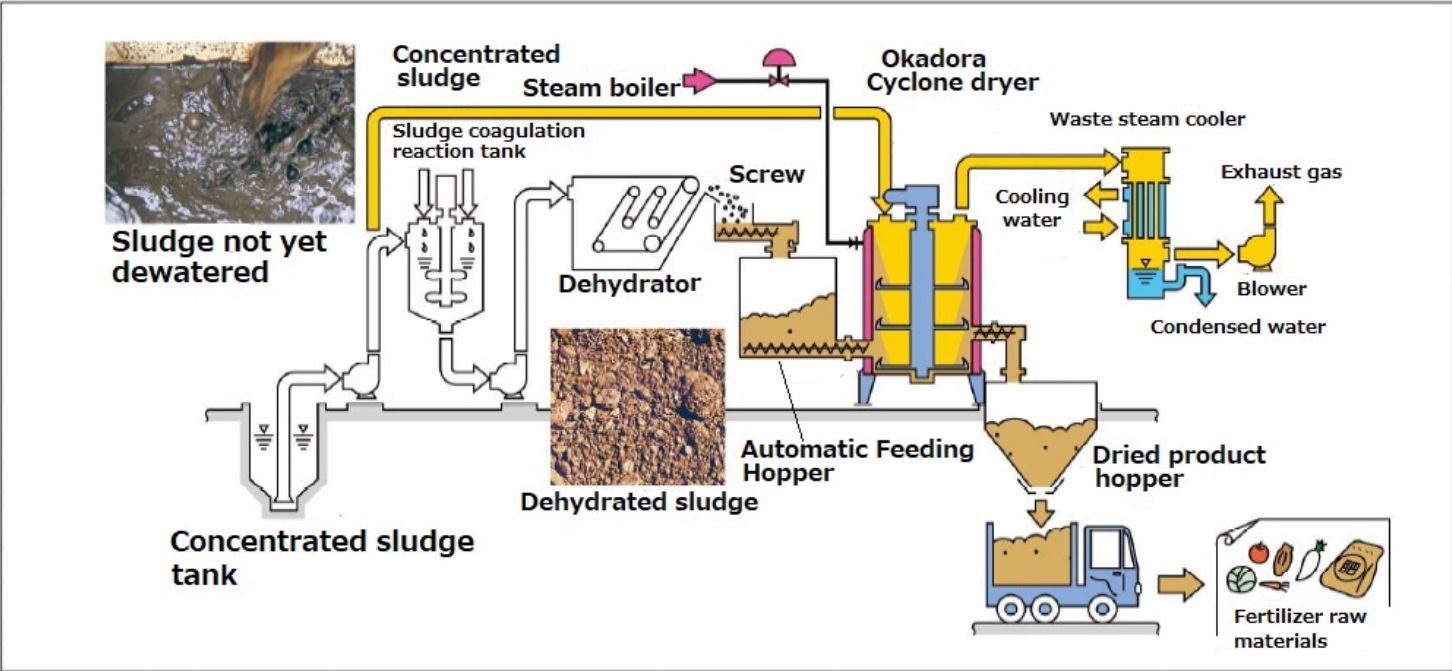
Model	Capacity (kg/day)	Capacity per hour (kg/h)	Fuel consumption (Litter/h)	Equipent electricity Consumption (Kw)	Power consumption (Kw/h)
SD-800	1,000	40	3.2	17.0	8.5
SD-950	1,500	60	4.8	22.5	10.1
SD-1200	2,000	80	6.4	30.0	12.0



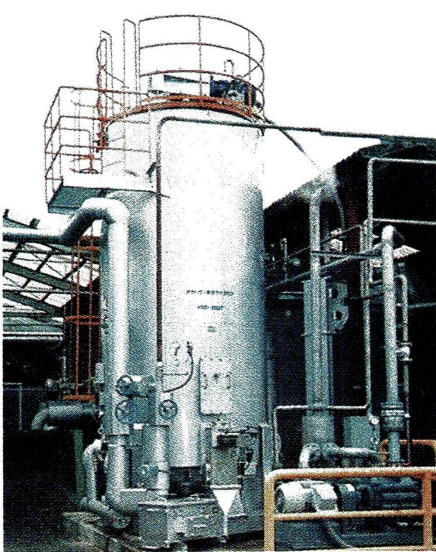
# Okadora sludge drying system

It is possible to freely adjust the moisture content of liquid sludge (moisture content 98%) or dewatered sludge (moisture content 85%) to the desired moisture content and dry it.

