

## Ozone In Fruits & Vegetables Industry:

# NO Chlorine



- **Quicker Process**
- **Increase Transit & Shelf Life**
- **Reduce Transit Spoilage**
- **Higher Safety & Hygiene**
- **USDA & GRAS Confirmation**

**Raw Flume Wash Water Ozonation**

**Surface & Equipment Ozone Sanitation**

**Bins | Crates - Disinfection & Sanitation**

**Air Disinfection - Production | Packing | Storage**

**Air Fumigation - Transport Vehicles & Containers**

**Waste Water | STP Tertiary Stage Ozonation**

## Pesticide Oxidation & Surface Disinfection

Chemtronics offers Integrated Ozone system [IOS] for pesticide removal & surface disinfection for:-

- 1. Batch Process**
- 2. Online Continuous Process**

## Application



FRUITS



VEGETABLES



LEAFY VEGETABLES



SEA FOOD



FROZEN FOOD



EXPORTS

### 1. Batch Process

Batch process is for smaller commercial applications, where commodity is self consumed like hospitals, hotels, restaurants, police, army, defence, temples, religious places, railways, hostels, airlines, etc. Generally commodities are fruits, vegetables, rice, pulses, meats, etc.

Batch process is also used for small to medium processing and distribution network or supply chain network. Ozone disinfection & pesticide removal process should be followed by a pre-washed operation. We recommend common ozone system for pre-wash also since operational cost is low. Also to save water consumption & reduce waste water, main process water can be reused for pre-wash operation.

An assorted commodity ranges from 50 kg – 10,000 kg per day.

Chemtronics offers four options for batch process:

Option A:- In tank ambient air feed ozone diffusion using Titanium dome diffuser.

Option B:- In tank oxygen feed ozone diffusion using titanium dome diffuser.

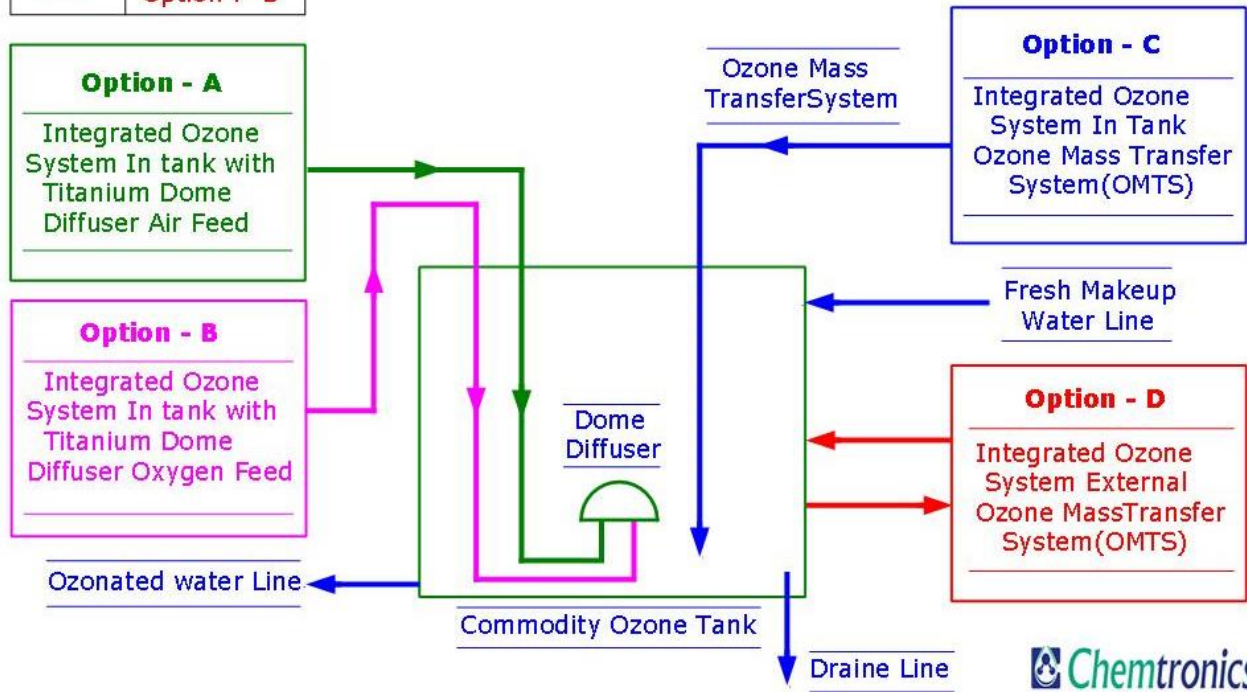
Option C:- In tank ozone diffusion using submersible (pump + venture + static mixer).

