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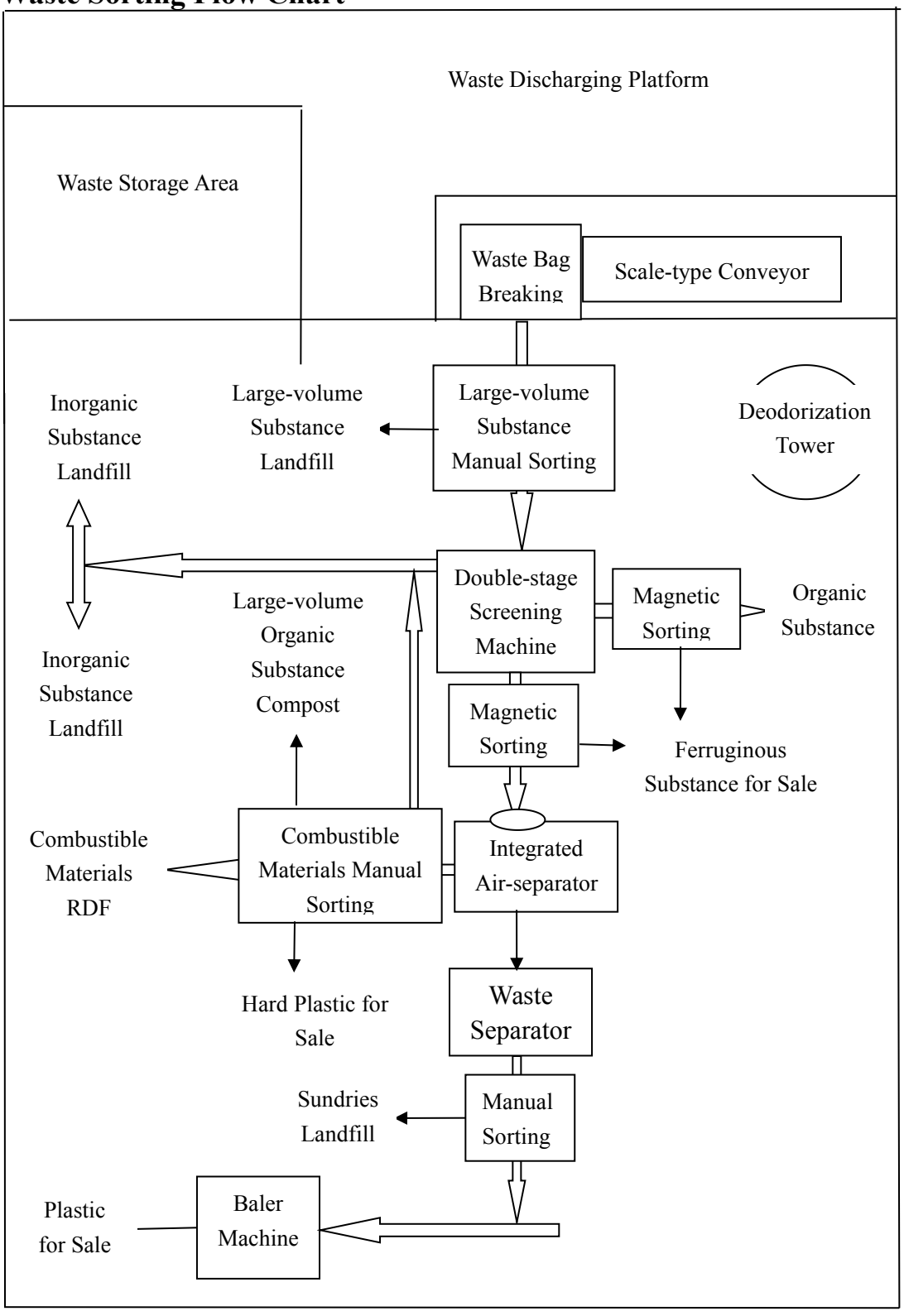
Keywords:

waste disposal, waste sorting equipment, RDF technological process, waste bio-treatment, waste composting process, municipal waste landfill, waste separator, belt-conveyor, magnetic separator for garbage, double-stage drum screening machine, integrated air separator, waste baler machine

Optimum Proposal of Daily 300 Ton Waste Disposal

Waste Sorting Flow Chart



Waste Sorting System Illustration

The waste processing line has a capacity of 300t per day.

