

Table 1. Effects of ultrahigh hydrostatic pressure on various microorganisms (Ortega-Rivas 2012)

Microorganism	Conditions		Decimal reduction	Media
	Pressure (MPa)	Time (min)		
<i>Saccharomyces cerevisiae</i>	300	5	5	Satsuma mandarin juice
<i>Aspergillus awamori</i>	300	5	5	Satsuma mandarin juice
<i>Listeria innocua</i>	360	5	1	Minced beef muscle
<i>Listeria monocytogenes</i>	350	10	4	Phosphate buffer saline
<i>Vibrio parahaemolyticus</i>	172	10	2.5	Phosphate buffer saline
<i>Salmonella typhimurium</i>	345	10	1.8	Phosphate buffer
Total plate count	340	5	1.9	Fresh cut pineapple

Table 2. Antimicrobial activity of aromatic plants and essential oils added to cheeses (Gouvea et al., 2017)

Cheese Type	Natural antimicrobial (Source and concentration)	Inhibitory activity (microorganisms, counts, and storage conditions)	Reference
Feta	Oregano (0.1mL 100g <sup>-1</sup> ) Thyme (0.1mL 100g <sup>-1</sup> )	Inhibition of <i>L. monocytogenes</i> and <i>E. coli</i> 0157: H7 population (10 <sup>4</sup> CFU g <sup>-1</sup> ) for 18 and 22 days, respectively, after storage under modified atmosphere packaging (50% de CO <sub>2</sub> e 50% de N <sub>2</sub> ) at 4°C.	GOVARIS et al. (2011)
Cheddar	Garlic (dipping 25g of cheese in 100mL of plant extract solution).	Inhibition of <i>L. monocytogenes</i> (2 log CFU mL <sup>-1</sup> ) after storage at 23°C for 9 days.	SHAN et al. (2011)
Kareich	Cayenne (3%) or Green Pepper (9%)	Inhibition of <i>S. aureus</i> (1x10 <sup>8</sup> CFU g <sup>-1</sup> ) to undetectable levels within 2 days of storage at 4°C±2°C.	WAHBA et al. (2010)
Domiaty	Black cumin seed oil (0.1% e 0.2%)	Decreased in <i>Salmonella enteritides</i> and <i>Escherichia coli</i> counts from 3.95log CFU mL <sup>-1</sup> to 2.6log CFU g <sup>-1</sup> after storage at 4°C for 42 days.	HASSANIEN et al. (2014)
Sheep's cheese	Rosemary essential oil (215mg L <sup>-1</sup> )	Prevented the growth of <i>Clostridium</i> spp. counts 3log CFU g <sup>-1</sup> ripened for 5 months at 12°C	MORO et al. (2015)
Coalho Cheese mimicking models	Thymus essential oils (2.5µL mL <sup>-1</sup> )	Reduced 1.3log CFU mL <sup>-1</sup> counts ( from initial count) of <i>L. monocytogenes</i> incubated at 10°C for 24 hours	CARVALHO et al. (2015)
Cheddar Based Media	Cinnamon (400µg mL <sup>-1</sup> ) garlic (625µg mL <sup>-1</sup> ), lemon grass (550µg mL <sup>-1</sup> ), cress (475µg mL <sup>-1</sup> ), rosemary (750µg mL <sup>-1</sup> ), sage (825µg mL <sup>-1</sup> ) and oregano extracts (950µg mL)	All extract concentrations individually inhibited the population of <i>L. monocytogenes</i> (4x10 <sup>5</sup> CFU mL <sup>-1</sup> ) incubated at 37°C for 24 hours	TAYEL et al. (2015)
Fior di Latte	Thyme and sage essential oil (1500mg kg <sup>-1</sup> )	Inhibition of <i>Pseudomonas</i> spp and coliforms stored at 10°C for 6 days	GAMMARIELLO et al. (2008)
Whey and Requesón whey	Safranal (35µg kg <sup>-1</sup> )	Inhibited over 15% <i>Penicillium verrucosum</i> growth (population of 10 <sup>5</sup> CFU mL <sup>-1</sup> of spore).	LIBRÀN et al. (2014)