Option D:- External ozone mass transfer system using ozone mixing tank & undissolved ozone destruction.

## Block diagram

LEGEND	
—	Option :- A
—	Option :- B
—	Option :- C
—	Option :- D

**PFD 03.01- A - Block Diagram For Batch Process  
Pesticide Oxidation & Surface Disinfection**



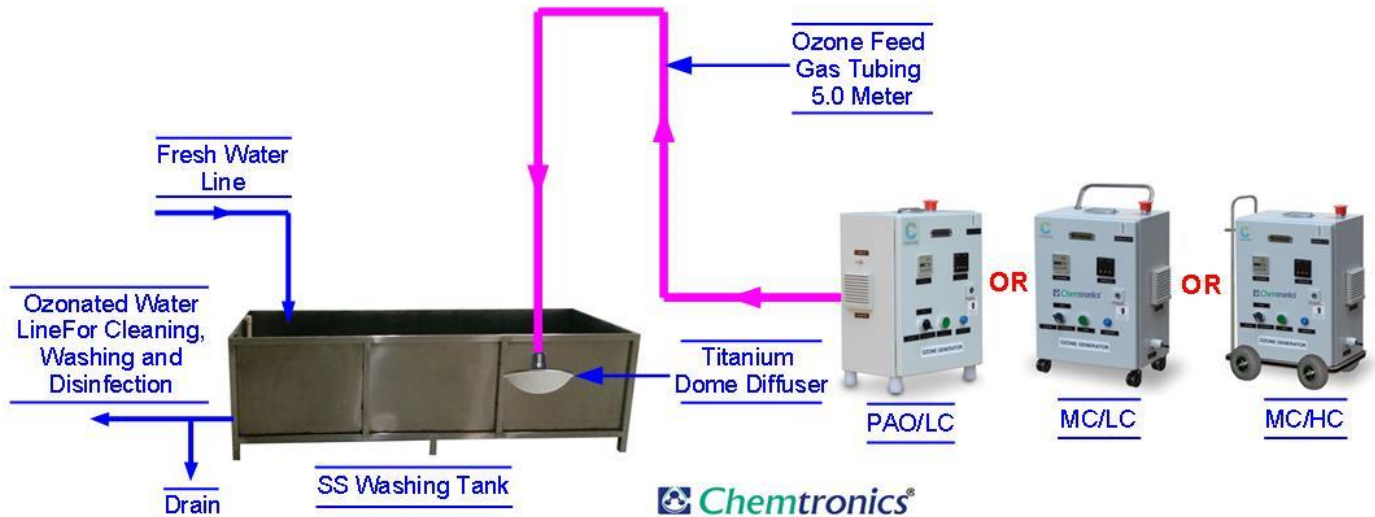
PFD 03.01 - B - Commodity Tank Plan View



## Option A: In tank ambient air feed ozone diffusion using Titanium dome diffuser

### PFD 03.02 - Fruits & Vegetables Ozone Cleaning & Disinfection

#### Option A : In Tank Air Feed Ozone Diffusion - Batch Process



Ozone generator is fed with ambient air where oxygen in the air is used to produce ozone gas using corona discharge technique. To increase the life of ozone cell ambient air drier option is also available. This ozone gas is conveyed through antioxidant flexible/rigid pipe to titanium dome diffuser. Titanium has higher resistance to ozone & has long service life.




**Installation:** Floor | Wall | Trolley

**Operation time:** 5 min to 20 min per batch. The time depends upon ozone capacity, ozone dose, contamination level, and commodity.

**Water quantity:** 2 times to 4 times of commodity by weight depending upon commodity & its density.

**Ozone dose:** 2-8 ppm depending upon operating time, ozone concentration, commodity & level of contamination. On an average as a rule of thumb it is 6ppm.

