

UV Sterilizers by Chiyoda Kohan

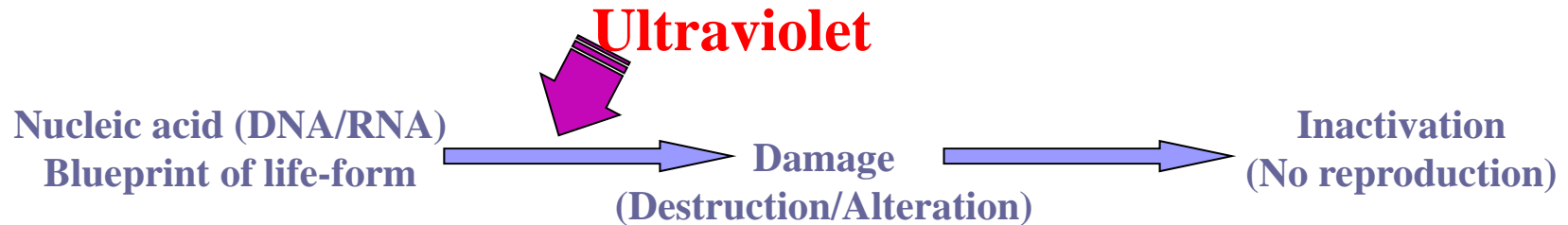
2017.9.20

 **Chiyoda Kohan Co., Ltd.**
UV Systems Division.

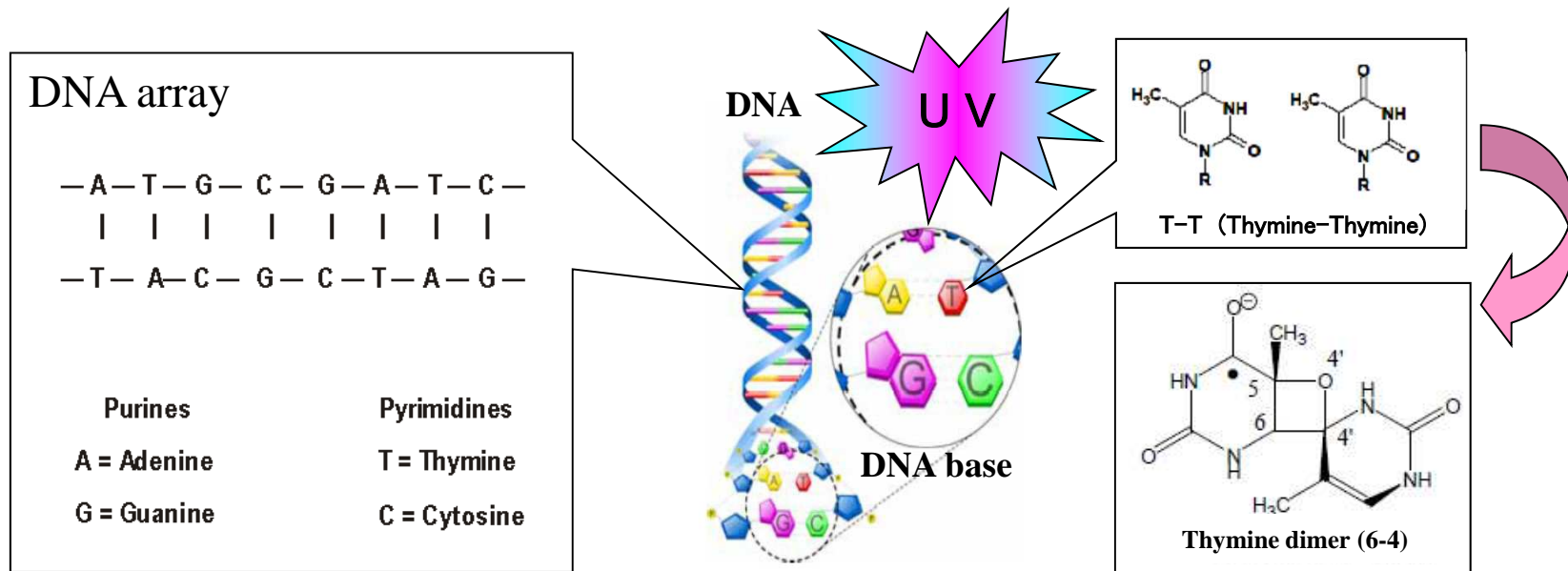
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Mechanism of inactivation by ultraviolet



The reproduction of DNA will be prevented by ultraviolet radiation that causes the dimerization of DNA base (ex. Thymine dimer).



