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Continuous Counter Flow Ethanol Extraction System

25Tons/day Hemp Extraction System

of producing 99+% CBD crystal

\$7,070,949 USD



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Part 1. Brief introduction

1. To get $>+99\%$ CBD Crystal, the system contains the following processes:

- ✧ Process of Extraction
- ✧ Process of De-colorization.
- ✧ Process of filtration.
- ✧ Process of ethanol recovery.
- ✧ Process of De-carboxylation.
- ✧ Process of Capturing THC
- ✧ Process of De-THC, pesticides and heavy metals.
- ✧ Process of Molecular distillation.
- ✧ Process of Crystallization.

2. This system is a turn-key systematic engineering project, including not only machinery but also technical services:

No.	Process	Names of Machinery	Quantity(set)	Total power (kw)
1	Ethanol storage, cooling and flow rate control	Tanks of storing fresh and recovered ethanol	1	22
2		Cooling station by liquid Nitrogen	1	6
3		Device of avoiding condensate water	1	0
4		Ethanol feeder and flow control	1	6
5	Biomass storage, conveying and flow rate control	Biomass storage hopper	1	6
6		Continuous and automatic flow meter for biomass	1	1
7		Conveyor to move biomass from hopper to extractor	1	8
8	Extraction	Continuous Counter-flow Extractor	1	11
9		Automatic washing for feeder and extractor	1	0
10	Spent biomass treatment	Recovering ethanol from spent biomass	1	41
11	De-color and filtration	Extracts settling and crude filtration	1	4
12		Extracts heating	1	13
13		Extracts Decolorization and fine filtration	1	40
14	Ethanol recovery	First evaporation to recover ethanol	1	60
15		Second evaporation to recover ethanol	1	48
16		Third evaporation to recover ethanol	1	21
17	Delete THC, pesticides and heavy metals	THC free	1	18
18	De-Carboxylation	De-Carboxylation	1	22
19	Molecular Distillation	Short pass	4	320
20	Crystallization	Tanks of storing fresh solvent	1	6
21		Crystallization	1	57
22		Evaporation to recover solvent	1	93
23		Recovering solvent from tail gas	1	34
24	Terpene	Terpene collector	1	6
25	Ethanol purification	Ethanol distillation	1	11
26	Breath Air	Recovering ethanol from tail gas	1	34
27	Water cooling	Water cooling tower and circulation pumps	1	247
28	Heating	Natural gas fired steam boiler	1	0
29		Low-temperature steam generator	1	6
30	Vacuum	Vacuum device	1	6
31	PLC	PLC electric control system	1	
32		sum=		1,143

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Technical services:

- ✧ Parameters and index of the whole process.
- ✧ Training for customer's workers and operators how to operate the whole machinery correctly and get the qualified products.
- ✧ Designing the whole plan and layout.

Part 2. Index and parameters

1 Final products

- ✧ Name: CBD Crystal.
- ✧ Quality: > +99% CBD.

2 By-products

- ✧ 85%~95% CBD fine oil of THC free
- ✧ 75%~85% CBD oil of THC free.
- ✧ Crude oil of full spectrum.
- ✧ Terpenes.
- ✧ THC

3 Raw material

- ✧ Name: Hemp
- ✧ Status: Dried and grinded.

4 Capacity (input quantity of raw material)

≥ 1042 kg/hr . Notes: Designed on continuous running of 24 hours per day.

5 Extraction rate

≥ 95 %.