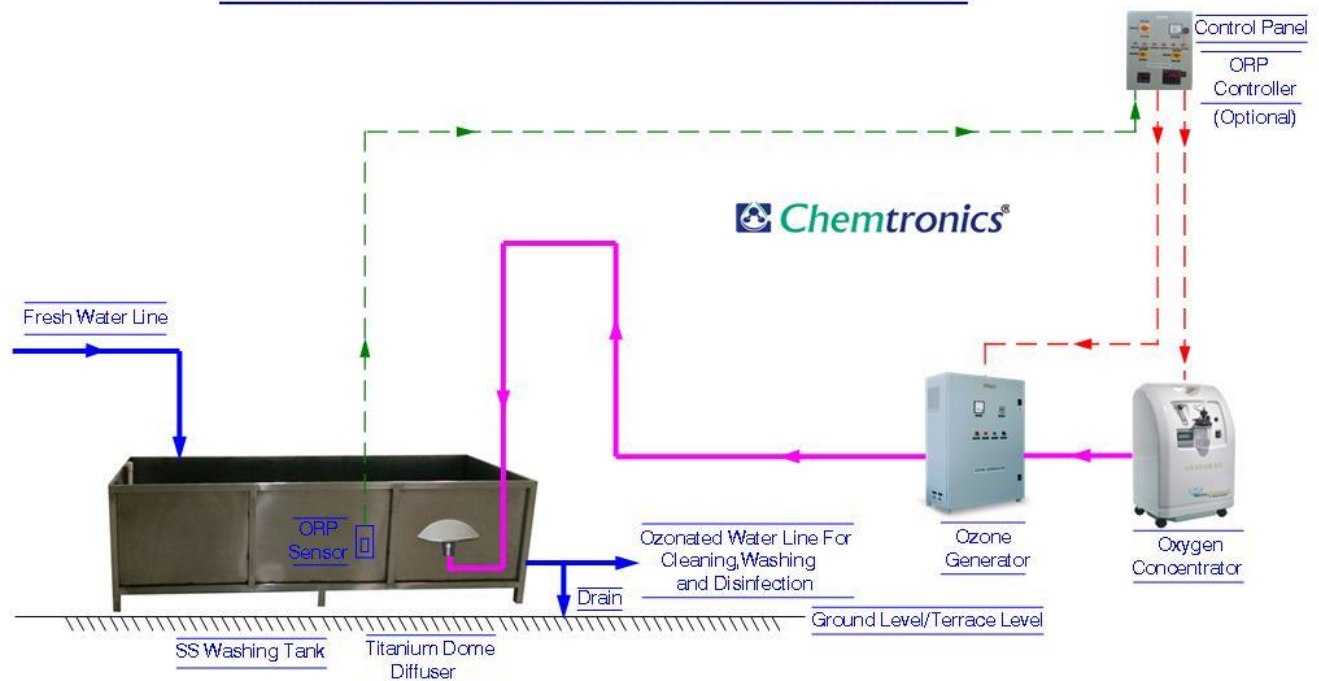
## CAPACITY

Model No.	Ozone output (mg/hr)	Batch size (kg)	Download data sheet
PAO/LC-250	250	2 - 5	
PAO/LC-500	500r	5 - 10	
PAO/LC-1000	1000	10 - 25	
MC/LC-250	250	2 - 5	
MC/LC-500	500	5 - 10	
MC/LC-1000	1000	10 - 25	
MC/HC-250	250	2 - 5	
MC/HC-500	500	5 - 10	
MC/HC-1000	1000	10 - 25	

**Option B: In tank oxygen feed ozone diffusion using titanium dome diffuser**

**PFD 03.03 - Fruits & Vegetables Ozone Cleaning & Disinfection**

**Option B : In Tank Oxygen Feed Ozone Diffusion - Batch Process**



Ozone generator is fed with oxygen source using oxygen concentrator. Oxygen concentrator uses ambient air having 20.8% oxygen gas to produce pure oxygen of 85-90% concentration. This concentrated oxygen is fed to ozone generator where this oxygen is converted into ozone using corona discharge technique. When ozone is produced from oxygen it has higher purity and concentration as compared to ambient air feed. This ozone gas is conveyed through antioxidant flexible/rigid pipe to titanium dome diffuser. Titanium has higher resistance to ozone & has long service life. Ozone concentration under option A, where ambient air is used can be upgraded to oxygen feed, simply by connecting oxygen concentrator. By connecting oxygen concentrator ozone output can be increased 8-10 times. Additional ORP monitor can be integrated in the system to monitor the residual ozone level and its disinfectant & oxidation power. It is always recommended to use ORP monitor to decide the operational time & confirmation of process effectiveness.




**Installation:** Floor | Wall | Trolley

**Operation time:** 5 min to 20 min per batch. The time depends upon ozone capacity, ozone dose, contamination level, and commodity.

**Water quantity:** 2 times to 4 times of commodity by weight depending upon commodity & its density.

**Ozone dose:** 2-8 ppm depending upon operating time, ozone concentration, commodity & level of contamination. On an average as a rule of thumb it is 6ppm.