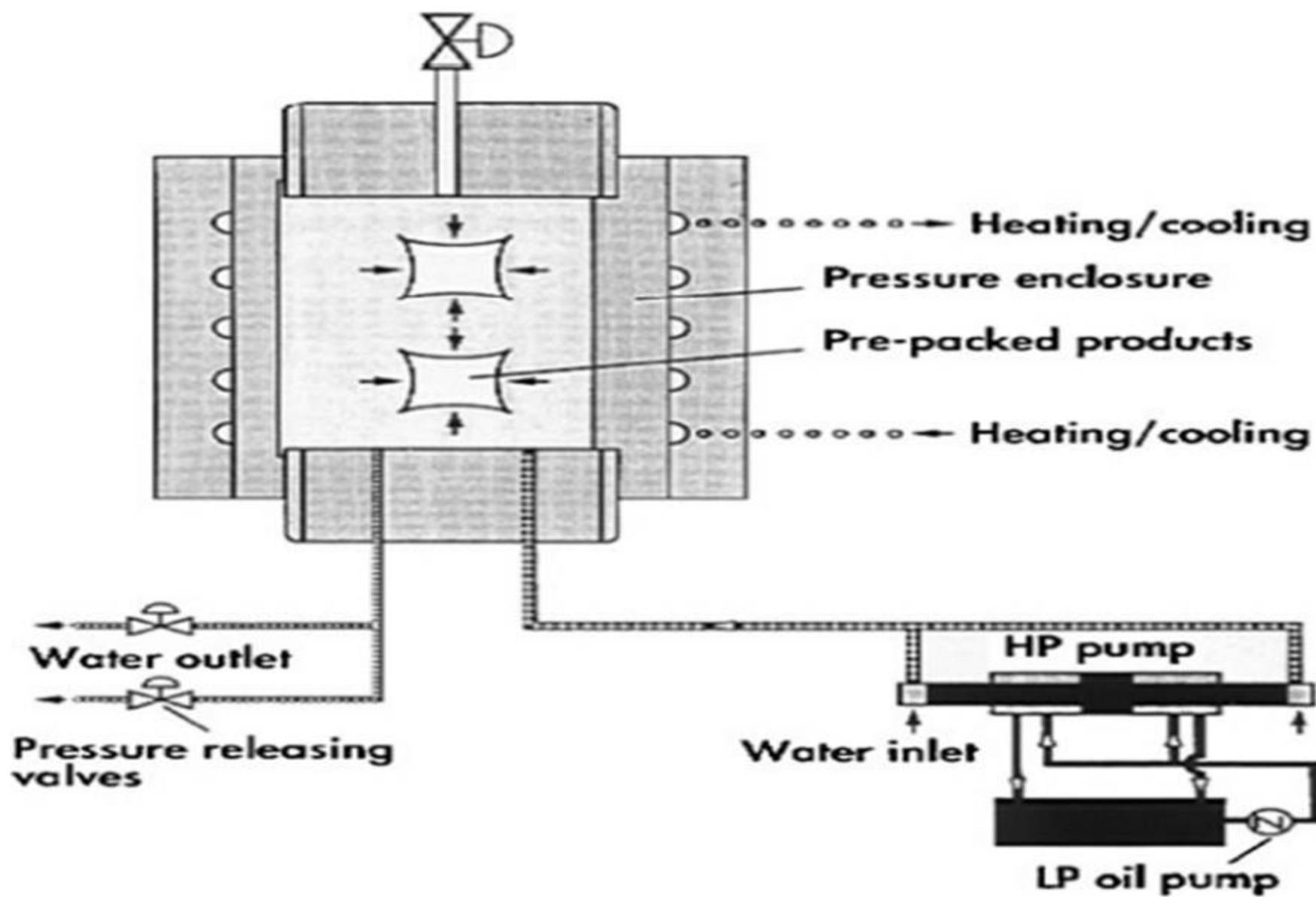


Fig. 1. A typical high-pressure processing system for treating prepackaged foods  
 (Source: Anon (2008))