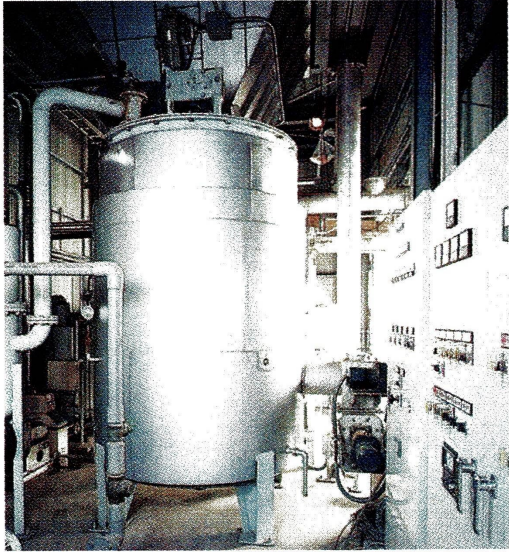
The excess sludge generated by activated sludge wastewater treatment contains all the cells of bio-bacteria. If this sludge is fermented with the usual moisture adjustment, it will mature after 2 to 4 months and can be used as fermented fertilizer. If this sludge is boiled and dried with an Okadora cyclone dryer, the cell tissue is destroyed, and if the moisture is adjusted to 40 to 50% and then fermented, it can mature in just 6 to 8 days. Also, if sludge that has been dried to 10% moisture with a conventional hot air dryer is soaked in water, it will return to sludge again, and if used as fertilizer, it will cause the roots of food to rot. If it is boiled and dried with a cyclone dryer, the cells are completely destroyed, so it will not return to sludge even if it is submerged in water, and it can be used as an optimal fertilizer.