6 Extraction process parameters

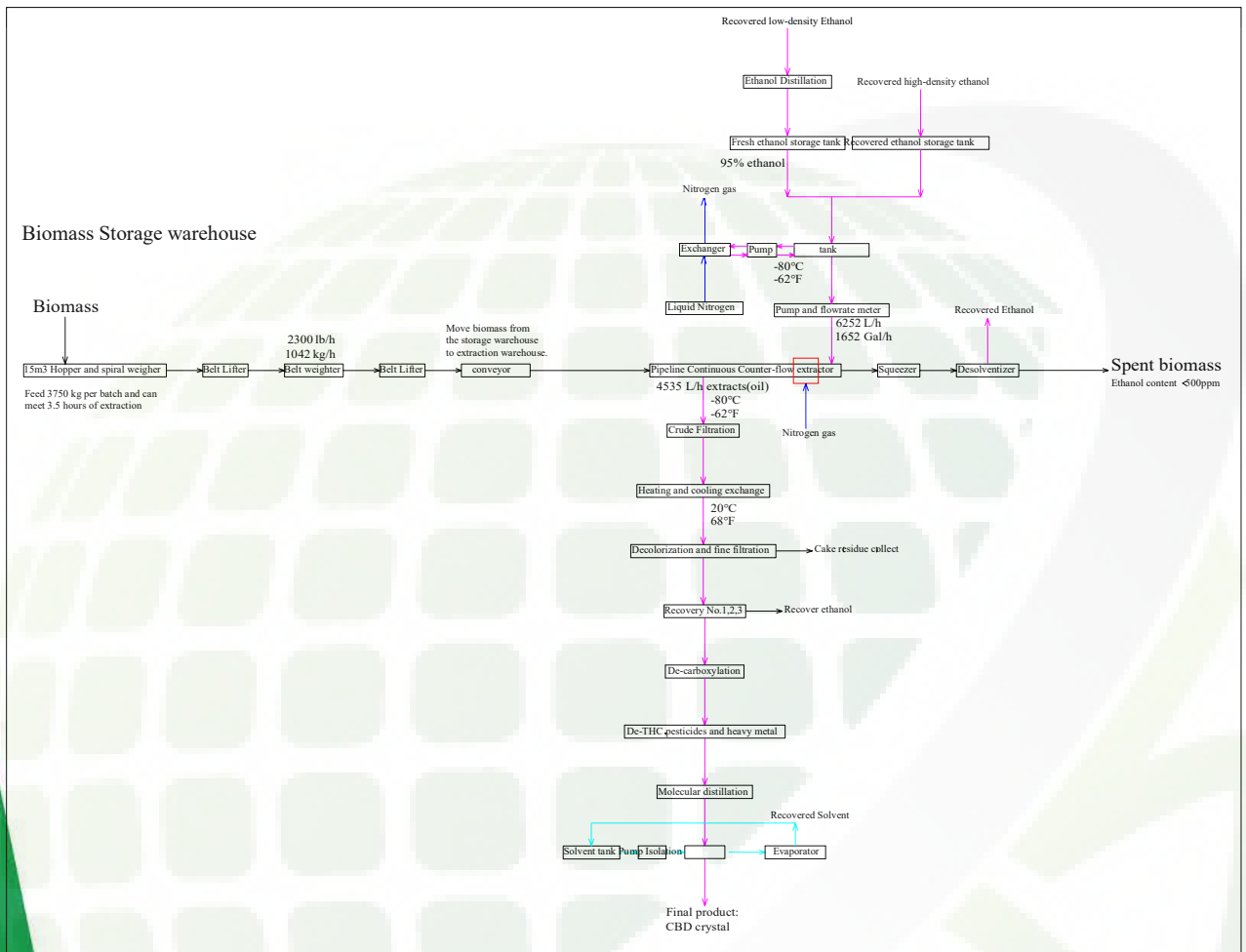
- ✧ Extraction temperature: < -75°C, and cooled by Liquid Nitrogen.
- ✧ Extraction time: < 60min.
- ✧ Solvent: 95% ethanol.
- ✧ Ratio between biomass and ethanol: 1:6 (kg:L), and the input volume of ethanol is around 6250L/h.

7 Ethanol remained in the spent biomass after recovery.

< 500ppm.