Comparison of inactivation methods

Chlorine / Ozone

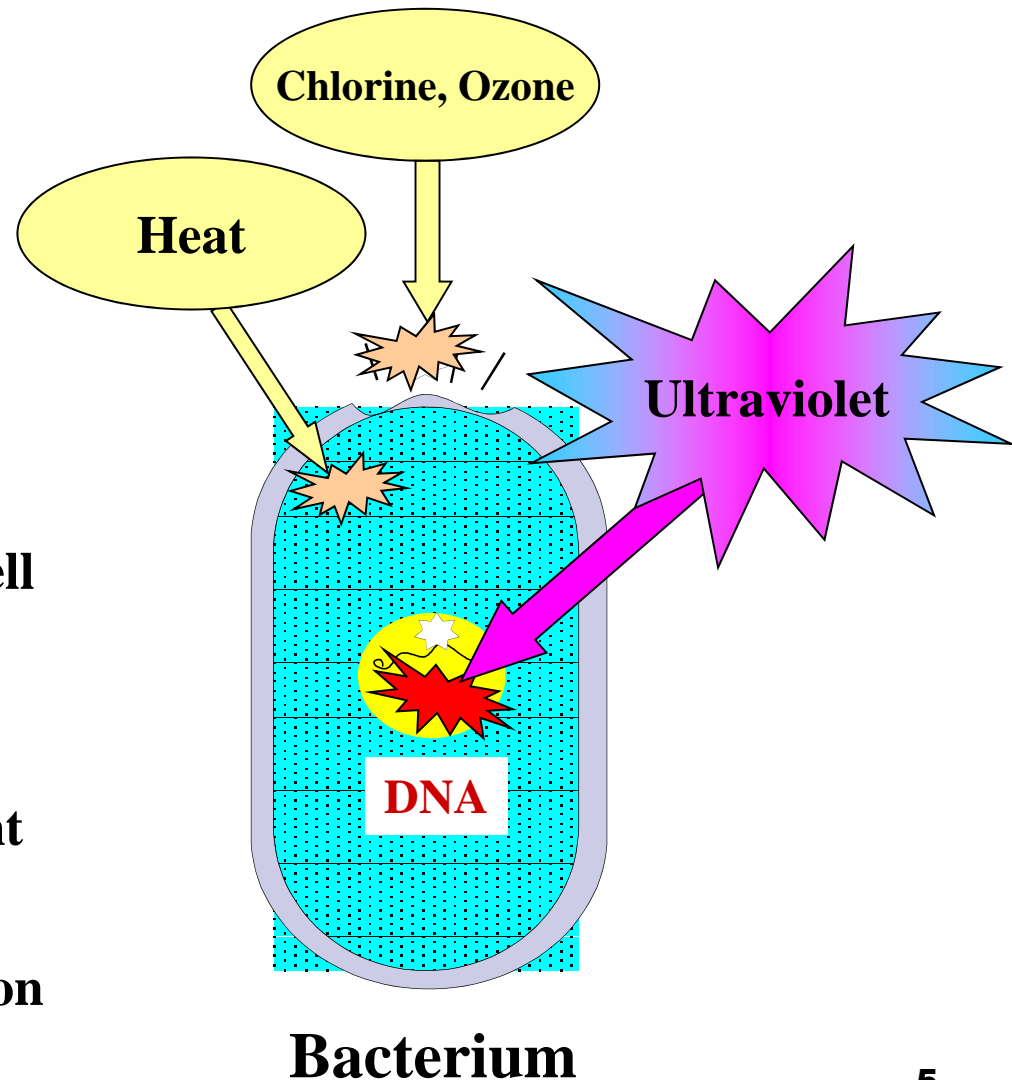
- Breaks the cell membrane

Heat

- Transforms the protein of the cytoplasm

Ultraviolet

- Destroys the DNA inside the cell
- ⇒ No UV-resistant bacteria is confirmed so far
- ⇒ Very effective for heat-resistant bacteria/viruses
- ⇒ Especially lethal for inactivation of cryptosporidium



Benefits of UV Sterilization

1) No harmful byproduct

For example, Chlorine is toxic itself and may produce unwanted byproducts, which can be harmful to human bodies. Meanwhile, ultraviolet does not change the quality of water and **leaves no toxic chemical residue** in the water to be processed (No change in pH, flavor, or taste). Also, no trihalomethan will be produced if UV is used to disinfect the water → Friendly to environment

2) Lethal to any microorganism

3) Easy installation, operation and maintenance

4) Economically superior

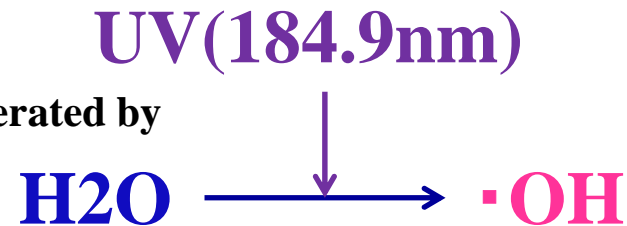
Required UV dose for various microorganisms

	Type of Microorganism	Required UV dose for 3log Inactivation (mJ/cm ²)
Germs	Escherichia coli	10
	Escherichia coli (O-157)	4
	Legionella pneumophila	4
	Pseudomonas aeruginosa	3~4
	Salmonella typhimurium	15
	Staphylococcus aureus	9
	Enterococcus faecalis	10
	Bacillus subtilis	8
	Bacillus subtilis	43
Fungi	Aspergillus niger	568
Protozoa	Cryptosporidium parvum	1~2

*Required UV dose will vary depending on the target microorganism to inactivate.

Mechanism of UV-AOP (1)

*Highly oxidative hydroxyl radicals ($\cdot\text{OH}$) are generated by irradiating deep UV light to decompose water.



CH_3OH (Methanol)



HCHO (Formaldehyde)



HCOOH (Formic acid)



$\text{CO}_2 + \text{H}_2\text{O}$

*Eventually decomposed to carbon dioxide and water

$\cdot\text{OH}$

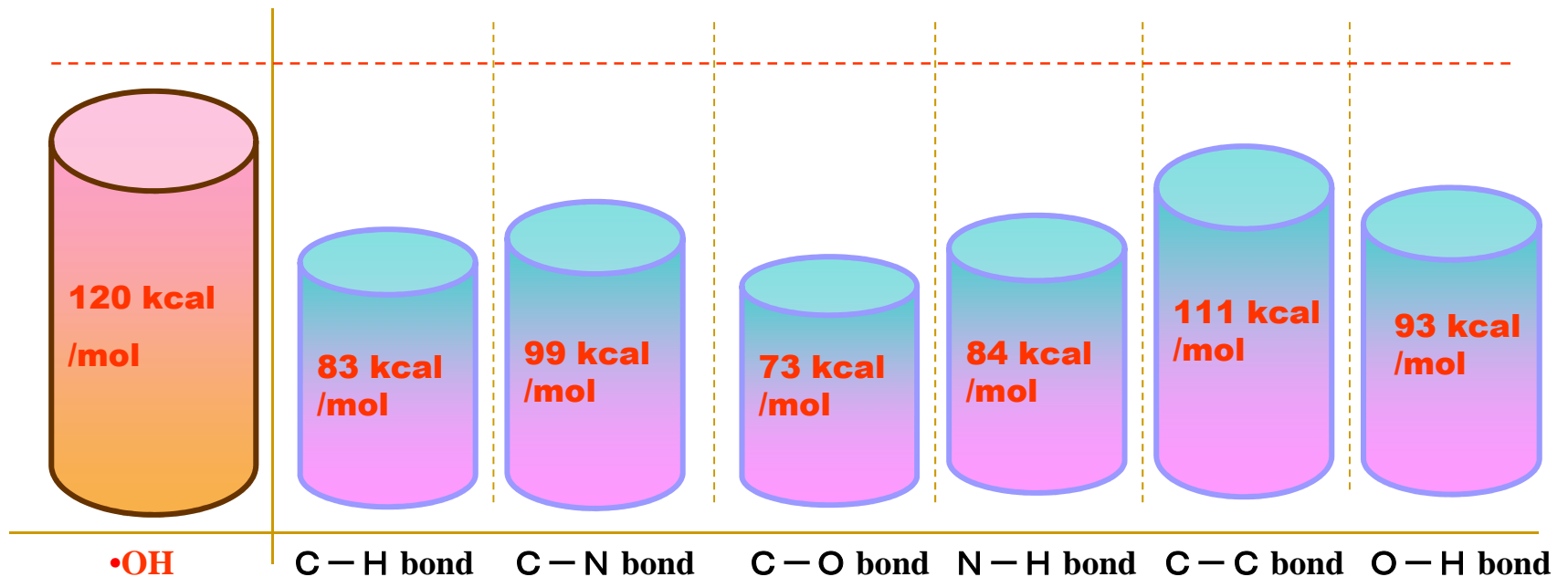
$\cdot\text{OH}$

$\cdot\text{OH}$

*Organic matters to be decomposed by generated $\cdot\text{OH}$



Mechanism of UV-AOP (2)