Firstly, the garbage truck is weighed by electronic truck scale; then the garbage truck is drove to waste loading platform saloon to deliver the waste into the waste storage room that is a hermetic place, and it is where the large-volume waste and hazardous waste, such as big furniture, quilts, cotton clothes, broken closestools, big stuffs for decoration, wine bottles, pesticide bottles, fluorescent lamps, etc. are manually sorted.

After manual separation, the garbage is transported into the waste receiving hopper of the plate waste feeder which is placed in the first floor. But the receiving hopper is placed in the second floor and its volume is 20m³. The bagged garbage of the refuse that is loaded by plate feeder, is processed by bag-breaking & waste-distributing machine and then it is delivered to the belt elevator. Our bag-breaking & waste-distributing machine has functions of breaking bags and distributing waste which helps even waste delivering for plate feeder to ensure a stable performance of the subsequent equipment. The waste storage pit opening can be set as automatic opening cover or automatic rolling door to keep a good sanitation of the discharging platform.

The waste after bag breaking is conveyed by the belt conveyor to the large-volume substance manual sorting platform to separate the bulky waste and hazardous waste.

The manually-separated waste is delivered into the double-stage drum screening machine by belt conveyor for screening process. The sieve tray aperture sizes of the double-stage sieving machine are 20mm and 60mm respectively. So, the waste can be divided into three sizes: < 20mm, 20mm-60mm and >60mm.

The <20mm-sized waste mainly is sand and dirt that are carried out by belt conveyor for landfill treatment; the major of the 20-60mm-sized waste is organic substances that are for direct compost treatment after separation of ferruginous substances (such as bottle caps, batteries, coins, etc.) by suspension-type magnetic separator.

To get a maximum batteries filtering from organic substances, the driving roller of the belt conveyor that is working for organic substances is designed to be a magnetic roller to filter small button batteries to improve the quality of waste compost.

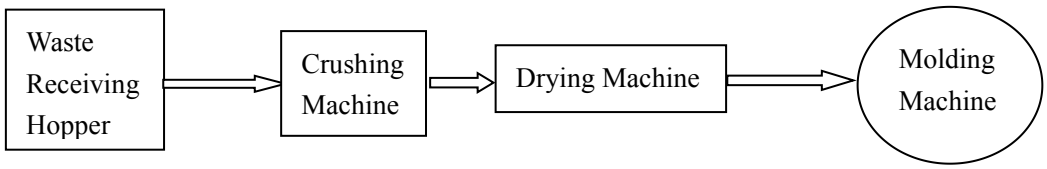
The >60mm-sized waste is sent into the integrated air-separator by belt-conveyor for air-separation process. And the integrated air-separator is kind of special equipment developed by our company used for handling municipal waste to group the oversize products into heavy waste, such as stones, construction garbage, glass, ceramics, hard plastic, textile fabrics, shoes, big organic pieces, wood, diapers, etc.; and light waste, such as light plastic, dry leaves, dry papers, etc.

The separated heavy waste is manually processed to filter the hard plastic,

big organic pieces and inert-incombustible items (stones, construction garbage, glass, ceramics, etc.); the residue is combustible items that will be crushed, dried and pressed into RDF fuel. The hard plastic is packed for sales; the big organic pieces are transported to the composting site for compost with the organic substances; the inert item is transported to the landfill site with sand and dirt for disposal.

The air-sorted light waste is sent to the manual sorting station by belt-conveyor for separating light plastic from sundries, and the residue is packed by baler machine for sales or recovering.

