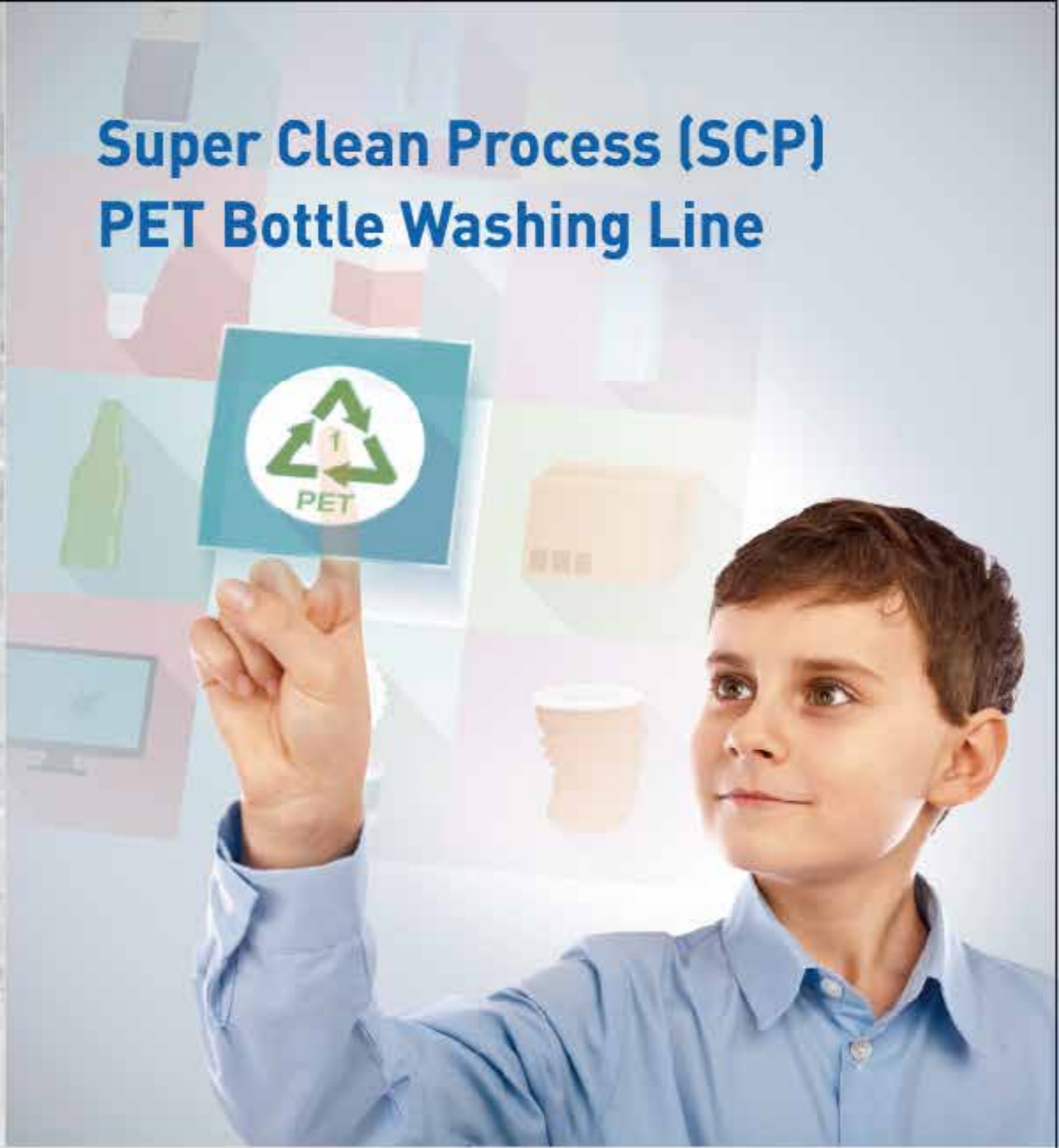




Super Clean Process (SCP) PET Bottle Washing Line



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BoReTech
PET Recycling Equipment

Preface

With the high-speed development of the global economy, the living standard of human as well as the demand for recycled PET plastics are increasing year by year. However, the petroleum resources are limited, excessive exploitation of petroleum increases the destructive effect to ecological environment.