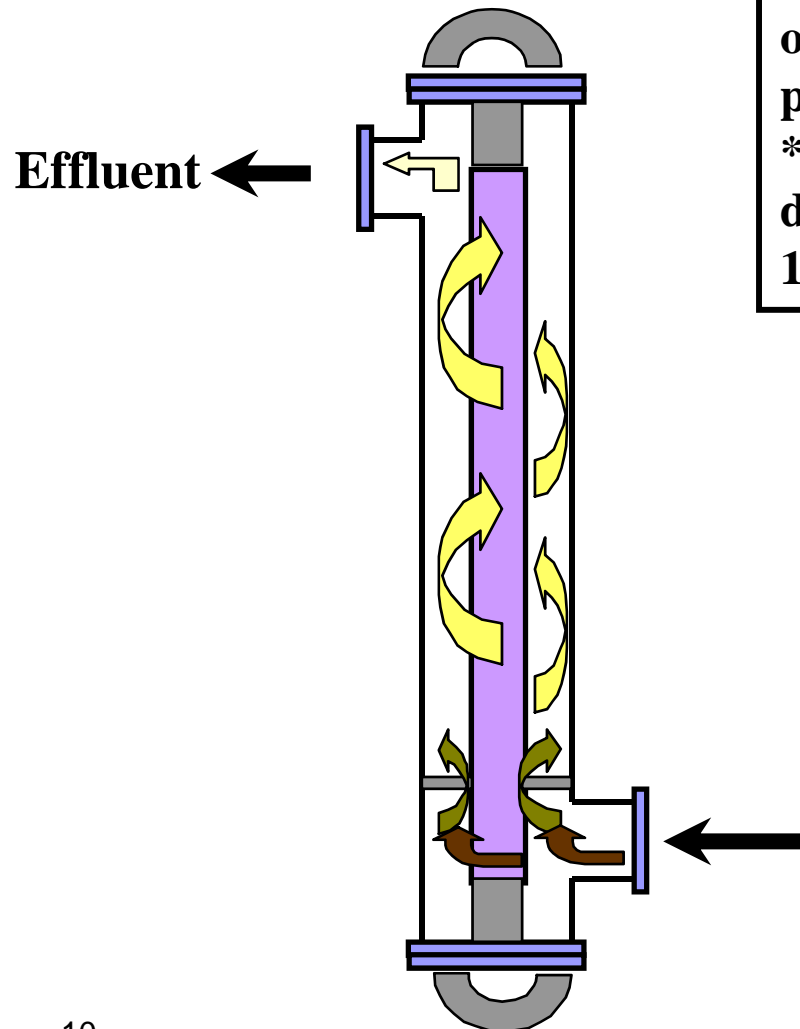


Chemical bonds of organic matters (such as above) will be ruptured due to the higher energy of $\bullet\text{OH}$



Basic Structure of UV- AOP Systems

UV Irradiation Unit

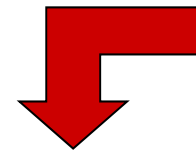


- * Large amount of hydroxyl radicals ($\cdot\text{OH}$) with strong oxidizing effect by irradiating UV to oxidizing agents such as ozone, hydrogen peroxide, etc.).
- * Higher concentration of organic matters can be decomposed than oxidation of organic matters by 184.9nm UV.

Ozonizer



Injection of
 O_3



Ejector

Feed



(1) Inline Quartz-Sleeved UV Sterilizers

- Widely used in sterilizing process water by incorporating into pipeline for a variety of applications.

<Features>

- LPHO lamps
- 10 models available
- Many optional functions



UEX Series



UEM Series

<Features>

- LP amalgam lamps
- Applicable to wide range of water temp
- 6 models available
- Many optional functions

(2) Non-Contact Type of Inline UV Sterilizers

- Highly corrosive liquids such as sea water and wastewater can be sterilized by using resin for all wetted parts.

<Features>

- LPHO lamps
- 29 models available



FDL/FDH Series



FDS-1

<Features>

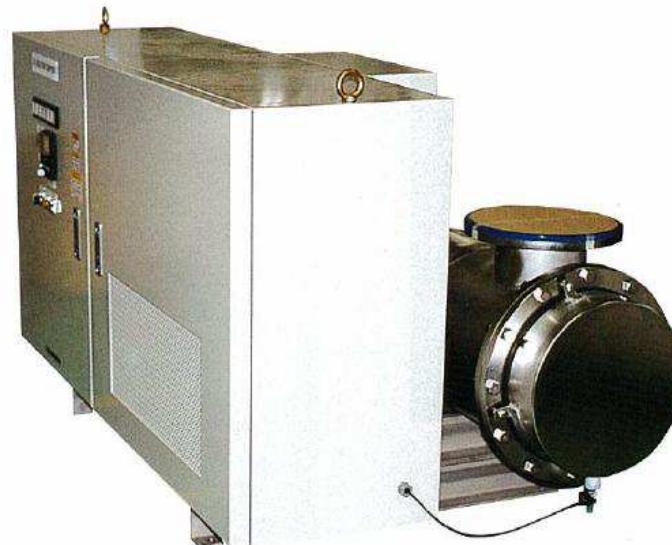
- Single lamp system
- Low cost

(3) Inline Quartz Sleeved UV Sterilizers for Low UVT Liquids

- Stirring effect by baffle plates incorporated inside the chamber leads to the sterilization of low UVT liquids such as liquid sugars and beverages.