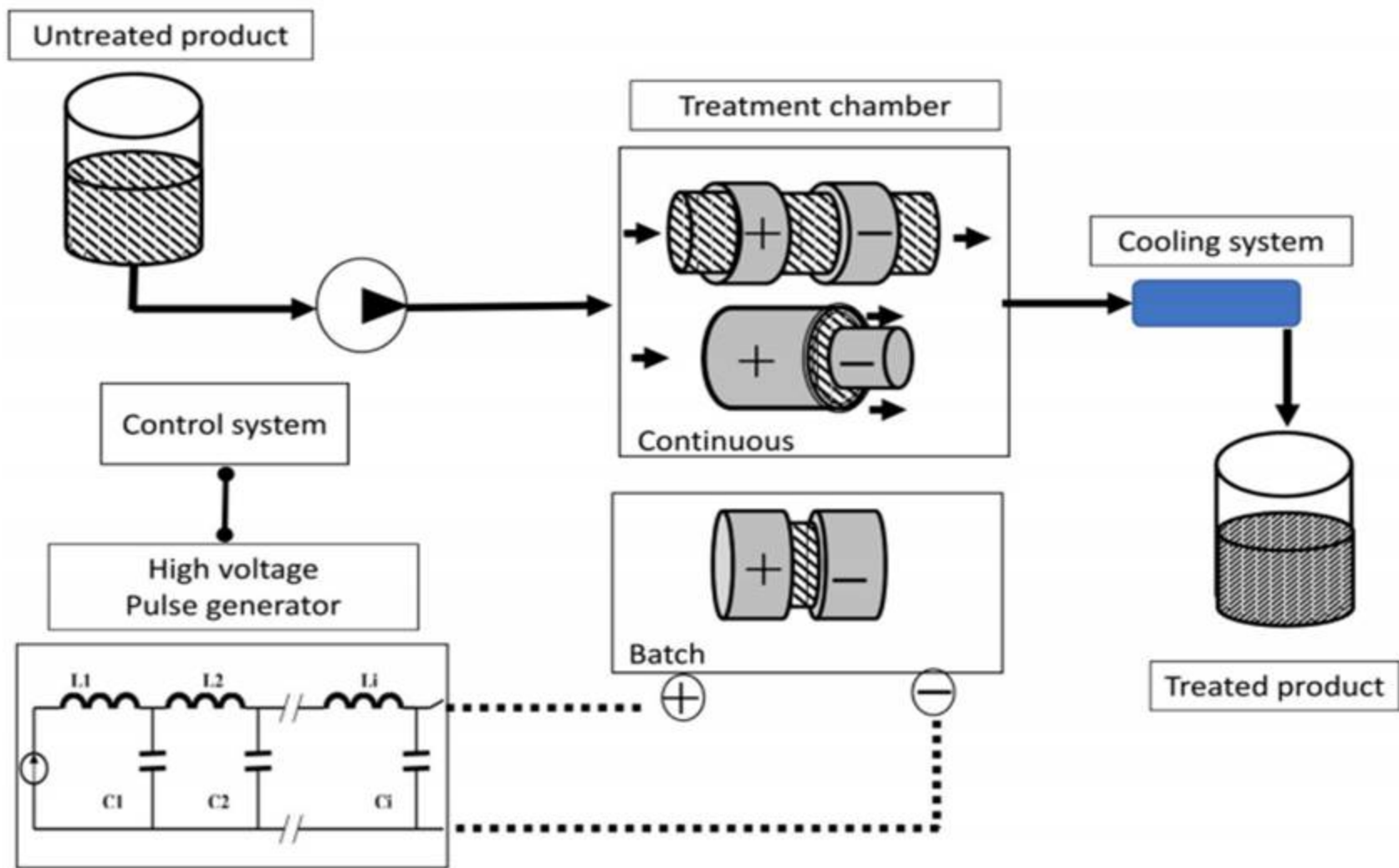


Fig. 2. Schematic layout for a Pulsed Electric Fields (PEF) treatment pilot [adapted from Picart and Cheftel (2003).