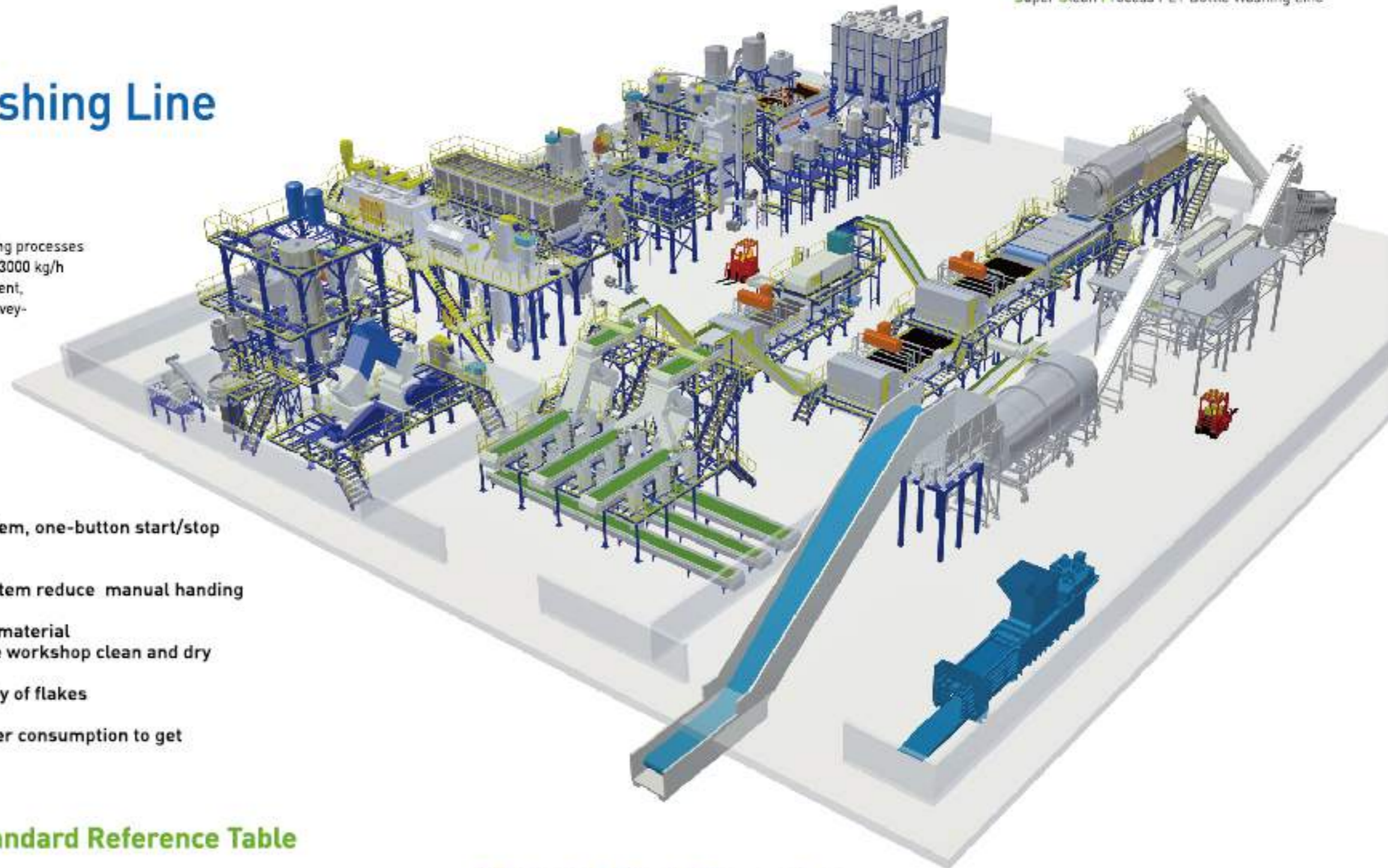
Recycled PET will eventually replace the virgin PET and fully occupy the global market. Driven by the market requirements for recycled PET, bottle-to-bottle recycling process is the highest level of PET bottle recycling, realizing the sustainable PET-to-PET recycling indeed.