<Features>

- LP amalgam lamps
- 6 models available
- Wide treatable range for liquid temp (Max. 80 degree-C)



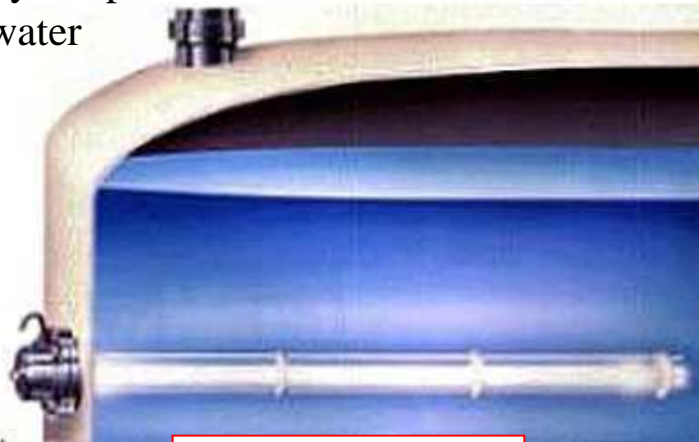
NWST Series

(4) UV Sterilizers for Liquid Storage Tanks

- To be installed on the sides or head space of tanks to **suppress the reproduction of bacteria and fungi** by irradiating UV onto the inner surfaces of storage tanks, the liquid surfaces, and in the middle of stored

<Features>

- LP mercury lamps
- For pure water tanks



OF Series

<Features>

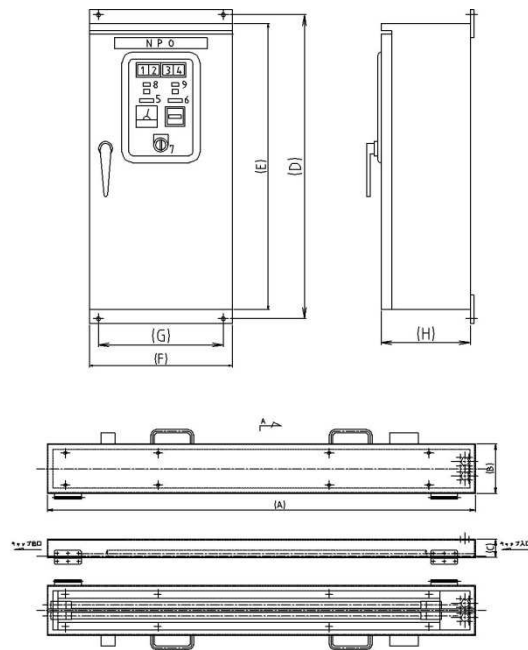
- LP mercury lamps
- For liquid sugar tanks



STN Series

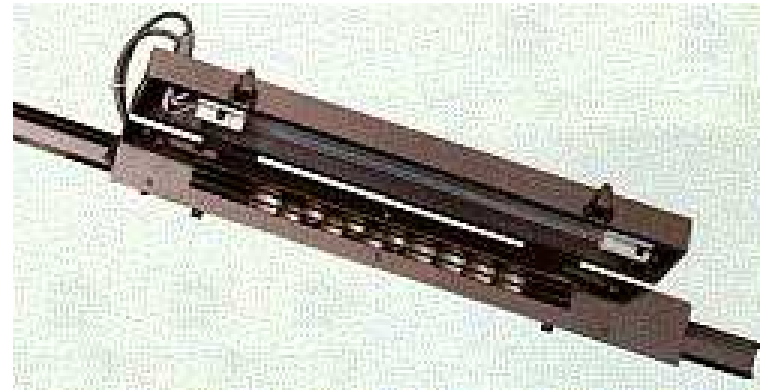
(5) UV Surface Sterilizers for Caps

- To be installed above conveyors to sterilize the bacteria and fungi on caps.



<Features>

- LP mercury lamps
- Lots of experience in PET bottle cap sterilization



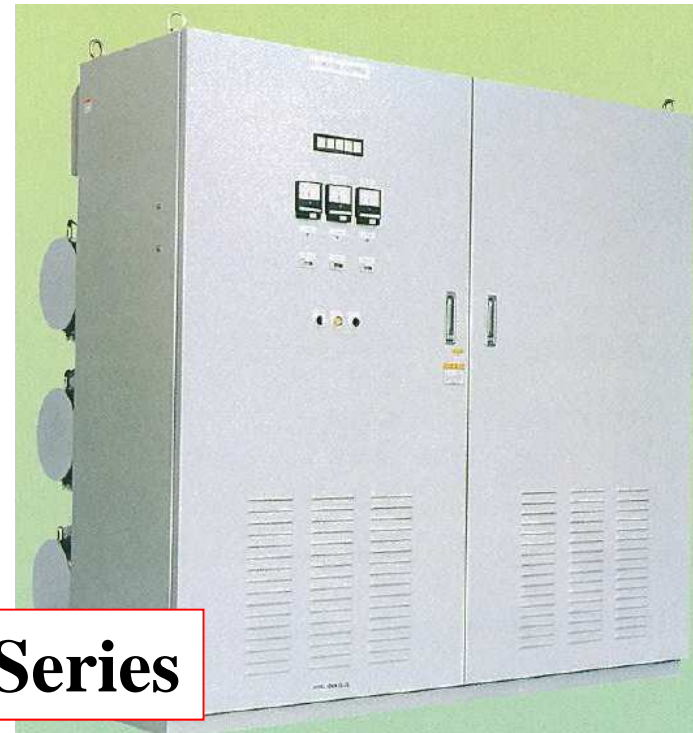
STO Series

(6) TOC-UV Systems for organic matter decomposition

- UV systems making use of photochemical reactions by deep UV light (184.9nm) to decompose small amounts of organic matter for ultra pure water lines of semiconductor fabs.

<Features>

- 184.9nm UV lamps
- Energy efficient compared to our old TOC-UV models.