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Part 3. Brief flow-chart



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Part 4. Features and Advantages

1 Continuous running and automatic control

Process from biomass input to spent biomass output

After the raw-material put into the hopper, the following process, from belt weigher, through conveyor, extractor, rinsing, squeezer, Desolventizer, to the last of spent biomass discharging, will have no hand-operated-transit process, the whole process is sealed, and running continuously and automatically, no solvent and vapor leak out, which guarantee the safety of the process.

Process from the fresh solvent input to the final product CBD crystal output

After the ethanol cooled down to -75°C , the following process, from the very beginning of flow rate metering, through rinsing, extractor, crude filter, de-color, fine filter, first and second and third evaporation, de-carboxylation, THC free, deleting pesticides and heavy metals, distillation, to the last of Crystallization, will have no hand-operated-transit process, the whole process is sealed, and running automatically, which guarantee the safety of the process. **Notes: the crystal will be collected by hand; and the cake from filters must be moved by hand.**

2 Real-time detection and Automatic control

All the following process parameters are detected real-timely:

The biomass feeding quantity.

The fresh solvent inputting volume for extraction.

The extracts inputting volume into the first evaporation.

All steam consumption amount.

Level value in all containers or tanks.

Temperature value for all equipments which need temperature control.

Vacuum value for all tanks which need vacuum control.

All machines are regulated and controlled automatically.

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3 PLC control.

The whole machinery is controlled and operated by a program in a computer, which has the functions below:

The operator only needs push a button, machines will run automatically step by step programmed.

The machines will stop automatically on any problems happened, or on the conditions that the relative control parts do not reach the start-value set.

All process parameters and production data will be recorded timely, and can be checked on any date or time you want, on any parameter you want.

4 Fine systematic design to guarantee the lowest ethanol and solvent loses.

For the whole process, to avoid the ethanol and solvent loss as lower as possible, we have focused on the following point:

First point is the ethanol remained in the spent biomass discharge. We have designed a high efficient and most suitable unit of recovering solvent from the spent biomass to let the content of solvent remained in the spent biomass discharged lower than 500ppm with the lowest consumption of steam.

Second point is the ethanol remained in the tail gas into the air. We have designed a centralized ethanol recovery device from the tail gas to let the content of ethanol remained in the tail gas discharged and meet the national standard.

Third point is any open-transit post operated by hand in the whole process, which will have ethanol vapor into the air. We have designed the whole process, except filtration, running continuously under the status of enclosed, that means there is no open-transit operated by hand and will have no ethanol vapor loss. **Remarks and Notes: The post must be operated by hand in the process is the work of collecting the residue (cake) from the filter and changing the filter. However, we design the filter to be changed every 4~10 hour which depends on the quality of raw material and status of the raw material chopped.**

Fourth point is the rotate sealing parts and static connects sealing parts. We have designed and chosen the most suitable model of mechanic sealing parts and high quality of static sealing materials to guarantee the whole machinery running

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stable and to avoid any problems which will cause leak of ethanol.

5 Energy saving

The counter-flow extraction, comparing to tank extraction, has the feature of using the lowest amount of fresh solvent to get the highest extraction rate (extraction rate), which reduces the amount of fresh solvent to 60% at least, that means **not only** saving the consumption of Liquid Nitrogen 60% at least used to cool the fresh solvent, **but also** saving the consumption of steam 60% at least used to recover solvent from the extracts.

6 Fine systematic design to guarantee the lowest consumption of cooling energy.

Using Liquid Nitrogen as cooling media will get not only a fast speed of cooling, but also a high efficiency of cooling exchange. Above all, to save consumption of Liquid Nitrogen, we design a system to use the waste tail gas of Liquid Nitrogen as media to keep the temperature of extraction pipes below -75°C .

Let extracts and fresh ethanol have heat exchange. The extracts, which comes out from the extraction pipe with temperature of about -75°C , will act as a cooling source to cool down the fresh ethanol, and meanwhile, the fresh ethanol will act as a heating source to heat up the extracts. That will solve energy.

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Part 5. Material

1 sus304 stainless steel

All parts, which contact raw material, solvent and extracts (oil) etc directly, are of sus304 stainless steel.