Super clean process (SCPI) PET bottle washing line is a completed PET bottle recycling process which developed for food grade bottle-to-bottle recycling. Post-consumer PET bottles are collected from market and packaged into bottle bales, then transported to the PET bottle recycling factory.

By means of recycling process including de-baling, label scraping, metal & other impurities removal, bottle pre-washing, crushing, flake washing and drying, post-consumer PET bottle bales can be processed into clean rPET flakes which can be directly used to food grade pelletizing production for bottle blowing in the downstream industry and approved by Food and Drug Administration (FDA) with food contact certification.

This bottle-grade rPET material saves the world's resources and minimizes the damage to the ecological environment which lays a foundation for the global sustainable development strategy.

SCP PET Bottle Washing Line Process Flowchat



SCP PET Bottle Washing Line consists of 16 complete washing processes modules and 2 optional modules with a standard capacity of 3000 kg/h and 6000 kg/h. It adopts modular design of standard equipment, flexible connection between modules with air pneumatic conveying and pumping connection to support long-distance module connection. The platform is movable and easy to assemble convenient and simple maintenance.

- International spare parts availability
- In-house developed automated DCS control system, one-button start/stop operation
- Sub-product (Labels, Fines, Caps) collection system reduce manual handing
- Used steam collection system and fully covered material conveying after bottle pre-washing unit keep the workshop clean and dry
- Inline product inspection to guarantee the quality of flakes
- Low water consumption, less than 1.5 m³ of water consumption to get 1 ton of flakes output

Food Grade PET Flakes Quality Standard Reference Table

Metal (ppm)	Moisture (%)	Glue (ppm)	PVC (ppm)	PP/PE (ppm)	Viscosity (dl/g)
<10	~0.7	~10	~10	~10	0.7~0.78

截图(Alt + A)

Inorganic Compounds (ppm)	Color Flakes (ppm)	Bulk Density (kg/m ³)	PH	Flake Size (mm)
<1	None	~400	≤ 7.3	5-12

Particle Size Distribution (mesh Ø12)	Ø ≤1mm	Ø ≥12mm
	≤ 2%	≤ 5%

Estimated Plant Parameters

Output Capacity (kg/h)	Required Area (m ²)	Installed Power (KW)	Required Water (m ³ /hr)	Required Steam (kg/h)	Required Compressed Air (Nm ³ /min)
3000	3000	1200	4.5	1200	6
6000	4500	1600	9	2000	12

Average Consumption by per Ton Flakes

Electricity (KWH)	Water (ton)	Compressed Air (m ³)	Steam (kg)	Washing Detergent (kg)
250	~1.5	~100	~400	~8

MODULE

1 De-baling
Dry Decontamination

2 Bottle Pre-washing



SCP PET Bottle Washing Line Flowchart

De-baling

De-baling and dry decontamination module includes units of de-baling, screening, metal separation and label scraping. Firstly, the bottle bales are transported to the de-baling machine by a chain conveyor equipped with an automatic weighing device, and the compressed bottles will be loosed by powerful mechanical structure.

The PET bottle bales which density below 350 kg/m³ can be easily loosed. The dry trommel then remove various sizes of impurities by multi-stage separations. Meanwhile, oversize PET bottles are also removed to avoid mechanical clogging in the following label scraping unit. Continuous heat shrinkage label scraping process can achieve over 95% label separation rate, and the bottle broken rate keeps below 5%. At the same time, these labels can be collected and packed inline.