## CAPACITY

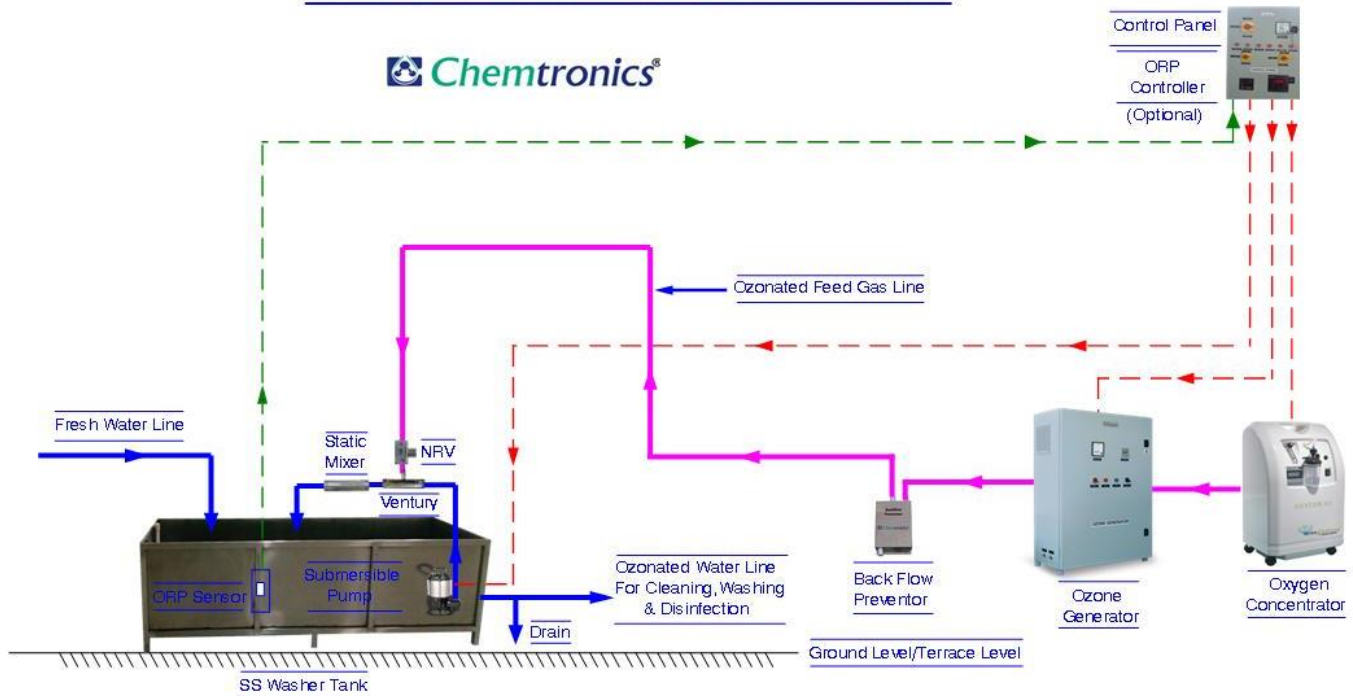
Model No.	Ozone output (g/hr)	Oxygen flow (lpm)	Batch size (kg)	Download data sheet
OG/LC-2	1.2 - 2.5	0.5 – 2.0	30 - 50	
OG/LC-5	2.5 – 3.5	1.0 – 5.0	75 – 100	
OG/LC-8	5.0 – 7.5	1.0 – 5.0	120 – 160	
OG/LC-10	5.5 – 10	2.0 – 5.0	180 – 200	
OG/LC-15	12 – 16	3.0 – 5.0	250 – 300	
OG/LC-20	18 – 22	3.0 – 5.0	350 – 400	
OG/LC-30	25 – 30	5.0 – 8.0	500 – 600	
OG/LC-40	30 – 43	6.0 – 10.0	700 - 800	



## Option C:- In tank ozone diffusion using submersible (pump + ventury + static mixer)

### PFD 03.04 - Fruits & Vegetables Ozone Cleaning & Disinfection

#### Option C : IOS In Tank Submersible Pump Ozone Mixing



Ozone generator is fed with oxygen source using oxygen concentrator. Oxygen concentrator uses ambient air having 20.8 % oxygen gas to produce pure oxygen of 85-90% concentration. This concentrated oxygen is fed to ozone generator where this oxygen is converted into ozone using corona discharge technique. When ozone is produced from oxygen it has higher purity and concentration as compared to ambient air feed.