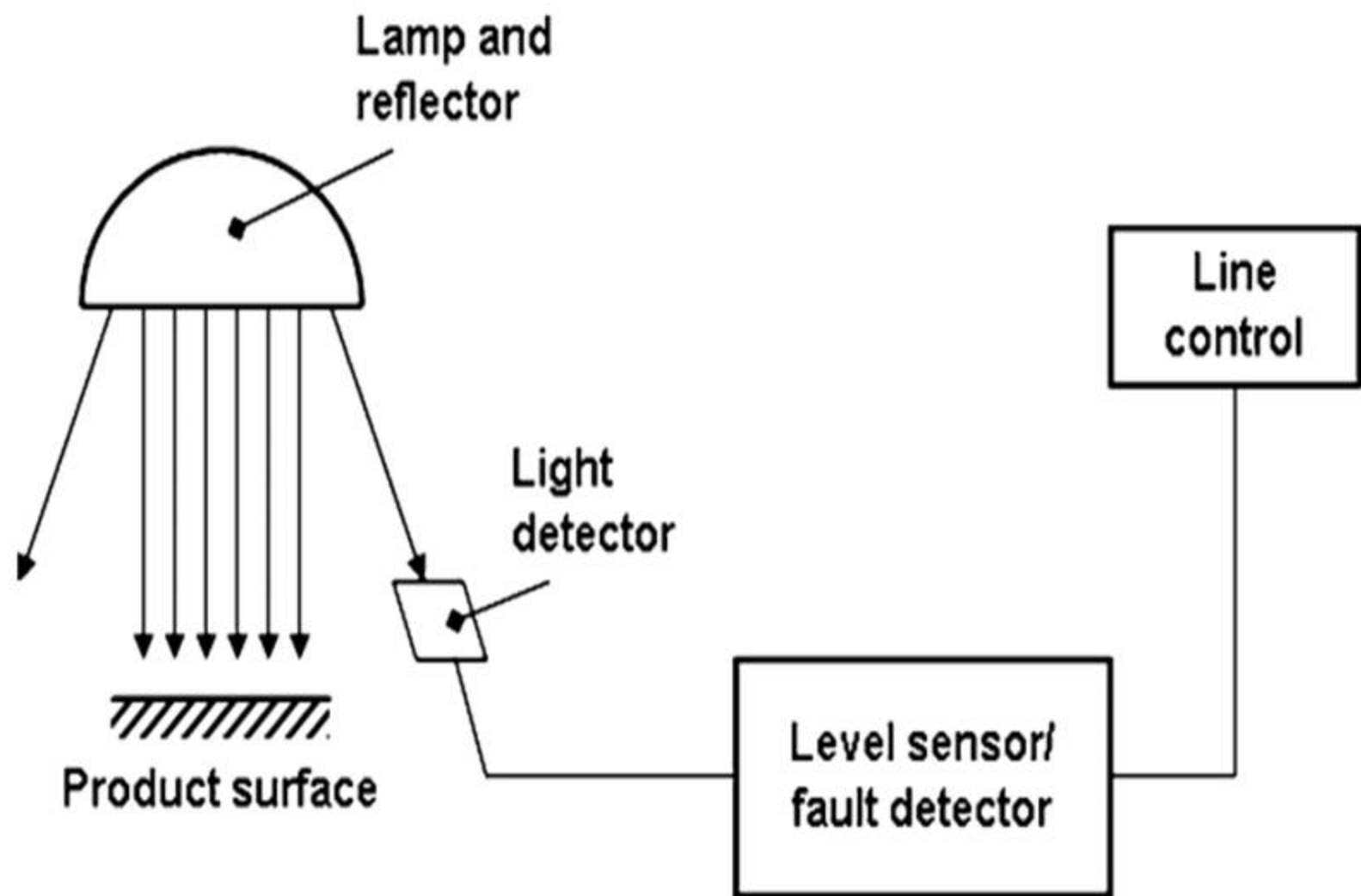


Fig. 3. A monitoring system for pulsed light energy (**Ortega-Rivas 2012**)