Dry Decontamination

The whole preprocessing module is designed with inverter and interlock control, metering feeding to prevent bottles jamming, metal separation device removes iron and non-ferrous metals by adjustable magnetic force. By removing impurities and labels before bottle washing without water in this module, the water consumption will be obviously saved.

- De-baling
- Screening
- Metal Separation
- Label Separation



- Pre-washing
- Impurity Separation

Bottle Pre-washing

The bottle pre-washing module mainly cleaning the surface of bottles, and removes the organic pollution, muds and sands by high-temperature chemical water and mechanical friction. More than 95% of adhesive labels are separated from the bottles, and these separated labels will be directly collected and packed inline. PVC bottles are easily identified due to high temperature washing, and bottles are evenly distributed to optical sorting belt conveyor through the vibration device. It guarantees sorting efficiency and sorting precision. Specially designed mesh structure of pre-washing drum is able to be fastly disassembled which support daily maintenance and cleaning. According to different bottle material composition, programmed dosing procedure can prepare chemical water under formulary ratio and dose it to chemical tank by quantitative supplement, then pumped to bottle pre-washing machine.

A closed loop of pre-washing chemical water circulation system is established through pumps and vibration screener that filter chemical water discharged. Chemical water temperature adjustment and water circulation is intelligently controlled by DCS in this unit. Mechanical seal design and inline steam recovery system keeps workshop in clean and dry.

“ This module provides several configurations options according to the composition of PET bottle bales. ”

MODULE

3 Optical Sorting

4 Manual Sorting

5 Grinding

6 Drying

SCP PET Bottle Washing Line Flowchart

Optical Sorting

BoReTech provides optical sorting machine which is cooperated with internationally well-known sorting machine makers in the world. Optical sorting machine detect and sort out non-PET and color PET bottles through NIR and camera. In accordance with various material composition from different regions, BoReTech provides optional solution including connection offer between washing line plant and sorting device.



Grinding

Grinding module includes wet grinding, dry grinding and drying. During first grinding process, add rinsing water to reduce the temperature of grinding chamber and decrease PET fine which will extend the service life of crusher blades. Besides, wet grinding has a superficial strong mechanical rinsing effect on PET flakes, which makes flakes clean.

Wet grinding machine equipped with forced feeding device crush PET bottles into PET flakes in a bigger size to ensure sufficient capacity feeding firstly, and then after secondary dry grinding, PET flakes reach to a indicated size. The flakes size will be much more equalized by this combination. Conveying system with a quick change of gas filter meet to food grade rPET requirement according to FDA certificate.



Manual Sorting

Meanwhile, BoReTech provides the total solution of automatic sorting combined with manual sorting. Manual sorting unit will improve sorting precision. All design of platform and stairways is in strict accordance with international safety standard. High standard protection and safety designed manual sorting platform keeps sorting labors in safe. Besides, All the platform is designed by assembly type, any parts of platform which is damaged can be replaced easily. It will save maintenance time and cost.



Drying

Vertical dryer through centrifugal force to separate dirty water and some impurities. Dryer mesh adopts quick assemble structure, which is easy to exchange and clean. Automated backflush screen clean fines and impurities attached on the screen.

This module can optionally equip the PET fines purifying system to separate muds, sands, labels from PET fines by multi-step separation.



MODULE

7 Pre-heating

8 Friction Washing

SCP PET Bottle Washing Line Flowchart

Pre-heating

PET flakes will be transported to a silo which filling with pre-heated chemical water that injected in by spraying system.

The specially designed silo structure makes the flakes through silo by sufficient time and effective friction force. So that the contaminants and adhesive are emulsified after soaking, which provides favorable conditions to remove impurities in the following hot washing section.