All parts, which are machinery 's supporter or insulate layer or cover etc. and do not contact raw material, solvent and extracts (oil) etc directly, are of sus304 stainless steel.

All pipes and valves, which are used for flowing solvent and extracts and oil, are of sus304.

All pipes and valves, which are used for flowing circulation hot and cold water and cold media from chiller, are of sus304.

2 Composite plate of sus304 stainless steel and carbon steel(Q235)

The de-solventizer, which is used for covering ethanol from spent biomass, is made of composite plate of sus 304 stainless steel and carbon steel. All parts, which contact the spent biomass with ethanol directly, are of sus304 stainless steel.

3 Carbon steel (Q235).

Motor and gear.

Shell bearing.

Platforms and stairs. **Notes: all guard bar or handrails on platforms and stairs are material of stainless steel.**

All pumps, which are used for circulating cooling water between the Water-Cooling-Tower and all condensers.

All pipes and valves, which are used for circulating cooling water between the Water-Cooling-Tower and all condensers.

All pipes and valves, which are used for flowing steam.

Steam drum and steam over heating exchanger.

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Part 6. Machinery List and Quotation

1 Quotation

No.	Process	Names of Machinery	Quantity(set)	Total power (kw)	Amount (USD)	Remarks
1	Ethanol storage, cooling and flow rate control	Tanks of storing fresh and recovered ethanol	1	22	67,534	
2		Cooling station by liquid Nitrogen	1	6	182,356	
3		Device of avoiding condensate water	1	0	8,796	
4		Ethanol feeder and flow control	1	6	19,659	
5	Biomass storage, conveying and flow rate control	Biomass storage hopper	1	6	33,641	
6		Continuous and automatic flow meter for biomass	1	1	61,798	
7		Conveyor to move biomass from hopper to extractor	1	8	67,798	
8	Extraction	Continuous Counter-flow Extractor	1	11	260,420	
9		Automatic washing for feeder and extractor	1	0	14,706	
10	Spent biomass treatment	Recovering ethanol from spent biomass	1	41	260,784	
11	De-color and filtration	Extracts settling and crude filtration	1	4	63,703	
12		Extracts heating	1	13	48,203	
13		Extracts Decolorization and fine filtration	1	40	209,372	
14	Ethanol recovery	First evaporation to recover ethanol	1	60	179,587	
15		Second evaporation to recover ethanol	1	48	80,685	
16		Third evaporation to recover ethanol	1	21	120,569	
17	Delete THC,pesticides and heavy metals	THC free	1	18	168,180	
18	DeCarboxylation	DeCarboxylation	1	22	125,611	
19	Molecular Distillation	Short pass	4	320	795,600	
20	Crystallization	Tanks of storing fresh solvent	1	6	22,841	
21		Crystallization	1	57	701,285	
22		Evaporation to recover solvent	1	93	122,693	
23		Recovering solvent from tail gas	1	34	69,585	
24	Terpene	Terpene collector	1	6	26,728	
25	Ethanol purification	Ethanol distillation	1	11	277,930	
26	Breath Air	Recovering ethanol from tail gas	1	34	69,585	
27	Water cooling	Water cooling tower and circulation pumps	1	247	108,515	
28	Heating	Natural gas fired steam boiler	1	0	191,086	
29		Low-temperature steam generator	1	6	35,767	
30	Vacuum	Vacuum device	1	6	35,767	
31	PLC	PLC electric control system	1		278,909	
32		Sub=Total		1,143	4,708,963	
33		Package and loading fee			1,661,986	
34		Platform				
35		Cables and protectors				
36		Pipes ,valves and connectors				
37		Spare parts and tools				
38		Fee of Transportation and customs	Not Included		0	
39		Fee of Workers for installation	Not Included		0	
40		Technical service			700,000	
41		Total Contract Price=			7,070,949	

2 Breakdown List of Machinery

Will be provided by the designer after this proposal is approved by the buyer.