RDF Technological Process

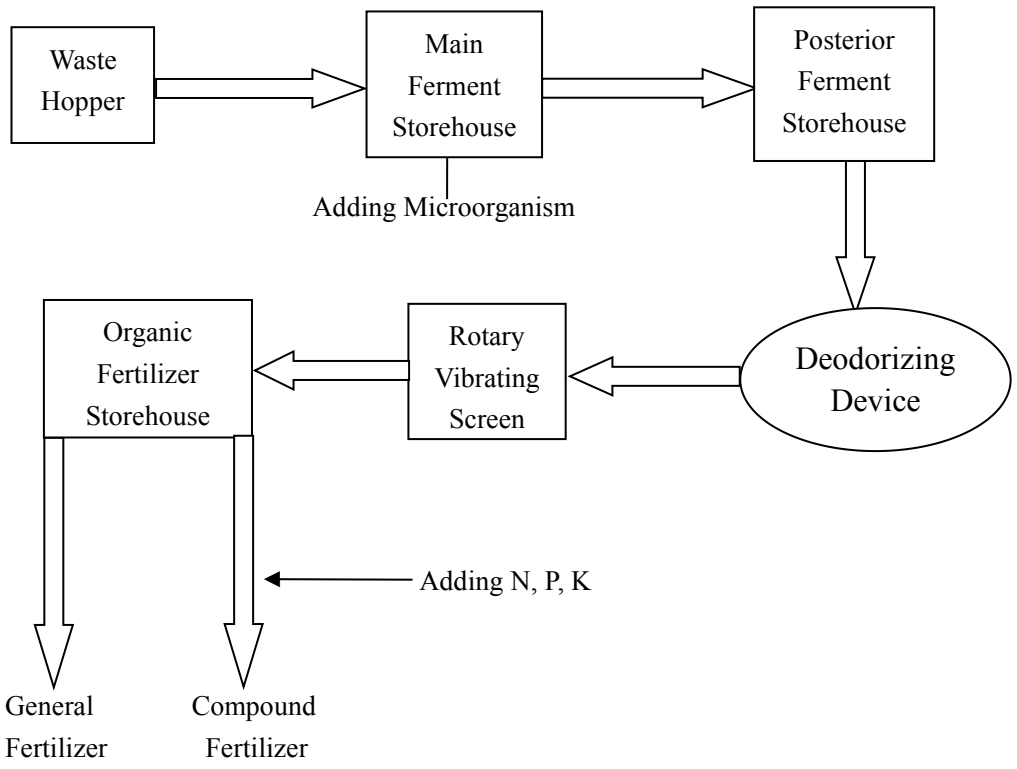


RDF Technological Process Illustration

The pre-processed combustible waste, water-separated light plastic, manually-sorted big combustible pieces are sent into waste receiving hopper by loading machine, and then they are sent into crusher machine by belt-conveyor to crush them into particles with a size that is less than 20mm. The crushed combustible waste is sent into drying machine by belt-conveyor to be dried until a moisture content less than 15%. Drying machine heat source can be varied according to specific working condition, and the industrial waste heat can be applied for drying. The

dried waste is sent into molding machine to be pressed by XYJ disc ring die extrusion machine, into RDF fuel rods sized by 30mm*30mm, and the fuel rods are for sales after cooled.

Waste Bio-treatment Technology Process



Waste Bio-treatment Illustration

The previously-sorted organic waste is delivered into the main ferment storehouse via the working of waste hopper and conveyor.

Main ferment can be implemented in the open air or in the fermentation room. By turning & mixing wastes and forced ventilation, the air needed in fermentation is supplied, and air supply differs by the type of fermentation room. In early days of fermenting, the mesophile bacteria (30 ～ 40 ℃ is its best propagation temperature) helps dis-composition.

With temperature increasing, thermophile bacteria (45~65 ℃ is its best propagation temperature) replaces the mesophile bacteria to help high-efficiency dis-composition. The performance of air supply and thermal insulation bed have great impact on temperature increase. And then the temperature falling period comes. Usually, the main fermentation time starts from temperature increasing to falling beginning; the main fermentation of waste aerobic composting will last 4-12 days.