Sewage sludge treatment



Factory sludge treatment



Frozen food sludge treatment



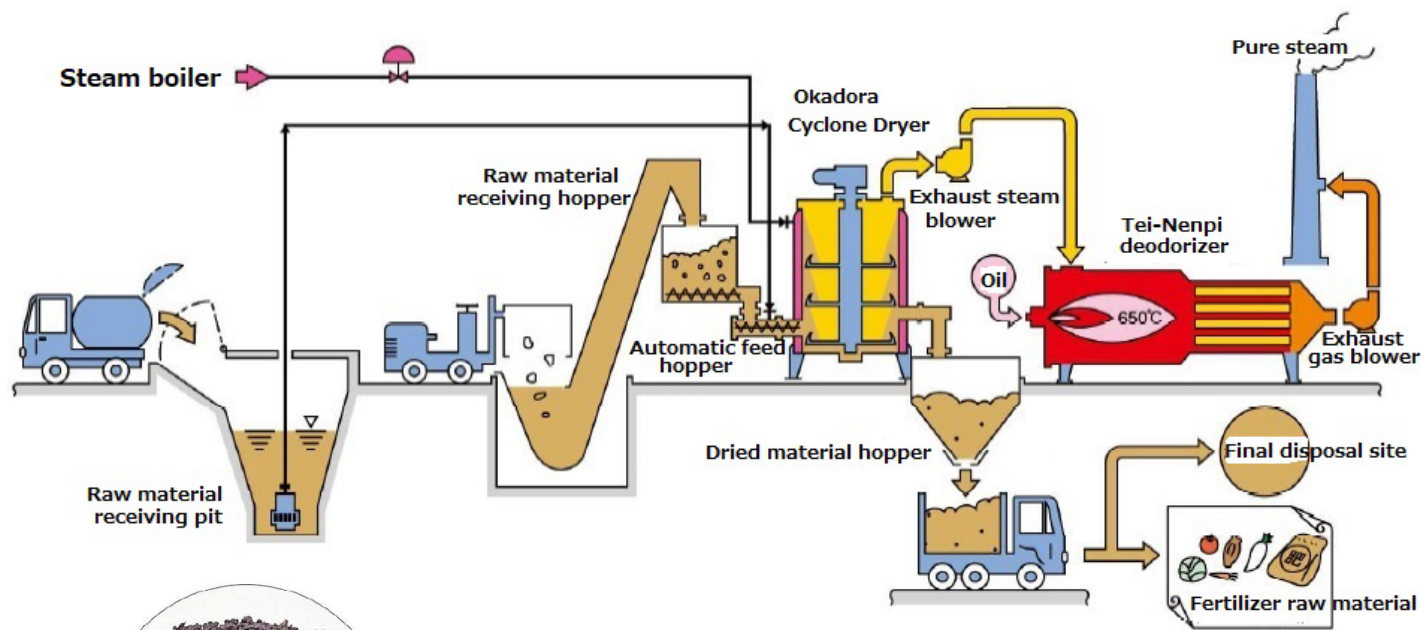
Line-Ups for Sludge treatment					
Model	Processing capacity Kg/h		Electric heating area (㎡)	Diameter X Height ( mm )	Power (Kw)
	Water content 85%	Water content 98%			
SD-650	25	35	1.0	650 × 750	3.7
SD-800	35	55	1.5	800 × 900	5.5
SD-950	50	70	2.0	950 × 1,100	7.5
SD-1200	75	105	3.0	1,200 × 1,400	11.0
SD-1500	125	175	5.0	1,500 × 1,700	15.0
SD-1750	175	245	7.0	1,750 × 2,000	18.5
SD-2000	225	315	9.0	2,000 × 2,250	22.0
SD-2250	275	385	11.0	2,250 × 2,500	37.0
SD-650Ⅱ	45	60	1.8	650 × 1,050	5.5
SD-800Ⅱ	60	85	2.5	800 × 1,250	7.5
SD-950Ⅱ	100	140	4.0	950 × 1,500	11.0
SD-1200Ⅱ	150	210	6.0	1,200 × 1,850	15.0
SD-1500Ⅱ	200	280	8.0	1,500 × 2,300	22.0
SD-1750Ⅱ	300	420	12.0	1,750 × 2,700	30.0
SD-2000Ⅱ	400	560	16.0	2,000 × 3,050	37.0
SD-2250Ⅱ	500	700	20.0	2,250 × 3,400	45.0
SD-2500Ⅱ	600	840	24.0	2,500 × 3,750	55.0
SD-2800Ⅱ	750	1,050	30.0	2,800 × 4,200	75.0
SD-650Ⅲ	60	80	2.4	650 × 1,350	7.5
SD-800Ⅲ	75	105	3.0	800 × 1,650	11.0
SD-950Ⅲ	125	175	5.0	950 × 2,000	18.5
SD-1200Ⅲ	200	280	8.0	1,200 × 2,450	22.0
SD-1500Ⅲ	300	420	12.0	1,500 × 3,050	30.0
SD-1750Ⅲ	425	595	17.0	1,750 × 3,550	37.0
SD-2000Ⅲ	550	770	22.0	2,000 × 4,050	45.0
SD-2250Ⅲ	700	980	28.0	2,250 × 4,500	55.0
SD-2500Ⅲ	850	1,190	34.0	2,500 × 5,000	75.0
SD-2800Ⅲ	1,075	1,500	43.0	2,800 × 5,600	90.0



# Sludge, no waste water, no-odor, drying

A completely pollution-free drying system that performs ultra-high-efficiency drying and deodorization without producing a single drop of wastewater.