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Part 7. Field installation

- 1 Platforms and stairs.
- 2 Field installation for the machineries
- 3 Field installation for the pipes
- 4 Electrical installation

Part 8. Qualification

- 1 Quantity check

Before loading into containers, the two parties must check the actual items in accordance with the Breakdown List of Machinery in Part 6, and Packing List.

- 2 Material checking:

the material of all the machineries and parts must meet the demands of Part 5.

- 3 IQ (Installation Qualifications)

In the process of installation and after the installation, the two parties must go through the IQ according to the IQ and other relevant technical documents.

- 4 OQ (Operation Qualifications)

The qualification conditions are as follows:

Operation at full load.

Running 48 hours continuously.

In the period of running, the two parties make the qualification according to the IQ and other relevant technical documents. And the whole lines must meet the following demands besides the technical index in the OQ.

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Do not have any mechanical failure.

Do not have any leak, for the checking method and standard as follows:

- ✧ No any leak between flange connection by eye.
- ✧ The mechanical sealing should meet the standard <GB/T14211-1993 Examining method for mechanical sealing>.

The whole process from the input of raw material, through the extraction pipes and to the end, i.e. output of crude, is smooth and unobstructed.

The whole process from the input of fresh extraction solvent, through the extraction pipes and to the end, i.e. output of extracts liquid is smooth and unobstructed.

Must meet the technical index and parameters of Part 2. 4.2.6The PLC controlling system must be correct and meeting the demands and achieving automatic controlling and operating.

Qualification for the quality of final product.

The CBD content of final product must meet the index value in Article No.1 of Part 3.

Qualification for the Extraction rate.

The Extraction rate must meet the index value of Article No.5 of Part 3.The test method and calculation formula is as below:

- ✧ $E = (C1 - C2) / C1$
- ✧ **E: Extraction rate.**
- ✧ **C1: Total CBD content in the samples of raw material (biomass before extraction) .**
- ✧ **C2: Total CBD content in in the samples of spent biomass (biomass after extraction) .**

Notes: The samples must be collected according to the international

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standards.

If there is any problem occurs, but do not affect normal running of the whole machineries, the Buyer should issue an acceptance, but the Supplier must solve the problem within short time, so the machinery will perform according to the specifications.

- 5 All documents must be provided in English.

Part 9. Facilities and equipment needed and must be provided by the Buyer

The Buyer must buy and construct the following machineries and facilities to let the whole extraction line work.

1 The machineries and facilities must be fitted.

- 1.1 Handling devices for the raw material.
- 1.2 Steam supply (boiler) .
- 1.3 Electrical supply.
- 1.4 Water supply.
- 1.5 Liquid Nitrogen.

2 The designing parameters for the facilities.

2.1 Power

Electricity source: 480v- 60Hz-3ph.

Total power: ≤ 1143 kW.

The following index will be provided by the supplier after contract signed.

Steam

- ✧ The total consumption of steam is about ____kg/h.

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- ✧ Needs a boiler of _____ t/h.