For soil, high C/N ratio immature compost will lead nitrogen deficiency, and low C/N ratio immature compost will decompose, producing ammonia gas and imperiling crops growth and production. So, post-fermentation is necessary for the semi-fermented compost. Post-fermentation can be proceeded in specialized storehouse where the semi-fermented waste is stacked up to 1-2m high for open-type post-fermentation. To improve fermenting efficiency, waste turning and ventilation are needed sometimes. The organic waste that is not broken down and hard to resolve during main-fermentation can have a full decomposition in post-fermentation, becoming humic acid, amino acid, etc. organic substances with more stable property to get fully mature compost. The post-fermentation will last 15-20 days or more.

In the composting process, the deodorizing treatment of waste must be conducted, because there will be ammonia, sulfuretted hydrogen, methanethiol, amine, etc. generated. The deodorizing method is varied by

chemical deodorization and adsorbent deodorization, etc. And one economical and practical method is biological deodorization by mature compost oxidative adsorption. Stack the mature compost into the deodorizer with a height of 0.8-1.2m; make the bad smell accessible to the deodorizing system to realize its interaction with biological decomposition and absorption, by which the ammonia and sulfuretted hydrogen removal rate can be more than 98%.

Almost all organic substances in the waste are stabilized and minimized after a second fermentation. However, the plastic, glass, ceramics, metal, small stones, etc. that are not completely removed in early process need another separation processing which employs rotary vibrating screen, magnetic separator, air-separator, etc. pre-treatment equipment to complete separating the above-mentioned impurities. At the same time, re-crushing can be done as required to make purified compost; or add N, P, K into the bulk compost according to the soil condition to make compound compost.

compost is commonly used in Spring and Autumn and is stored up in Summer and Winter. So, the storage facilities that is able to hold at least 6-month production should be set in general compost plant to ensure a continuous production.

Proposal Description and Cost Presentation

1. The waste handling capacity is designed as 300t/d for this proposal

2. The design reference is based on waste contents

Municipal Waste Physical Content Analysis Table (Dry Basis)

Number	Organic Content		Inorganic Content		Recyclable Content					
	Animal	Plant	Dust	Brick& Ceramics	Metal	Glass	Paper	Plastic& Rubber	Textile Fabrics	Wood& Bamboo
1	0.07	48.43	5.63	3.51	1.05	1.05	6.29	23.67	6.26	3.41
2	0.83	44.57	4.02	0.83	0.42	0.42	12.13	25.88	1.16	5.57
3	1.19	51.59	6.70	0.00	0.79	0.79	9.60	17.88	4.38	5.88
Average	0.91	48.20	5.45	1.45	0.75	0.75	9.34	22.48	3.93	4.95
	49.10		6.90		42.21					

Municipal Waste Physical Content Analysis Table (Wet Basis)

Number	Organic Content		Inorganic Content		Recyclable Content					
	Animal	Plant	Dust	Brick& Ceramics	Metal	Glass	Paper	Plastic& Rubber	Textile Fabrics	Wood& Bamboo
1	0.31	56.85	4.05	1.56	0.47	0.47	6.23	20.29	6.23	3.74
2	0.35	55.34	2.59	0.35	0.17	1.90	12.26	19.00	1.21	8.64
3	0.52	53.36	4.71	0.00	0.35	0.35	11.78	16.81	3.98	7.62
Average	0.39	55.18	3.78	0.64	0.33	0.33	10.09	18.63	3.81	6.67
	55.58		4.42		40.61					

3. Technology employment of this proposal

Crude waste pre-separation: quantity is 300t/d

Separate organic waste to add microbial agent for aerobic composting: 20-60mm waste 50%

Separate construction waste (dust, brick and ceramics, etc.) for landfill: 20% (including some small organic substances and leachate)