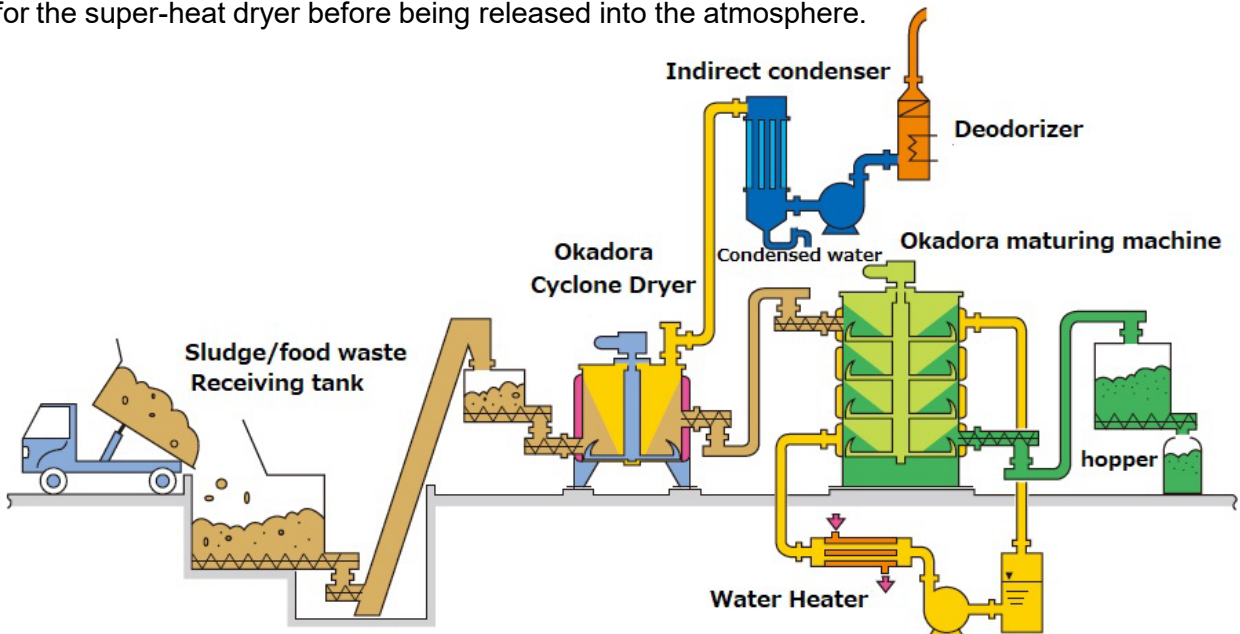
Organic sludge, which itself has a strong odor, or which emits a strong odor when dried, contains high concentrations of BOD and COD. Typically, separate equipment such as deodorization devices or large wastewater treatment facilities are installed, but the high concentrations of BOD and COD emitted from the aforementioned waste vary greatly, making equipment design extremely difficult. This system eliminates odor and harmful components by high-temperature oxidation decomposition using the Tei-Nenpi high-temperature oxidation deodorization device, regardless of the concentration fluctuations of BOD and COD. The exhaust steam generated by the cyclone dryer is released into the atmosphere in an odorless and pollution-free state, without producing a single drop of wastewater.



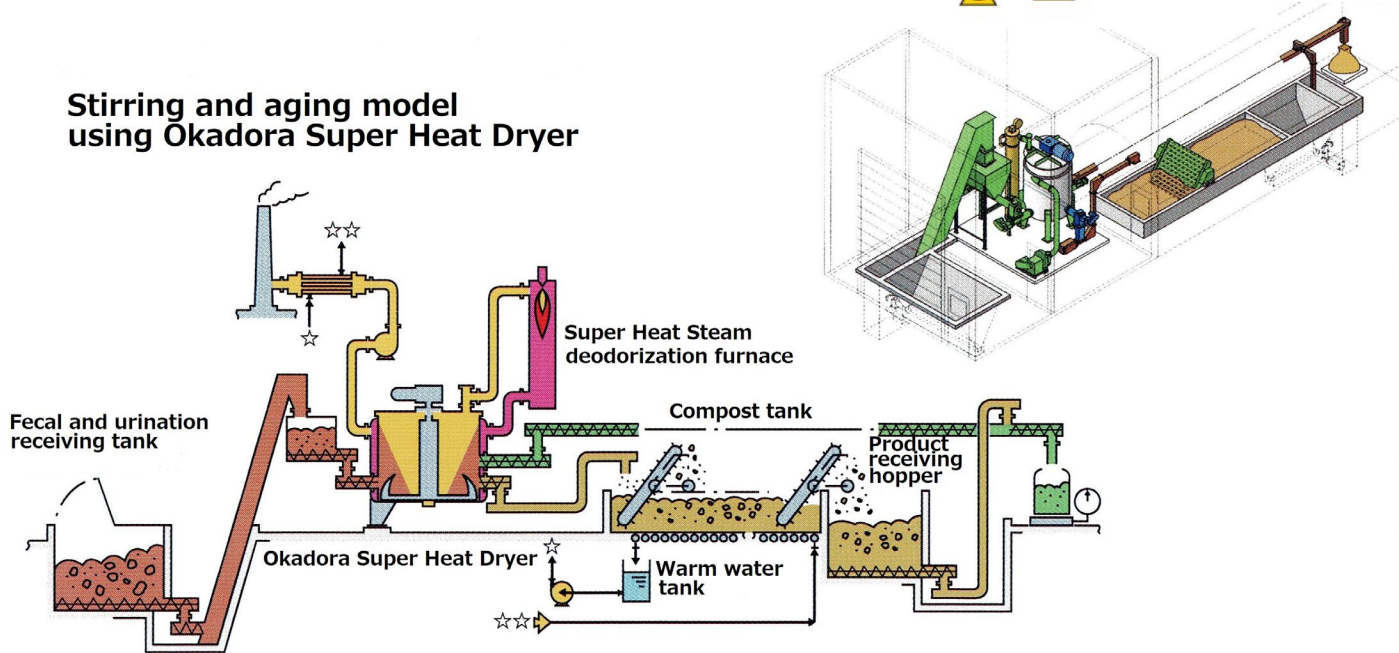
# Sludge, livestock manure Boiled, dried, odorless Composted