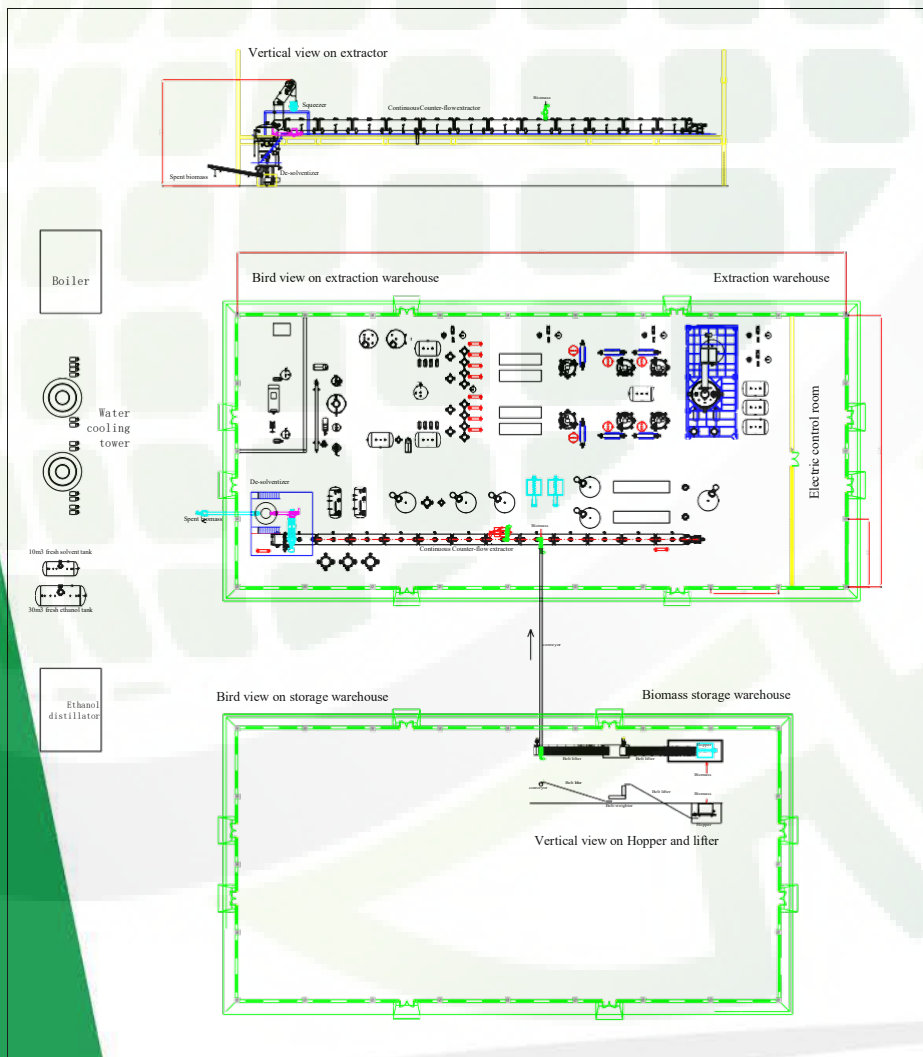
Circulation cooling water

- ✧ The total volume of circulation water is about _____ m³/h.
- ✧ Needs a water cooling tower of _____ m³/h.

Liquid Nitrogen

The consumption of Liquid Nitrogen is around _____ kg/h.

Part 10. Layout and footprint.



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Remarks and Notes:

- ✧ A storage warehouse of storing raw material and placing the chopping machine and the Device of Hemp feeder and flow control.
Dimensions will depend on how many pounds of Biomass will be stored at a certain time.
- ✧ An extraction warehouse of larger than 14220 (79 x 180) SQF with several separate rooms of placing extractor, filter, evaporator, distillator, and isolator, electric control room etc. The height of the warehouse must be at least 35 feet tall.
- ✧ An area of placing the Boiler and water treating equipment.
- ✧ An area of placing Tanks of storing fresh and recovered solvent, water tower, ethanol distillation etc.
- ✧ Besides, the customer must consider the space for office building and lab used for checking and testing the final products.
- ✧ Remarks and Notes: we will provide the service of designing the factory plan, designing the layout and warehouses, and give all the drawings needed free of charges.

Part 11. Workers and operators needed

The extraction line should be run at 24 hours per day continuously in terms of getting high efficiency. Thus, three shifts at least should be arranged. For each shift, 8~10 peoples at least must be needed.

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Our company

Global Hemp Solutions is your all inclusive post-harvest processing and extraction equipment provider. We have partnerships with some of the world's largest and best manufacturers. We not only provide you with the best equipment to help make you successful, we are there every step of the way even after the installation of the equipment. We value long term relationships and are truly here to serve you.



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All prices and shipping times subject to change. Please contact us for updated lead times and pricing.



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