Separate high-quality plastic to pack for sale: 5%

Sort ferruginous waste magnetic separator for sale: 1%

Separate other combustible waste for making RDF: 24%

4. Process analysis and cost estimation of separated waste

1) Organic waste composting process by adding microbial agent is the patented technology of Beijing Academy of Agricultural Sciences (See the enclosure of the composting project report for its brief introduction);

50% organic materials that suit for composting can be filtered from the 300t waste, that is 150t per day, 54000t per year, which can be used to produce 18000t fertilizer; the consumption of microbial agent is 0.1% of the total fertilizer production, so it is 18t for one year; the price of microbial agent is $8060 per ton, so it is 18*8060=$145080 for one year;

The market price of finished organic fertilizer is $97 per ton, but the fertilizer produced by organic waste is just the low-level fertilizer of which some valuable composition content does not reach the marketing standards, so it can be sold by adding requisite elements to meet the sales requirement, or as a kind of raw material for producing compound organic fertilizer, and if its price is $48 per ton, then the total value of 18000t is 18000*48=$864000;

The gross profit is 864000-145080=$718920;

2) The separated high-quality plastic

Per day separating amount is 300*5%=15t,

One-year amount is 5400t, and its marketing price is $48 per ton,

So one-year gross profit is 5400*48=$259200;

3) The separated ferruginous waste

Per day separation amount is 300*1%=3t,

One-year amount is 1080t, and its sales price is $81 per ton,

So one-year gross profit is 1080*81=$87480

4) The separated inflammable waste is only for RDF fuel rod manufacture (see enclosure for RDF process technology), and the RDF whose calorific value can be 3600-5000 kilocalorie is mainly used as the energy of thermal power plant.

The RDF fuel rod can be used either for chain-stove or for circulating fluidized bed furnace when it is used together with coal. Because the pollutant generated by RDF can be eliminated by the off-gas disposal system, and RDF has no that large using amount as coal, the application of RDF will not increase the pollutant managing load of the furnace, also RDF has a similar heat value with coal.

The produced RDF also can be used as fuel for cement plants, and the production technique is performing well.

Per-day amount of combustible waste is 300*24%=72 t,

72t combustible waste can work for 61.4t RDF,

One-year RDF output is 20736 t,

RDF sales price is set based on its kilocalorie content, $0.0161/kcal.t,

Calculated at $48/t, one-year value is 20736*48=$995328

5) The separated dust, bricks & stones, construction waste

Per-day separating amount is 300*20%=60t,

This part of waste includes leachate, organics that is <20mm, cullet, dust,

bricks & stones, construction waste, etc. and its volume-weight may be greater than 1.5t/cube. The volume of 60t waste is 40 m^3, but it has a decreasing after stacking. If this part of wast is all buried, one-year landfill amount is 14580 m^3, and there will be an amount reduce after a period of stacking, so the actual land covering area is small.

Some organic substances of the buried waste will release bad smell. To solve this problem, proper amount of deodorizing microbial agent can be added when burying to speed up the decomposition of organic substance, reduce the generation of bad smell and turn the buried organics into harmless inert matters to serve them as construction materials, roadbed soil, etc.

If the addition of deodorizing microbial agent is calculated at 0.02% of landfill amount, then the one-year additive amount is 14580*0.02%=3t, and the cost is 3*8060=$24180

6) Cost accounting

Total electricity consumption: 3328KWH per day, 1198080 KWH per year

One-year expense: $193433

Workers wages: 20 workers, $645/m for one worker

One-year wages: $154746

With no equipment depreciation counted in, then one-year gross profit is 726052+261379+87126+1003695=$2078252