WOX Series

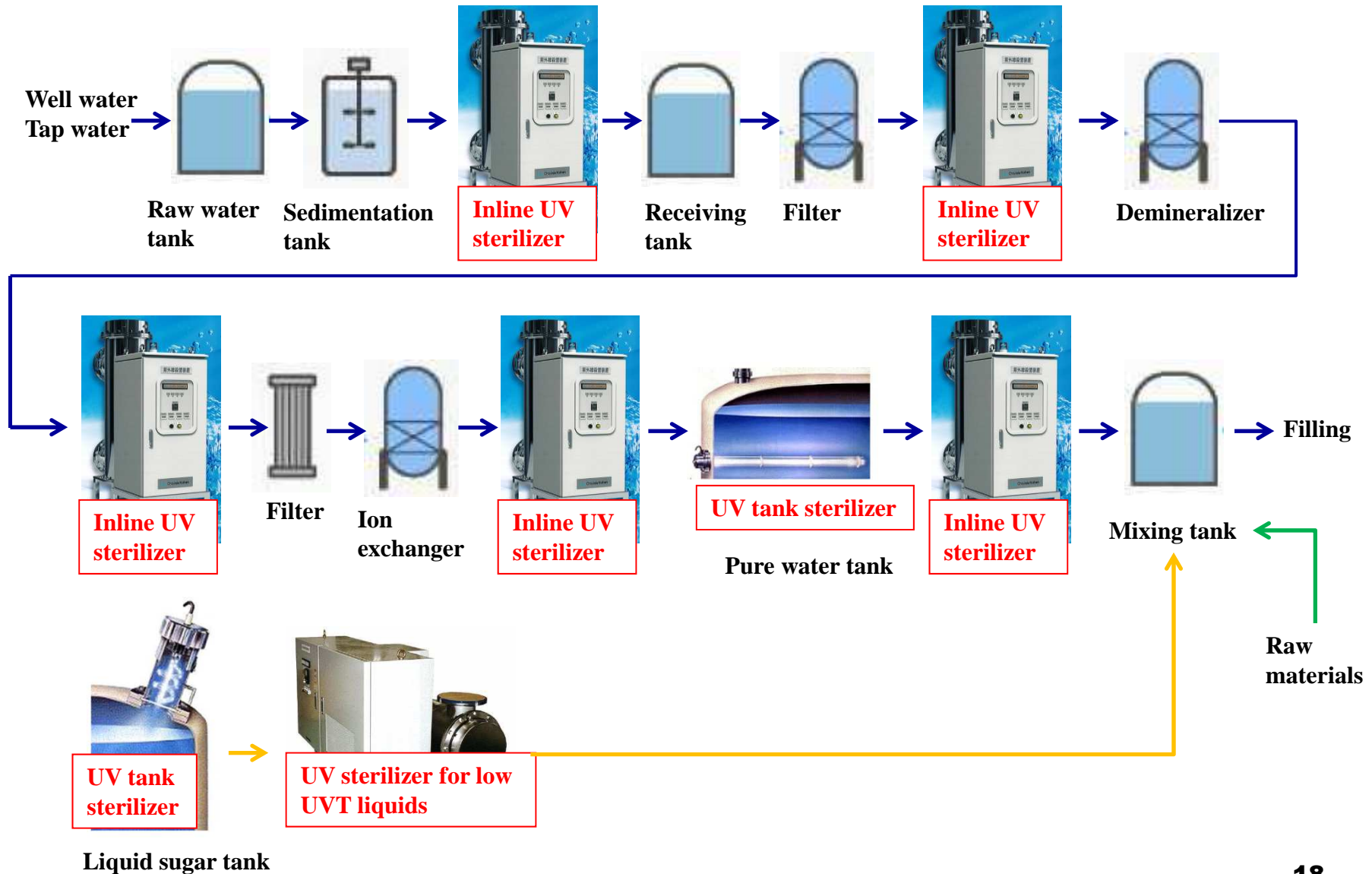
(7) Organic Matter Decomposition Systems (AOP: Advanced Oxidation Process)

- UV-AOP systems decompose organic matter by chemical reactions of UV and oxidizing agents (ozone, H₂O₂, etc.) to be used in treating wastewater from factories.