At the same time, this buffer silo provides storage space for PET flakes. The vertical dryer removes some contaminants and dirty water separated. And in this module, a closed water cycle loop by pumping transportation is set up available.



Friction Washing

Hot washing and friction module include four consecutive hot-washing machines and a rotating water-spray device. PET flakes transported to hot washing machines loaded with high temperature chemical water, and it takes advantage of mechanical force and chemical effect to emulsify contaminants, adhesives, then passed through the rotating water-spray device to separate from the impurities of the caustic water, including adhesive, paper pulp, organic compounds, etc..

Washing chemical is calculated by the PLC under formulary ratio and injected into chemical tank to achieve the best washing effect. The high-temperature washing water is heated by steam, equipped with a vapor-liquid mixing nozzle and an integrated control valves for convenient daily maintenance.



MODULE

9 Flotation

10 Rinsing

11 Flake Drying

SCP PET Bottle Washing Line Flowchart

Flotation

Flotation module separate labels, caps, rings relying on density contrast of PET, PP and PE which density is below 1 by using water as the separation media. Secondary washing of PET flakes after crushing is very important. It's good to remove caps, rings to keep flakes with stable quality and meet food contact standard.



Flake Drying

Drying unit is functioned by fluid bed device, PET flakes are evenly distributed and fed into the fluidized bed by air pneumatic conveying, moisture are taken away from flakes after full contact in hot air and reduced below 0.7%.



Features:

PET flakes are evenly heated in fluid bed device, with high-efficiency of drying, water content of the final product can be adjusted.

There is no phenomenon of gap or blowing out of uniform fluid-bed, it can obtain dry flakes which water content is average.

Vibration frequency is adjustable, the vibration speed of flakes also can be controlled according to flakes quality, valued contact area is larger.

Hot air drying reduce scraping of flakes surface and prevent PET fines, vibration screen with the structure of quick change can remove PVC.

It adopts a fully closed structure to effectively prevent PET flakes contact to outside air, and keep workshop clean.

Rinsing

The rinsing module with fresh industrial water added, and using the strong spiral stirring force to float out residual chemicals and fine impurities mixed in PET flakes, so that the PH value of PET flakes meets the food grade PET according to FDA or EFSA.

Over 50% rinsing water can be reusing it in rinsing unit after inline processing, which saves water consumption.



MODULE

12 Dust Removal 13 Flake Sorting 14 Blending 15 Quality Analysis 16 Packing

SCP PET Bottle Washing Line Flowchart

Dust Removal

Zig-zag separator can effectively separate the dust in the flakes, small plastic labels or film. By taking advantage of the gravity and the special internal structure design, PET flakes through the zig-zag separator, PET fines and small films will be suctioned by negative pressure, and the suction force which can be stepless adjusted. All the PET fines and small impurities can be collected inline which keep workshop clean.



Flake Sorting

For food grade PET flakes applications, automatic optical flake sorting unit is an indispensable module. The module takes advantage of automatic flake sorting, eddy current, and pipe-type metal separator. These devices would remove impurities in maximize before packing to ensure the stability of flakes quality. Flakes sorter will remove non-PET, color PET + metals and aluminum will be removed by eddy current and metal separator.



Blending

Food grade PET bottle flakes have higher quality requirements. The specially designed blending device mixes PET flakes, and guarantee the flakes quality index in a stable range, then transports them to analysis storage silos.

Quality Analysis

Before packaging, PET flakes through inline quality analysis, different quality level of PET flakes will be transported to different silos according to sampling inspection result. Unqualified flakes will be degraded and bagged separately.



Packing

Packing unit, by taking advantage of the shaking system specially designed, can make the packing of the flakes reach the fixed weight and maximize bulk density, which greatly reduce the packing and transportation costs. Except flakes packaging, caps, rings and PET fines are collected from inline collection system and packed into the warehouse. Inline weighing device of PET flakes can monitor real-time production flow.