Expenditure: 193680+153330+24210=$371220

Actual gross profit: 2078252-371220=$1707032

Details of Waste Separation Processing Equipment

	Equipment	Specification	Quantity	Unit	Power (KW)	Notes
1	Plate waste feeder	1.8*10m	1	set	7.5	Receiving hopper included
2	Bag-breaking and waste-distributing machine	1.8m	1	set	5.5	
3	Elevating belt-conveyor	1.2*15m	1	set	4	
4	Large-volume waste manual sorting		1	suit	5	Belt, steel frame, sorting room, fresh-air conditioner included
5	Double-stage drum screening machine	Φ2.5*10m	1	set	22	
6	Undersized product collecting belt-conveyor	1.2*6m	2	set	4.4	
7	Suspension-type magnetic separator	RCYD-12	2	suit	8	Suspension bracket and stainless steel funnel included
8	Belt-conveyor for undersized product out	1.2*20m	1	set	5.5	
9	Undersized product entrucking belt-conveyor	1.0*5m	1	set	2.2	
10	Belt-conveyor for undersized organics out	1.2*8m	1	set	3	
11	Belt-conveyor for organics out	1.2*40m	1	set	7.5	
12	Belt-conveyor for oversize product	1.2*12.3m	1	set	4	
13	Integrated air-separator		1	suit	32.8	Positive and negative

						pressure
14	Belt-conveyor for heavy waste out	1.2*15m	1	set	4	
15	Inert waste transit belt-conveyor	1.2*15m	1	set	4	
16	Combustible waste manual sorting		1	suit	4	Belt,steel frame, sorting room,fresh-air conditioner included
17	Light waste belt-conveyor	1.2*8m	1	set	2.2	
18	Light waste manual sorting		1	suit	5	Belt,steel frame, sorting room,fresh-air conditioner included
19	Belt-conveyor for baler waste loading	1.2*18m	1	set	5.5	
20	Specified waste baler machine	80T	1	set	22	
21	Steel frame for maintenance		1	suit		
22	Electronic control system		1	suit		Cable bridge included
23	Monitoring system		1	suit		Large screen, 6 cameras included
24	Deodorizing system		1	suit	45	Only separation in sorting workshop included
	Summation				203.1	
25	Compost production system		1	suit	100	Simple,static and aerobic
26	RDF production equipment		1	suit	200	Crushing machine,drying machine and molding machine included
	Summation				300	
27	Installation cost	8% of the				

		total cost of the whole system				
28	Transport cost					Delivered to the port

Floor Area and Structure Description of Each Workshop

1. Waste loading platform: 30*30=900m²

The ground level is 6m for the second floor of the platform, and the eaves height to the top is 6m; the eaves height of workshop is 12m.

2. Waste storage area: 16*15=240m², which can hold one-day amount of waste.

3. Sorting workshop: 30*67.5=2025m²

4. Waste storeroom and post-processing workshop: 20*40=800m²

5. Fertilizer post-processing workshop: 20*40=800m²

Total: 4525m²

Major Equipment Presentation

1. Plate waste feeder

Plate width	1800mm
Notional length	10000mm

Rated power	7.5KW
Plate thickness	8mm
Weight	12t
Materials for Manufacture	Plate: 16MN HDG(Hot Dip Galvanised)
	Chain wheel&wheel axle: high-quality structural steel 45, thermal treatment
	Frame&lead rail: welding steel with international standard

2. Bag-breaking and waste-distributing machine

Width	1800mm
Power	5.5KW
Weight	4t
Material for manufacture	welding steel with international standard

3. Belt-conveyor

Driving roller	φ340×1150 (rubber coating)
Tail roller	φ320×1150
Upper supporting roller	φ89
Lower supporting roller	φ133×1150 (comb-type)
Belt	Width: customized as required
	Model:（3+1.5）×3 (rubber belt)
Material for manufacture	Frame: U-steel with international standards (welding assembly parts)
	Belt joint: vulcanized joint (hot melt)

4. Double-stage drum Screening Machine

Inner diameter of the drum	Φ2500mm
Valid screening length	10000mm
Sieve plate	Sieving hole diameter:Φ20mm&60mm
	Made of 16MN
	Thickness: 10mm
Driving mode	Single speed reducer drives double supporting wheel
Driving power	20KW, 3 vibrators with 0.3KW power
Weight	16t
Materials for manufacture	Supporting wheel structure: steel bud coated with PU
	Frame: weld by H-steel and U-steel with international standards