Not only sludge, but also livestock manure is composted through boil drying and rapid maturation without waste water or odor.

By boiling and drying sludge and livestock manure, the cell structures of the raw materials are destroyed while moisture is removed, resulting in a uniform moisture content of 40-50% throughout the cells. This completes the primary fermentation, which is traditionally associated with anaerobic fermentation accompanied by foul odors, and the secondary fermentation, which is the transition from anaerobic to aerobic fermentation. Following this, the actual fermentation process of maturation can be immediately carried out, eliminating odor generation and reducing the previously required fermentation period of 60-70 days to 7-10 days—a tenfold reduction—while also reducing the required fermentation area to one-thirtieth of the previous size. Additionally, livestock manure, which was previously considered impossible to dry quickly, is now co-dried with sludge using a super-heat dryer for high-speed boiling drying. The waste steam generated during drying is subjected to high-temperature oxidative decomposition in a super-heat steam-generating deodorization furnace, rendering it odorless and non-polluting. It is then utilized as a heat source for the super-heat dryer before being released into the atmosphere.



Stirring and aging model using Okadora Super Heat Dryer

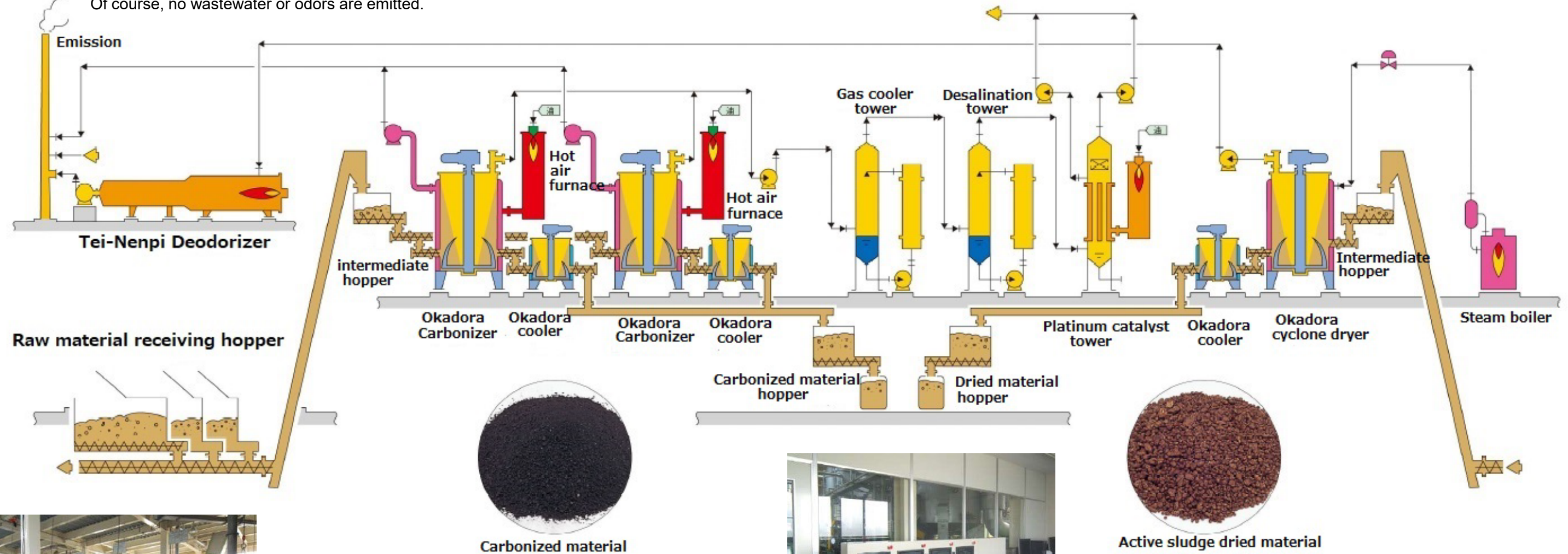




# Sludge drying and carbonization

## Drying and carbonization systems for all types of sludge

Un-dewatered sludge (high-moisture sludge), dewatered sludge, etc., can be boiled and carbonized regardless of moisture content. Sludge is sorted into separate receiving hoppers based on type. Those that can be recycled as fertilizer through drying are sent to the Okadra Cyclone Dryer for boiling drying. Others are sent to the Okadra Carbonizer for carbonization processing and recycling. Of course, no wastewater or odors are emitted.