High efficiency ozone mixing technique is used comprising of submersible pump, ventury, static mixer. The role of pump is to churn the water within commodity tank & provide higher flow & pressure at the inlet of ventury. Ventury is a mechanical device, sucks gas when low pressure (suction) is created by passing higher velocity water flow. The water and ozone gas mixes then passes through another mechanical device called the static mixer. Static mixer breaks the ozone bubbles into finer bubbles to increase the total surface area of the ozone bubble. By increasing the number of finer bubbles the gas to liquid transfer efficiency is increased. As a result more ozone gets dissolved in the water without any extra energy or capital & operational cost. Also energy within the technique of ozone dissolution quantity of undissolved ozone escaping out of the commodity tank is significantly reduced. This enhances the higher safety for plant operators & staff working in nearby vicinity. Since high pressure pump is used for mixing ozone, there is a possibility of water entering the ozone cell through ventury. To prevent this condition a safety device called back flow preventer & non return valve is installed between ozone generators & ventury as seen in process flow diagram. The location of pump & outlet

of static mixer are so strategically placed to avoid short circuit & provide maximum efficiency. Additional ORP monitor can be integrated in the system to monitor the residual ozone level and its disinfectant & oxidation power. It is always recommended to use ORP monitor to decide the operational time & confirmation of process effectiveness. **Upgradation:** by adding oxygen concentrator, option A can be upgraded to option B, option B can be further upgraded simply by adding pump + ventury + static mixer + BFP in place of titanium dome diffuser for higher performance & increased plant capacity.

Ozone concentration under option A, where ambient air is used can be upgraded to oxygen feed, simply by connecting oxygen concentrator. By connecting oxygen concentrator ozone output can be increased 8-10 times.


**Installation:** Floor | Wall

**Operation time:** 5 min to 20 min per batch. The time depends upon ozone capacity, ozone dose, contamination level, and commodity.

**Water quantity:** 2 times to 4 times of commodity by weight depending upon commodity & its density.

**Ozone dose:** 2-8 ppm depending upon operating time, ozone concentration, commodity & level of contamination. On an average as a rule of thumb it is 6ppm.