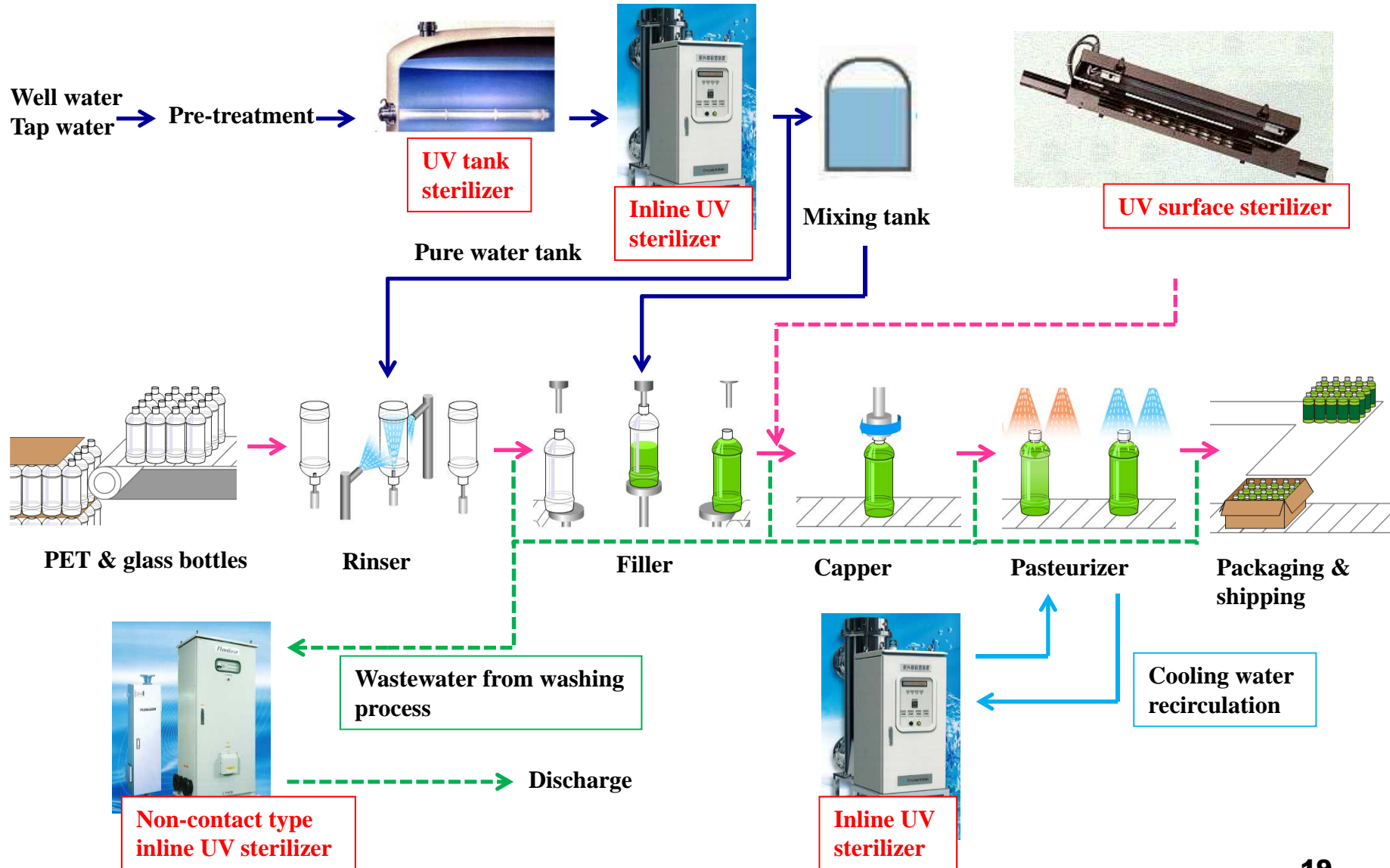


UV-AOP System

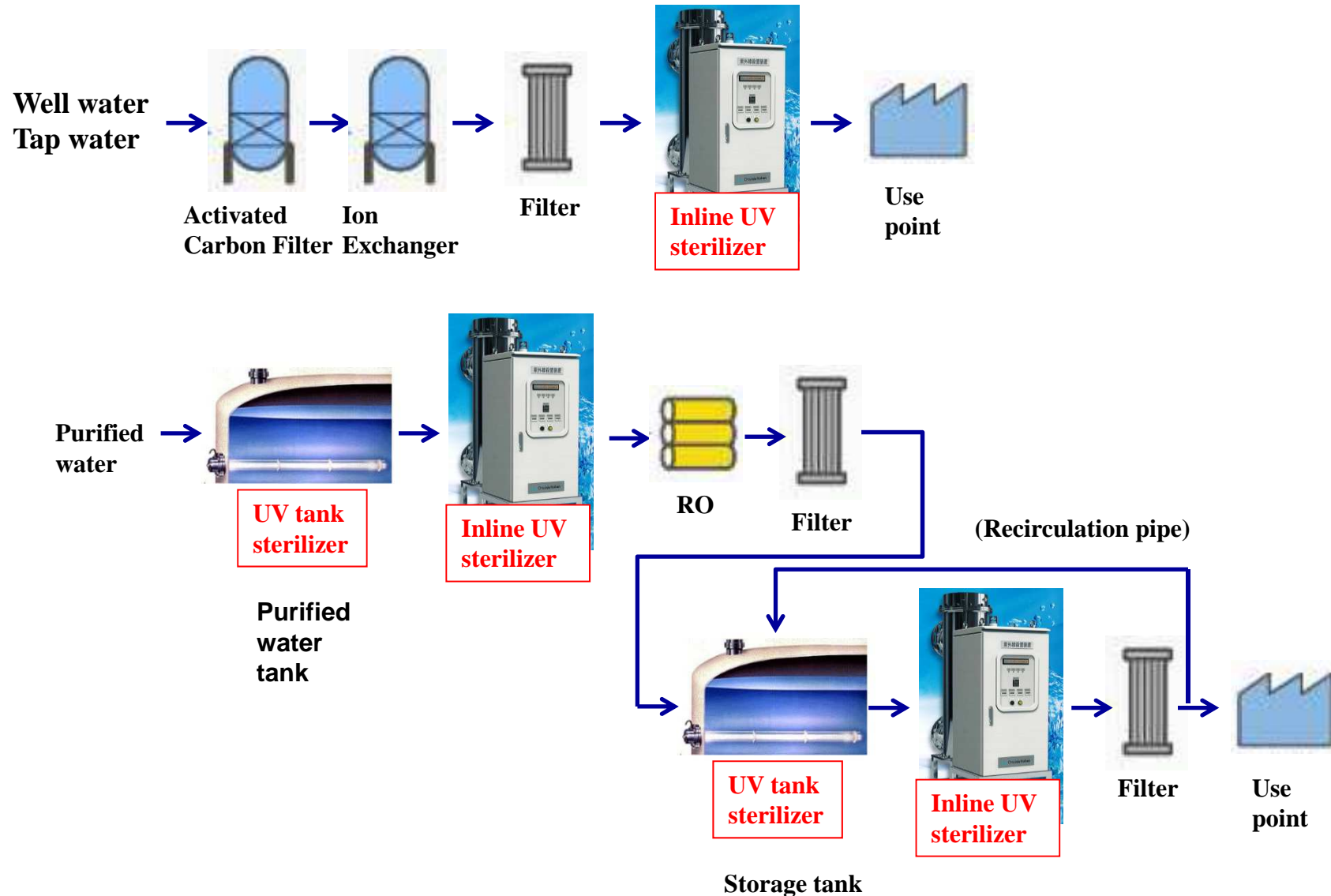
Application Example of UV Systems at Food/Beverage Plants (1)



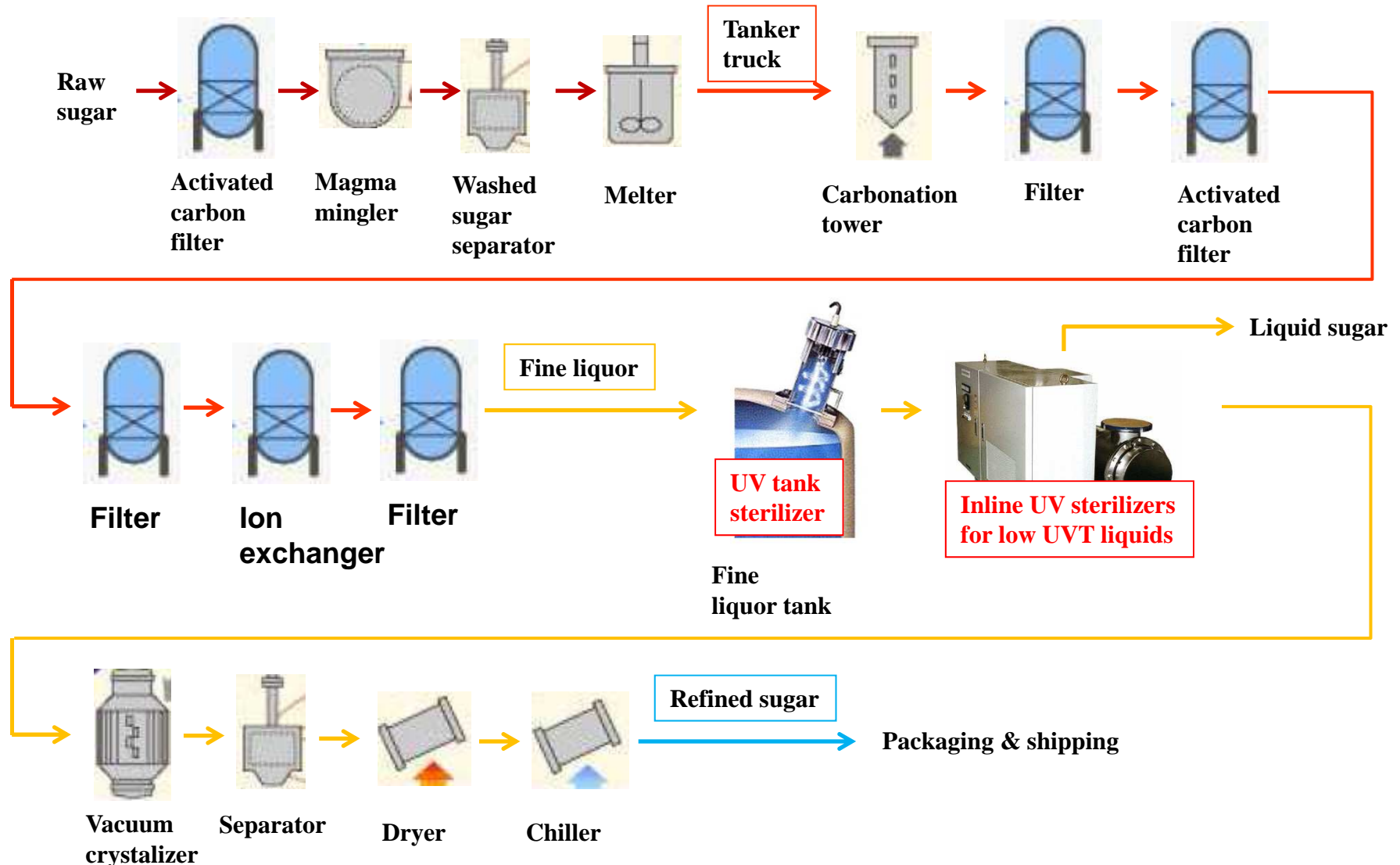
Application Example of UV Systems at Food/Beverage Plants (2)