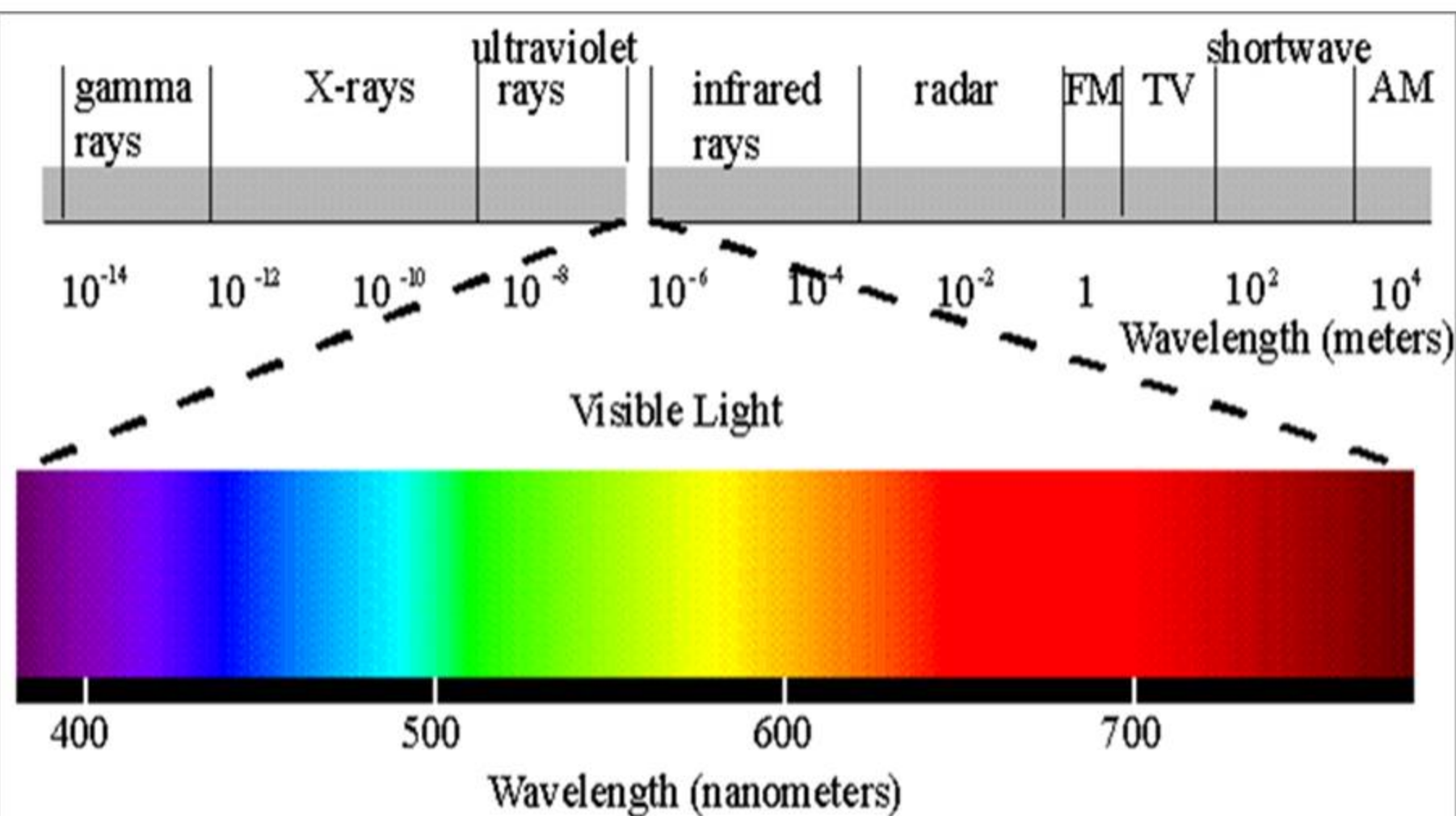