Raw material receiving area



Okadra carbonizer



Control room



Okadra cyclone dryer



Tei-Nenpi deodorizer



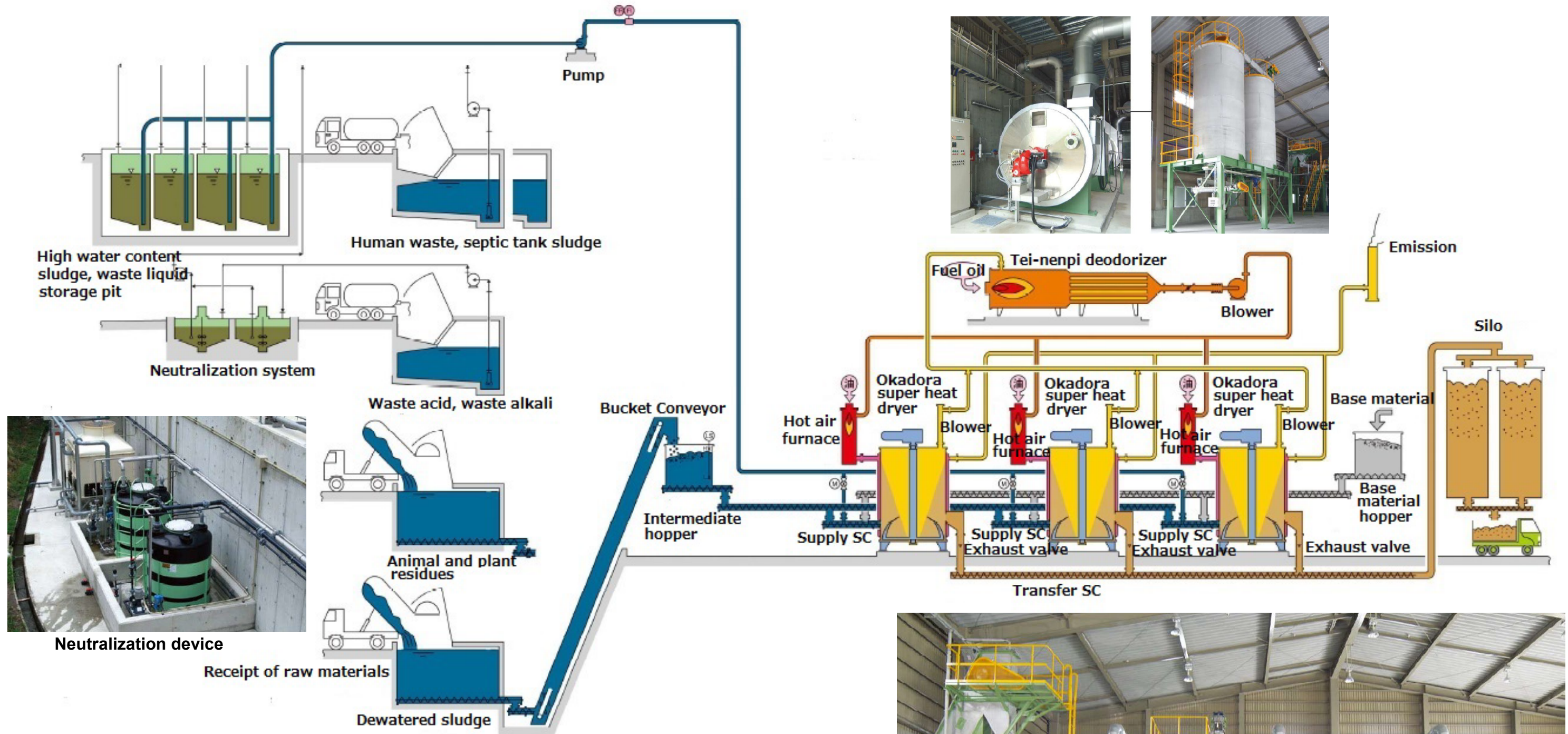


# Human urine, sludge drying

Raw sewage can also be dried quickly Super drying system that handles all types of waste

The Okadra Super Heat Dryer dries all kinds of waste that is normally difficult to process, such as raw sewage, sludge, waste acid, waste alkali liquid, and raw garbage.

The waste steam generated during drying is sent to the Tei-nenpi deodorization device, where odors and harmful substances are decomposed by high-temperature oxidation, eliminating any foul odors or wastewater.