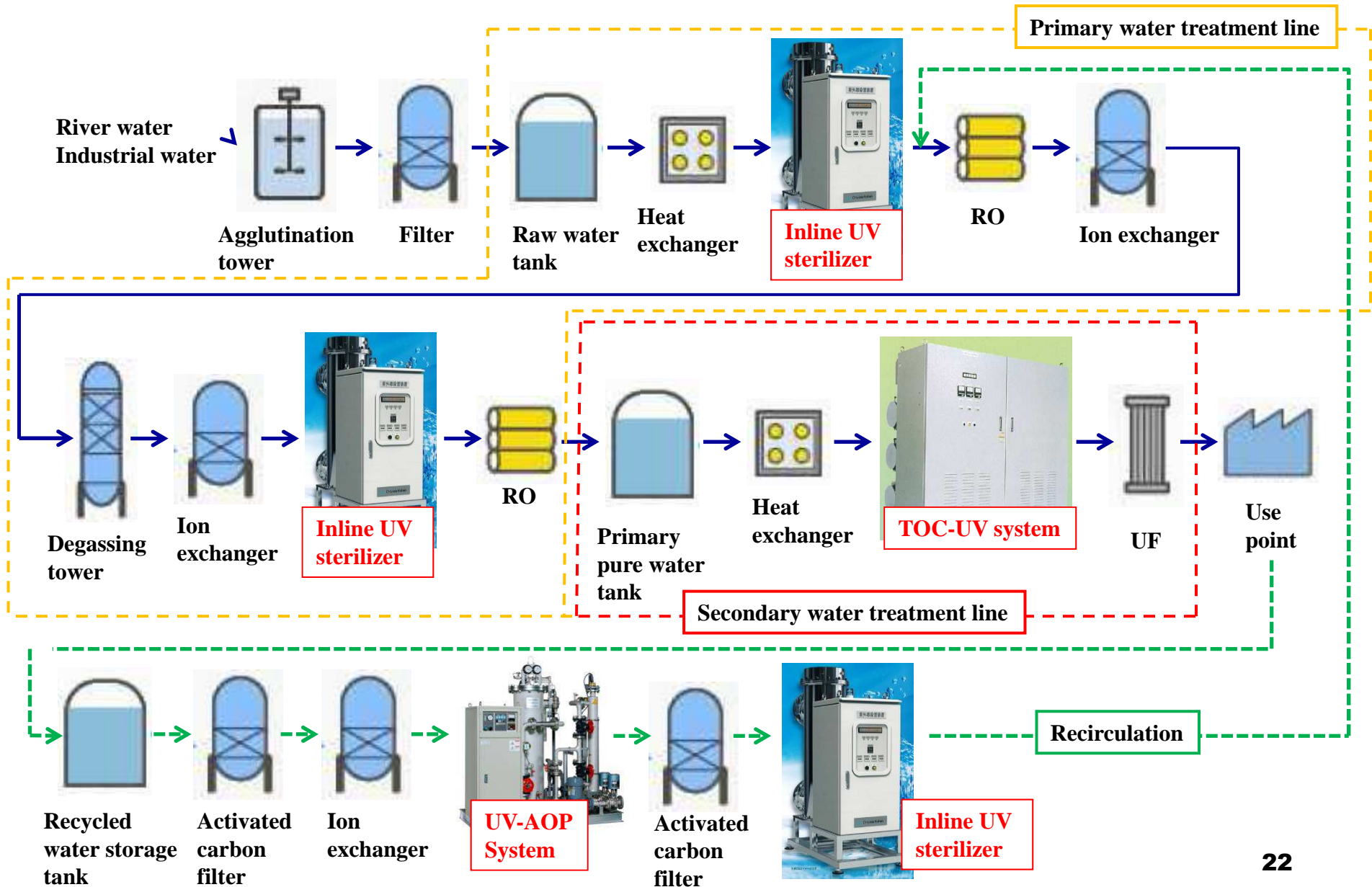
Application Example of UV Systems at Pharmaceutical Plants