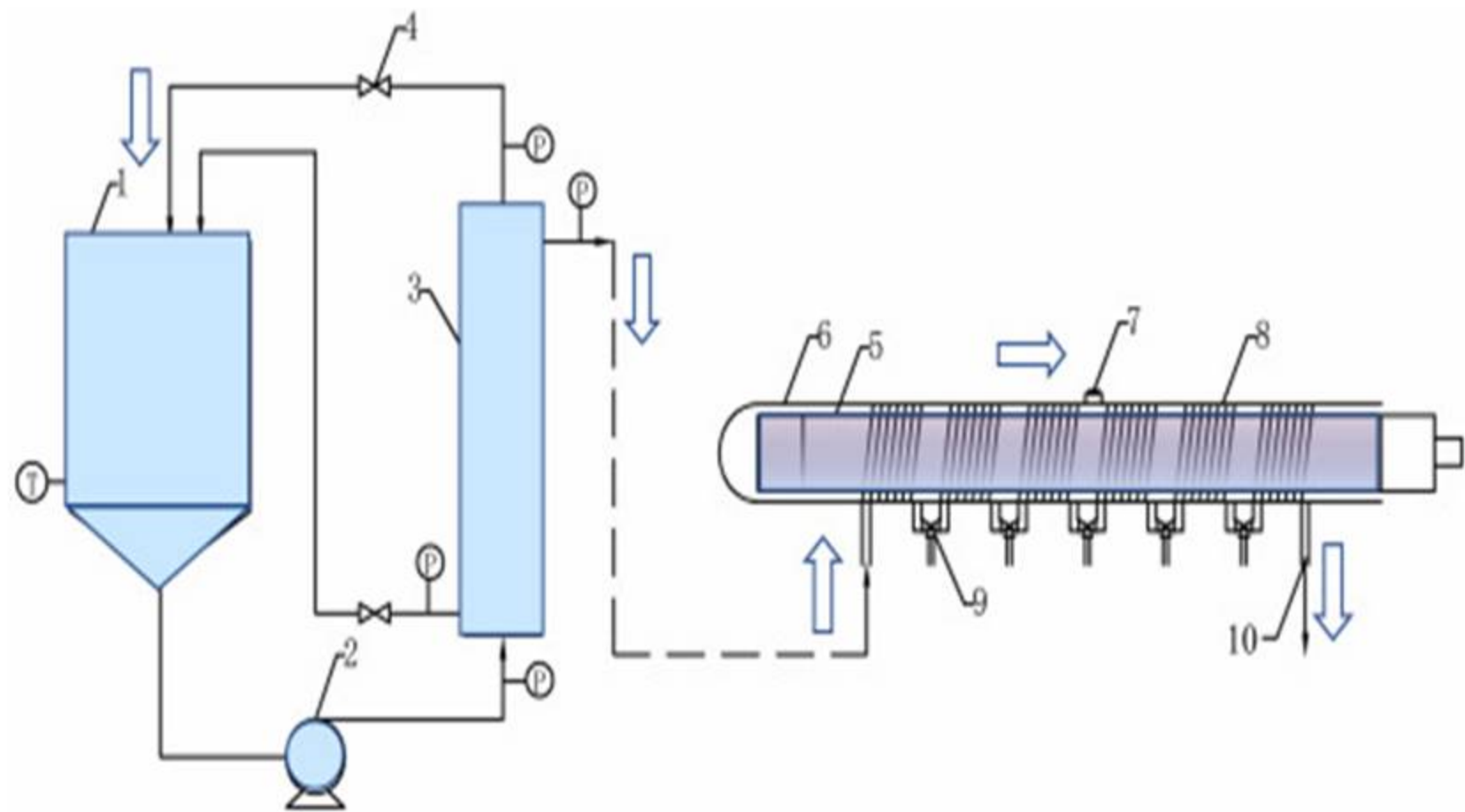