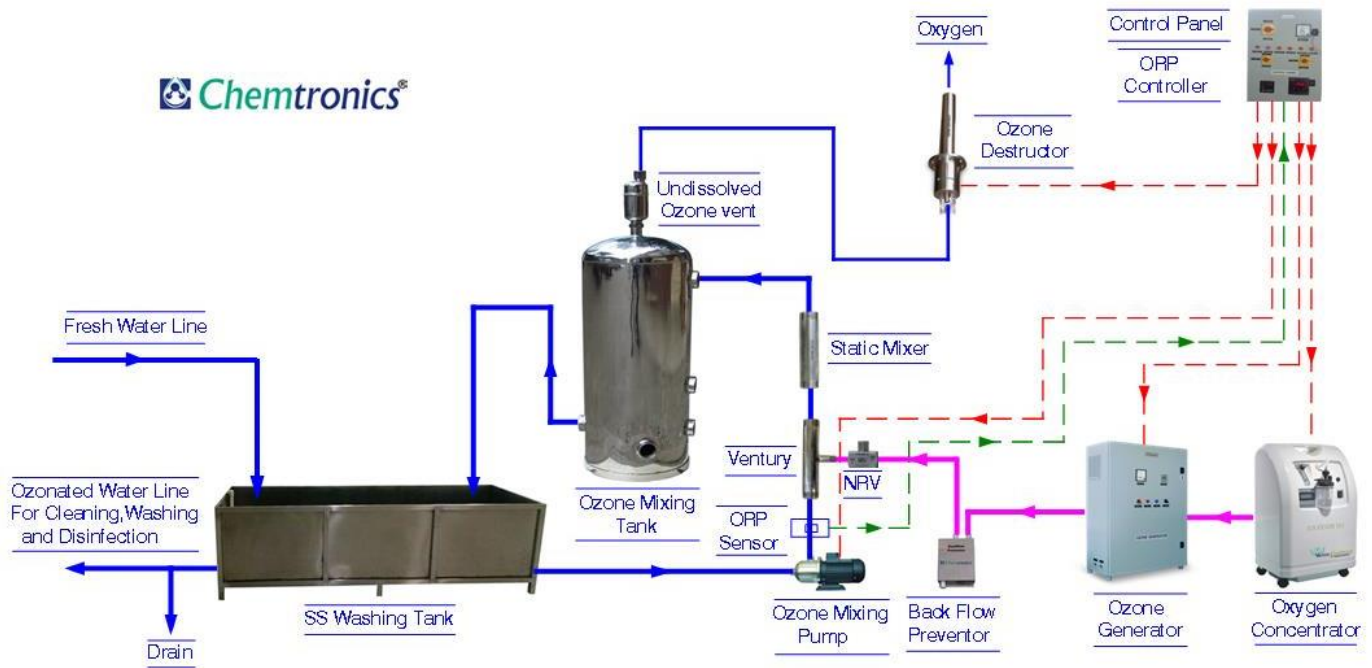
## CAPACITY

Model No.	Ozone output (g/hr)	Oxygen flow (lpm)	Batch size (kg)	Download data sheet
OG/LC-2	1.2 -2.5	0.5 – 2.0	60 – 100	
OG/LC-5	2.5 – 3.5	1.0 – 5.0	150 – 200	
OG/LC-8	5.0 – 7.5	1.0 – 5.0	250 – 300	
OG/LC-10	5.5 – 10	2.0 – 5.0	350 – 400	
OG/LC-15	12 – 16	3.0 – 5.0	500 – 600	
OG/LC-20	18 – 22	3.0 – 5.0	700 – 800	
OG/LC-30	25 – 30	5.0 – 8.0	1000 – 1200	
OG/LC-40	30 – 43	6.0 – 10.0	1400 - 1600	

**Option D:- External ozone mass transfer system using ozone mixing tank & undissolved ozone destruction**

**PFD 03.05 - Fruits & Vegetables Ozone Cleaning & Disinfection**

**Option D : IOS - With Ozone Mass Transfer Tank**



Ozone generator is fed with oxygen source using oxygen concentrator. Oxygen concentrator uses ambient air having 20.8 % oxygen gas to produce pure oxygen of 85-90% concentration. This concentrated oxygen is fed to ozone generator where this oxygen is converted into ozone using corona discharge technique. When ozone is produced from oxygen it has higher purity and concentration as compared to ambient air feed. The external ozone mass transfer for system is deployed, the main feature of this option is ozone mixing tank which is used for high ozone dissolution under pressure and extended ozone contact time. Also any ozone which is not dissolved in water is segregated & released from ozone vent. This undissolved ozone is passed through static ozone destruct device which internally breaks ozone into oxygen before releasing in the atmosphere.

Water is drawn from the commodity tank using SS-316 ozone mixing pump & fed to ventury & static mixer to ozone contact tank & back to commodity tank. High efficiency ozone mixing technique is used comprising of ozone mixing tank, ozone mixing pump, ventury, static mixer. The Ventury is a mechanical device which sucks gas when low pressure (suction) is created by passing higher velocity water flow. The water and ozone gas mixes then passes through another mechanical device called the static mixer. Static mixer breaks the ozone bubbles into finer bubbles to increase the total surface area of the ozone bubble. By increasing the number of finer bubbles the gas to liquid transfer efficiency is increased. As a result more ozone gets dissolved in the

water without any extra energy or capital & operational cost. Also energy within the technique of ozone dissolution quantity of undissolved ozone escaping out of the ozone mixing tank is significantly reduced. This enhances the higher safety for plant operators & staff working in nearby vicinity.

Since high pressure pump is used for mixing ozone, there is a possibility of water entering the ozone cell through ventury. To prevent this condition a safety device called back flow preventer & non return valve is installed between ozone generators & ventury as seen in process flow diagram. The location of pump & outlet of static mixer are so strategically placed to avoid short circuit & provide maximum efficiency. Additional ORP monitor can be integrated in the system to monitor the residual ozone level and its disinfectant & oxidation power. It is always recommended to use ORP monitor to decide the operational time & confirmation of process effectiveness. **Upgradation:** by adding oxygen concentrator, option A can be upgraded to option B, option B can be upgraded simply by adding pump + ventury + static mixer + BFP to option C in the same way option C can be upgraded to option D by providing ozone mixing tank and undissolved ozone destruction.


**Installation:** Floor

**Operation time:** 5 min to 20 min per batch. The time depends upon ozone capacity, ozone dose, contamination level, and commodity.

**Water quantity:** 2 times to 4 times of commodity by weight depending upon commodity & its density.

**Ozone dose:** 2-8 ppm depending upon operating time, ozone concentration, commodity & level of contamination. On an average as a rule of thumb it is 6ppm.

## CAPACITY

Model No.	Ozone output (g/hr)	Oxygen flow (lpm)	Batch size (kg)	Download data sheet
OG/LC-2	1.2 -2.5	0.5 – 2.0	60 – 100	
OG/LC-5	2.5 – 3.5	1.0 – 5.0	150 – 200	
OG/LC-8	5.0 – 7.5	1.0 – 5.0	250 – 300	
OG/LC-10	5.5 – 10	2.0 – 5.0	350 – 400	
OG/LC-15	12 – 16	3.0 – 5.0	500 – 600	
OG/LC-20	18 – 22	3.0 – 5.0	700 – 800	
OG/LC-30	25 – 30	5.0 – 8.0	1000 – 1200	
OG/LC-40	30 – 43	6.0 – 10.0	1400 - 1600	