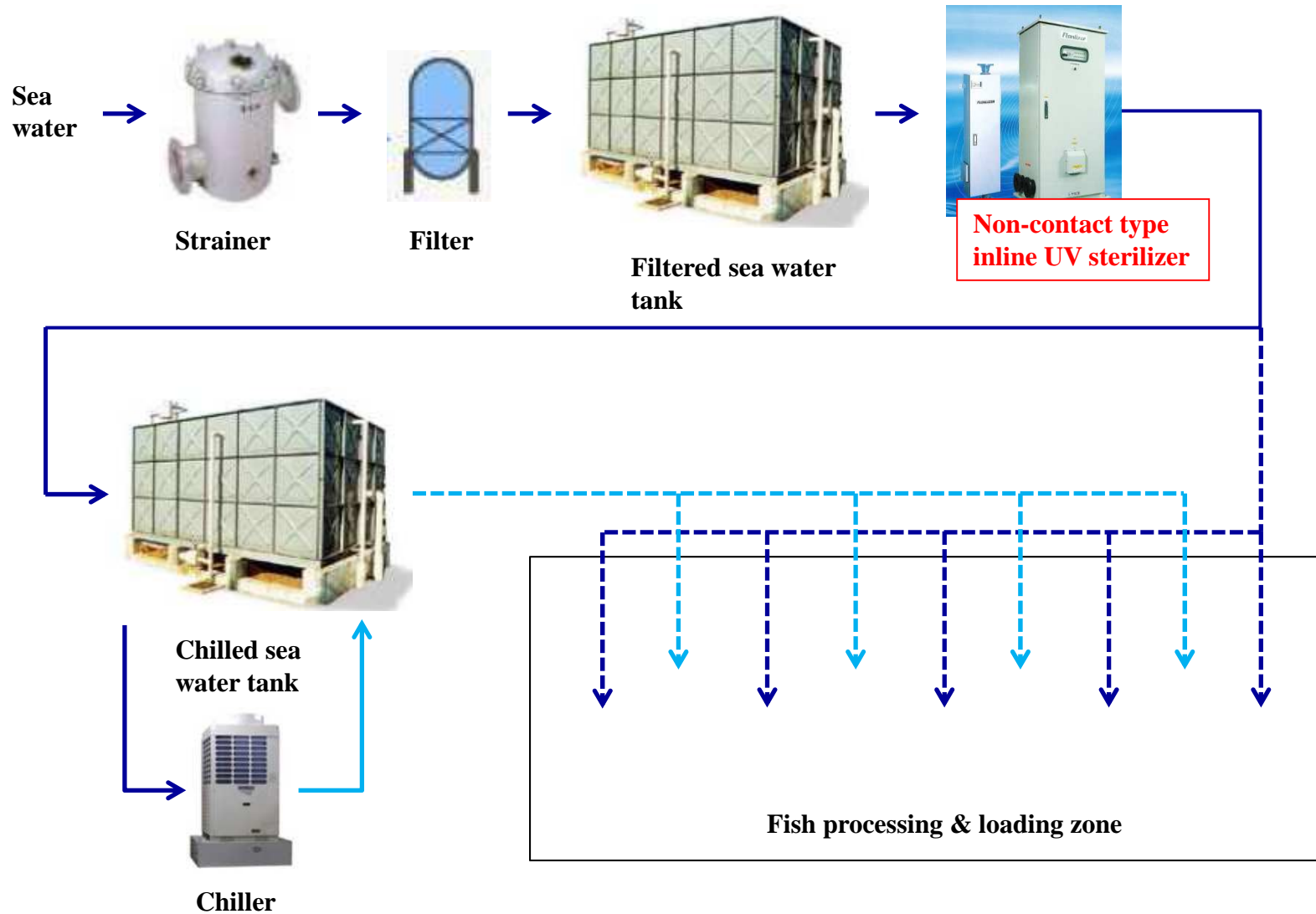
Application Example of UV Systems at Sugar Plants



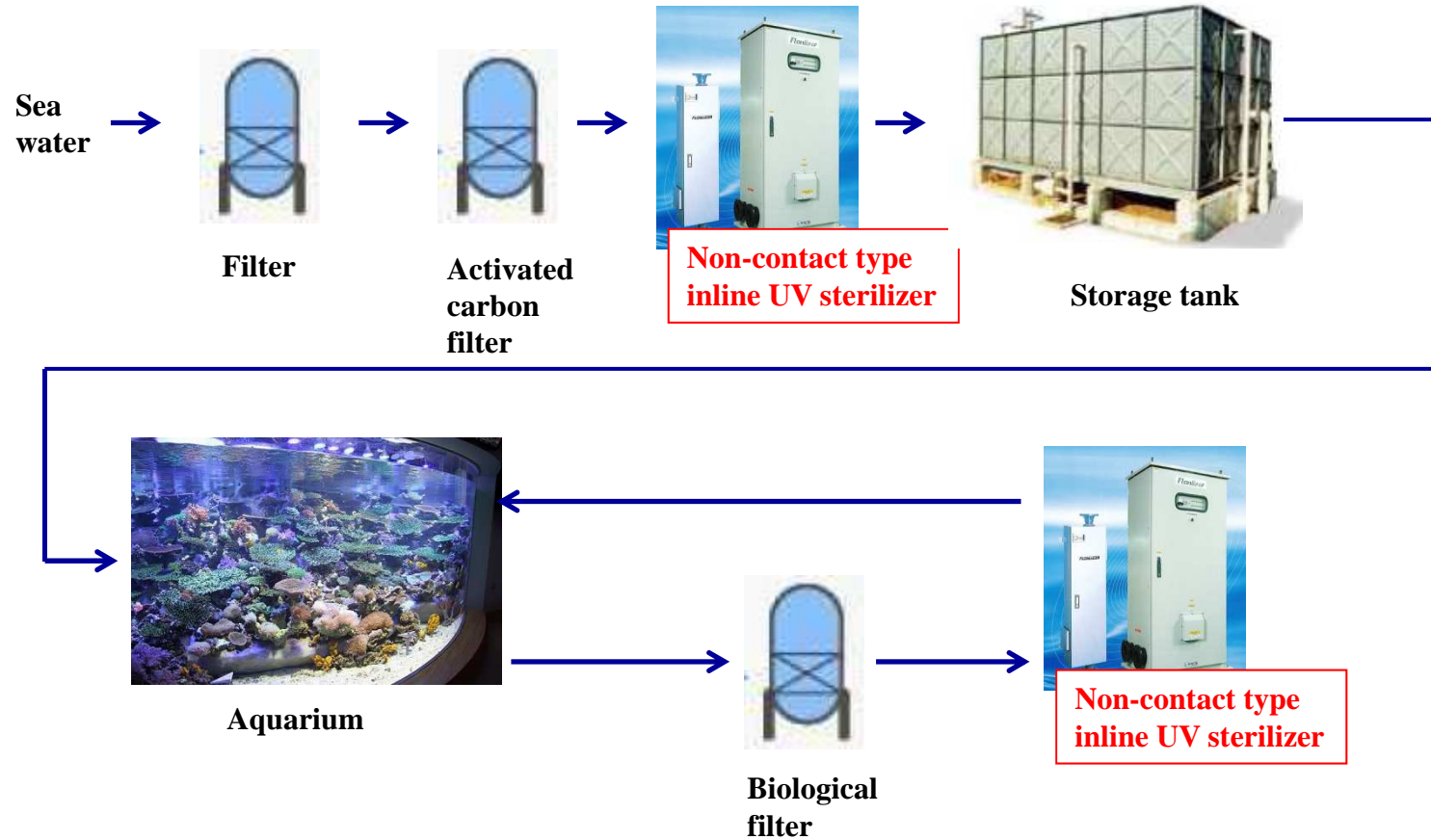
Application Example of UV Systems at Ultrapure Water Plants



Application Example of UV Systems at Fish Processing Facilities



Application Example of UV Systems at Aquariums





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