Fig. 4. Different types of irradiation

(<https://www.altermedicine.org/electromagnetic-fields-spectrum/>)



1- milk inlet; 2-pump; 3-membrane; 4- valve; 5- UV-C lamp; 6- quartz sleeve;  
 7- power detector of UV-C; 8- perfluoroalkoxy tube; 9- 3-way valve; 10- milk outlet

Fig. 5. UV light processing (Zhang, et al., 2021)

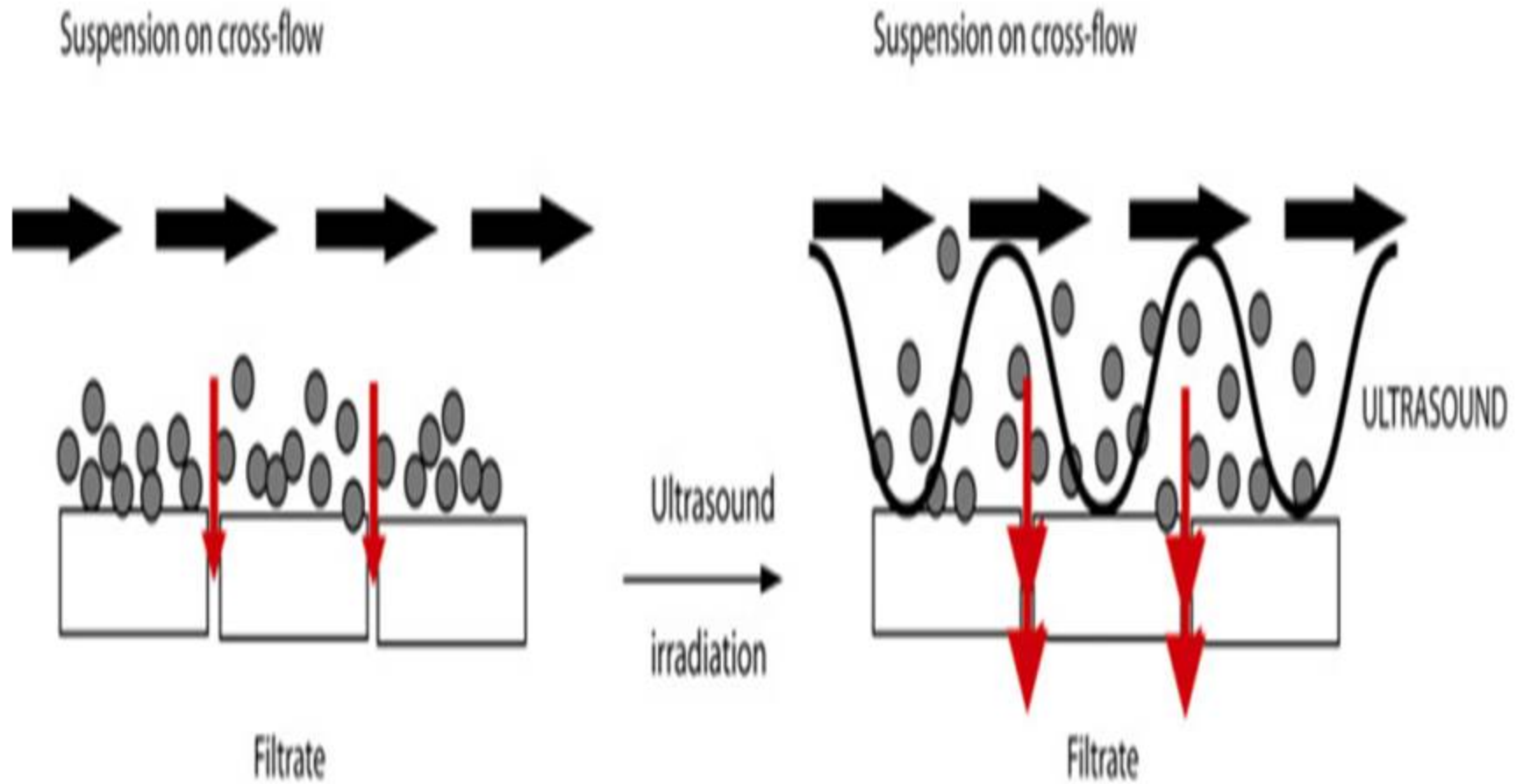


Fig. 6. Ultrasound processing

<https://www.slideshare.net/siddharthVishwakarma5/ultrasound-processing-91038608>