5. Integrated air-separator

Configuration	Air box, belt-conveyor, fan, air duct, steel frame, etc.
Air box	Size: 12M*3.6M
	Made of carbon structural steel
Fan power	30kw，(air quantity) Q=20000m3/h，total pressure 2500Pa，motor frequency speed control
Air duct	Made of galvanized steel plate with a thickness of 1.5mm
Platform checkered plate thickness	4mm
Weight	6t
The steel frame is welded with U-steel of international standards	

6. Suspension-type magnetic separator

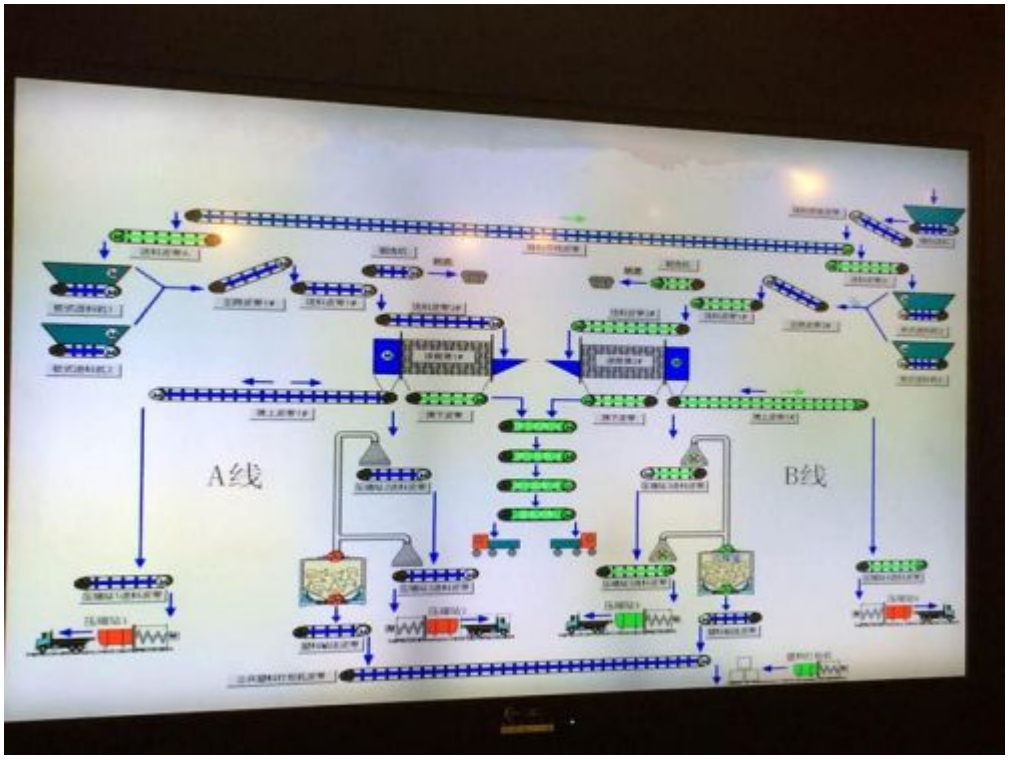
Configuration	Suspension magnetic separator, suspension bracket, waste leading funnel
Separator model	RCYD-12
Driving power	4KW
Weight	4t
The suspension bracket is welded with H-formed steel and U-steel of international standards	
The waste leading funnel is welded with 304 stainless steel (1mm thick)	

7. Hydraulic-automatic baler machine

Application: this machine is mainly used for baling the separated light waste to reduce space covering and facilitate storing and transporting. The waste is baled as cuboid, and the length can be adjusted as required. The baled waste is stored in the storage area of sorting workshop temporarily, then it will be delivered for export sales.

Bale size	700mm*800mm, the length is adjustable on request
Baling pressure	80t
Power	22KW
Weight	18t

8. Electronic control system



Including frequency converter cabinet, operation cabinet, cable, and cable bridge
Reliable operation: PLC is from Taiwan Joint Venture, frequency is from Siemens
The bridge frame is galvanized or plastic coated for anti-corrosion; thickness of plate is 1-1.5mm

9. Monitoring system

This system consists of 1 set of 32-inch monitor, 4-6 cameras, wire cable, converter, distributor, operation board, etc.