### Comparison Table

Comparisons	Option A	Option B	Option C	Option D
<b>Feed gas</b>	Ambient air	Oxygen feed	Oxygen feed	Oxygen feed
<b>Efficiency</b>	Low	Medium	High	Highest
<b>Ozone dissolution</b>	40 – 50 %	50 – 70 %	70 – 80 %	75 – 85 %
<b>Un-dissolved ozone emission</b>	Highest	High	Medium	Nil
<b>Safety</b>	Low	Medium	High	Highest
<b>Capital investment</b>	Low	Medium	High	Highest
<b>Capital cost per kg</b>	Highest	High	Low	Low
<b>Running cost</b>	Low	Medium	High	High
<b>Running cost per kg</b>	Hgh	Medium	Low	Low
<b>Space</b>	Less	Moderate	Moderate	More
<b>Operation time</b>	High	Medium	Less	Less
<b>Consumables</b>	Lowest	Less	Less	Less
<b>Maintenance</b>	Negligible	Once in year	Once in year	Once in year
<b>Operation complexity</b>	Simplest	Simple	Simple	Simple
<b>Mode of operation</b>	Manual	Manual/automatic	Manual/automatic	Manual/automatic

## 2. Online continuous process

For larger & automated cleaning & disinfection facilities. Chemtronics offers state of the art online continuous flume wash operation. In online continuous process as the contact time is less, the capacity of ozone required is more.

An assorted commodity ranges from 50 kg – 10,000 kg per day.

In this process we offer two options as listed below:

**Option A:** dissolved ozonated water for online continuous process

**Option B:** Dissolved ozonated water for online continuous process with water recycling & saving process

## Application



SAUCE



WAFERS



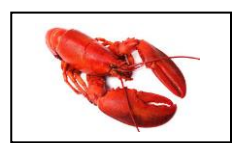
JAM



JUICE



WINE



SEAFOOD



FROZEN FOOD

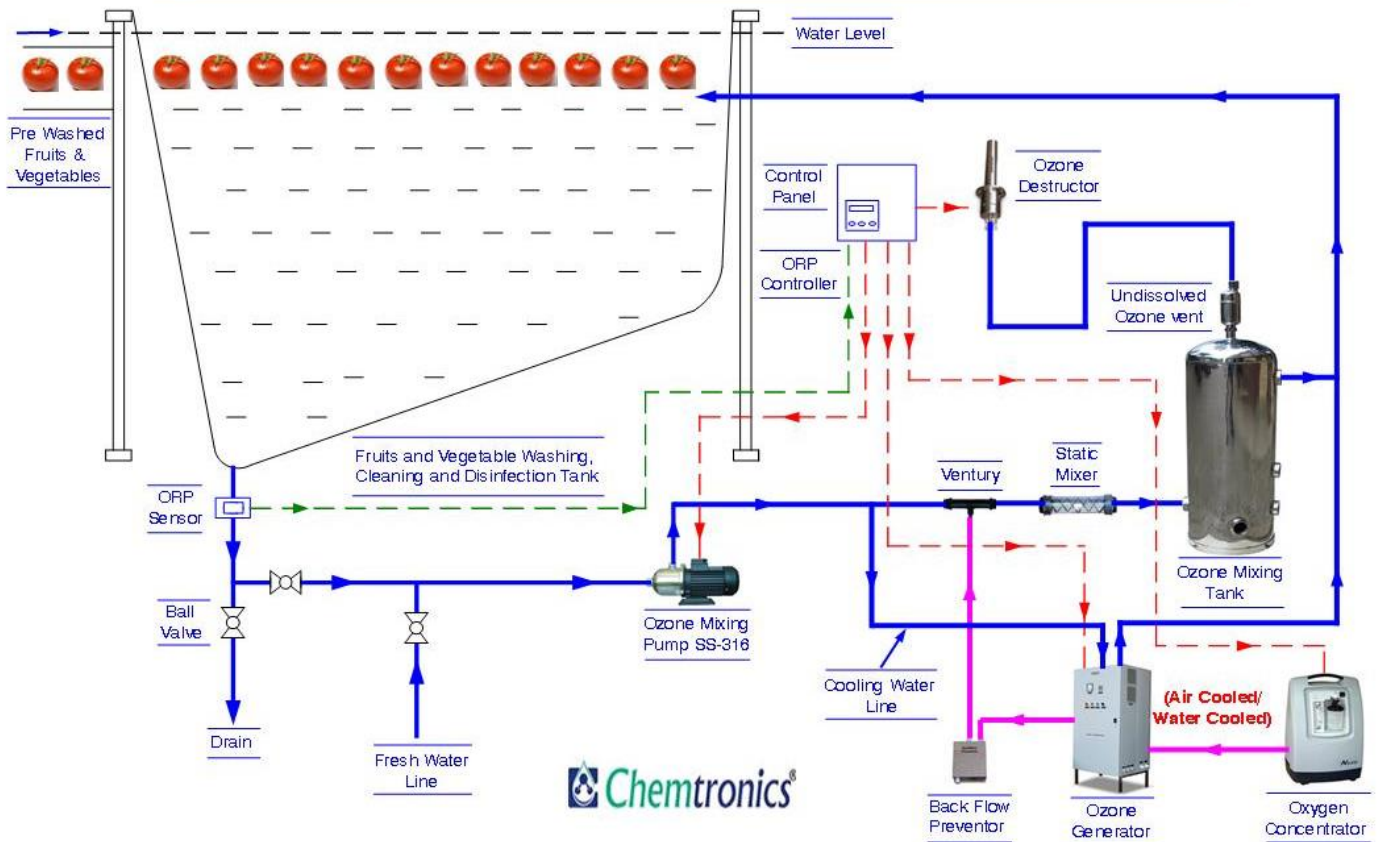


EXPORTS



Option A: dissolved ozonated water for online continuous process

**PFD 03.06 - Fruits/Vegetable/Poke/Beaf/Meat/Seafood/Ozone Cleaning & Surface Disinfection  
Option : A - Dissolved Ozonated Water For Online Continuous Process**



Ozone generator is fed with oxygen source using oxygen concentrator. Oxygen concentrator uses ambient air having 20.8 % oxygen gas to produce pure oxygen of 85-90% concentration. This concentrated oxygen is fed to ozone generator where this oxygen is converted into ozone using corona discharge technique. When ozone is produced from oxygen it has higher purity and concentration as compared to ambient air feed. As high capacity ozone generators are used so the ozone cell are water cooled, hence to cool the ozone cell water line is derived from the system only. The external ozone mass transfer for system is deployed, the main feature of this option is ozone mixing tank which is used for high ozone dissolution under pressure and extended ozone contact time. Also any ozone which is not dissolved in water is segregated & released from ozone vent. This undissolved ozone is passed through static ozone destruct device which internally breaks ozone into oxygen before releasing in the atmosphere.

Water is drawn from the commodity tank using SS-316 ozone mixing pump & fed to ventury & static mixer to ozone contact tank & back to commodity tank. High efficiency ozone mixing technique is used comprising of



ozone mixing tank, ozone mixing pump, ventury, static mixer. The Ventury is a mechanical device which sucks gas when low pressure (suction) is created by passing higher velocity water flow. The water and ozone gas mixes then passes through another mechanical device called the static mixer. Static mixer breaks the ozone bubbles into finer bubbles to increase the total surface area of the ozone bubble. By increasing the number of finer bubbles the gas to liquid transfer efficiency is increased. As a result more ozone gets dissolved in the water without any extra energy or capital & operational cost. Also energy within the technique of ozone dissolution quantity of undissolved ozone escaping out of the ozone mixing tank is significantly reduced. This enhances the higher safety for plant operators & staff working in nearby vicinity.

Since high pressure pump is used for mixing ozone, there is a possibility of water entering the ozone cell through ventury. To prevent this condition a safety device called back flow preventer & non return valve is installed between ozone generators & ventury as seen in process flow diagram. The location of pump & outlet of static mixer are so strategically placed to avoid short circuit & provide maximum efficiency. Additional ORP monitor can be integrated in the system to monitor the residual ozone level and its disinfectant & oxidation power. It is always recommended to use ORP monitor to decide the operational time & confirmation of process effectiveness. **Upgradation:** by adding oxygen concentrator, option A can be upgraded to option B, option B can be upgraded simply by adding pump + ventury + static mixer + BFP to option C in the same way option C can be upgraded to option D by providing ozone mixing tank and undissolved ozone destruction.

**Installation:** Floor

**Operation time:** 5 min to 20 min per batch. The time depends upon ozone capacity, ozone dose, contamination level, and commodity.

**Water quantity:** 2 times to 4 times of commodity by weight depending upon commodity & its density.

**Ozone dose:** 2-8 ppm depending upon operating time, ozone concentration, commodity & level of contamination. On an average as a rule of thumb it is 6ppm.

## CAPACITY

**Option B: Dissolved ozonated water for online continuous process with water recycling & saving process**

**PFD 03.07 - Fruits/Vegetable/poke/Beat/Meat/Seafood Ozone Cleaning & Surface Disinfection**  
**Option B : Dissolved Ozonated Water For Online Continous Process With Recycling & Saving Process**