Neutralization device



Control room



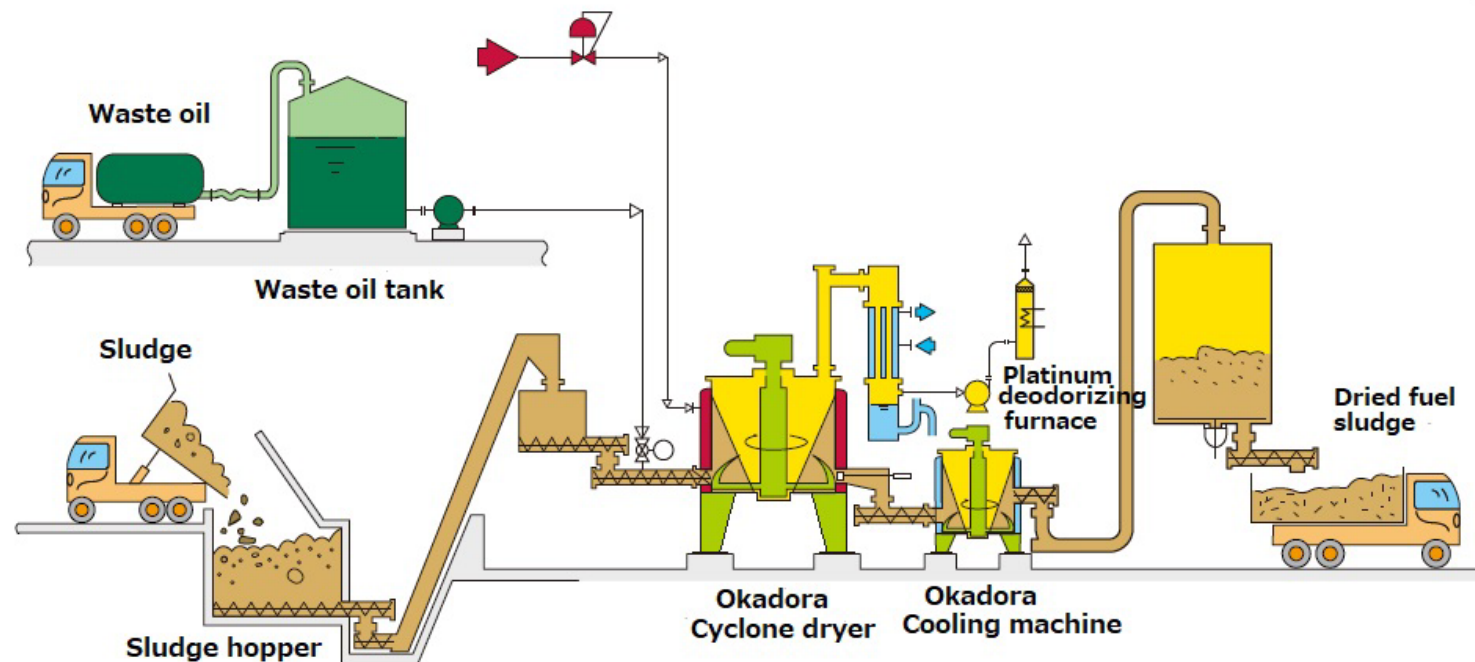
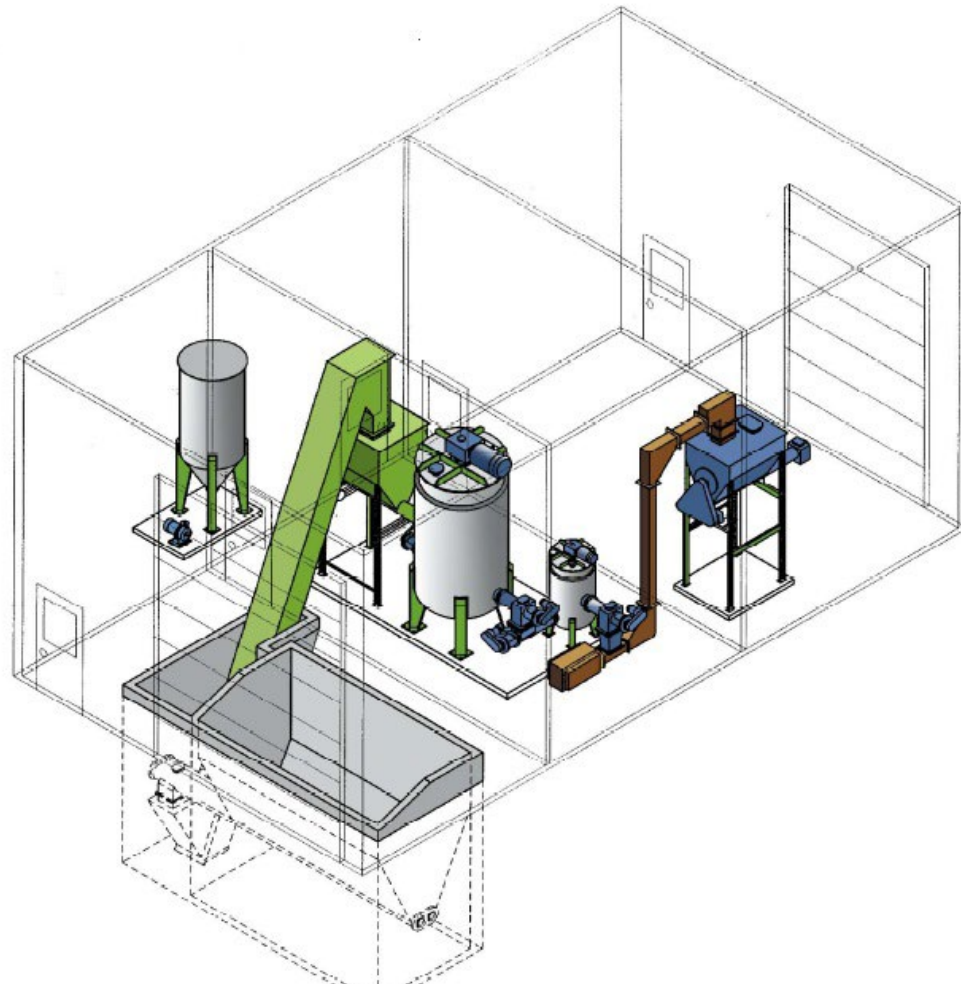
Okadra Super Dryer



# Activated sludge dried fuel

Activated sludge and waste oil recycled as auxiliary fuel without dioxin generation

By adding used cooking oil and other waste oils that have deteriorated to activated sludge and drying them, they can be recycled as auxiliary fuel that does not generate dioxins and can be used in incinerators, thermal power plants, and other facilities.



# Direct carbonization of sludge and livestock manure

Sludge and livestock manure are fed directly into the carbonization machine for ultra-fast carbonization with no wastewater, no odor, and no pollution.

Strongly malodorous sludge and livestock manure are fed directly into the Okadara Carbonizer for ultra-high-speed carbonization treatment.

The odorous components and dissolved nitrogen components contained in the organic gas generated during carbonization are sent to a hot air deodorization furnace, where they are oxidized and decomposed at high temperatures to become harmless. After being used as a heat source for the carbonizer, they are released into the atmosphere.