10. Manually sorting equipment

It consists of 1200mm flat belt for sorting belt-conveyor, steel platform, sorting funnel, steel-plastic doors and windows, colored steel plate housing, fresh air conditioner, illumination, etc.

11. Anti-corrosion treatment for the supplied equipment

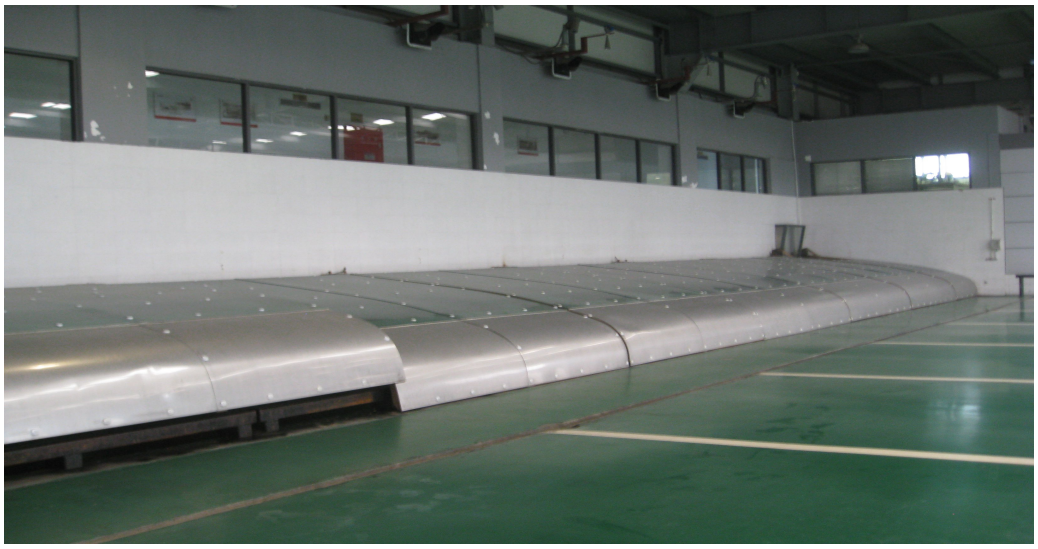
All the facilities we manufacture apply to the corrosive environment of the waste processing plant, which is supported by following facts:

1) the derusting grade of all the carbon-steel parts conforms to the Sa2.5 standard of GB8923-88

2) All parts are coated with zinc-rich primer, alcohol-acid finishing coat, and the thickness of the coating film is not less than 160μm

3) If there is damage of the coating, it will be repaired in accordance with the coating process norm, and the re-coating quality is as good as the original coating.

12. Waste loading platform



13. Deodorizing equipment

14. Crushing machine

15. Drying machine

16. RDF molding machine

Arranged Workers for the Processing Line Per Shift

Truck scale control room: 1 worker, to measure the garbage weight to be processed

Waste receiving platform: 1worker

Electronic control room: 1 worker, to do the electronic control operation, and monitor the workstations running condition and complete daily record

Mechanical maintenance, 1 worker; electrical repair, 1 worker: to direct the routine maintaining of the machines

Single line sorting: 8 workers, to conduct the operating of sorting station. 2 for large-volume waste and wine bottles sorting, 4 for combustible waste sorting, 2 for hard plastic sorting (1 for large organics, 1 for inert waste), 2 for sundries sorting in plastic separating room

Waste baling: 1 worker, to operate the baler machine to finish baling

process

Crew leader: 1 worker, to schedule, deploy and monitor the working of the processing line

Forklift driver: 1 worker, to lead the baled waste transporting and stacking

Cleaning work: 2 workers, to clean the workshops and processing line

Total number of 2 lines: 18 workers