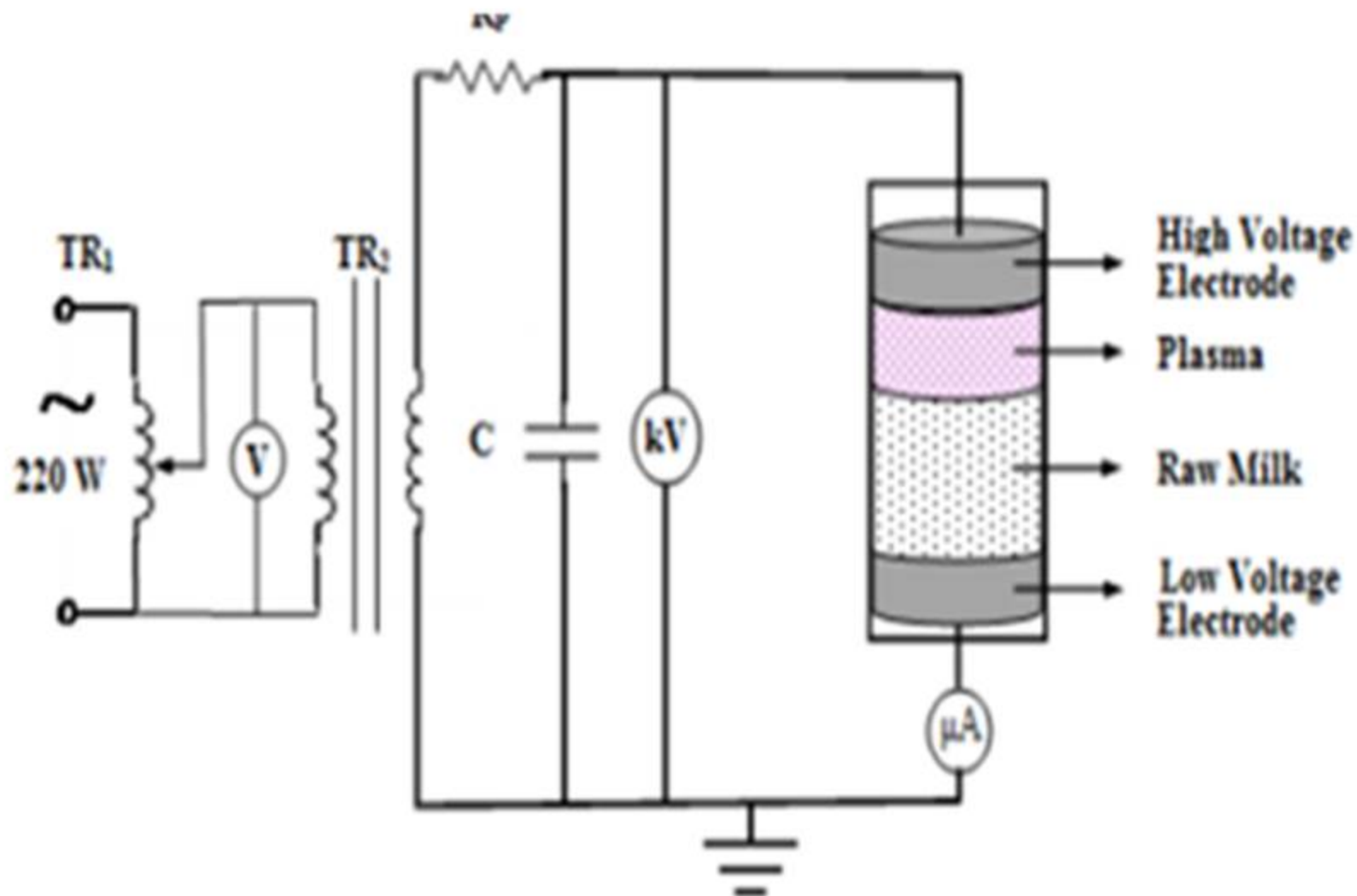


Fig. 7. Dielectric Barrier Discharge Plasma treatment (Yakup, 2016)

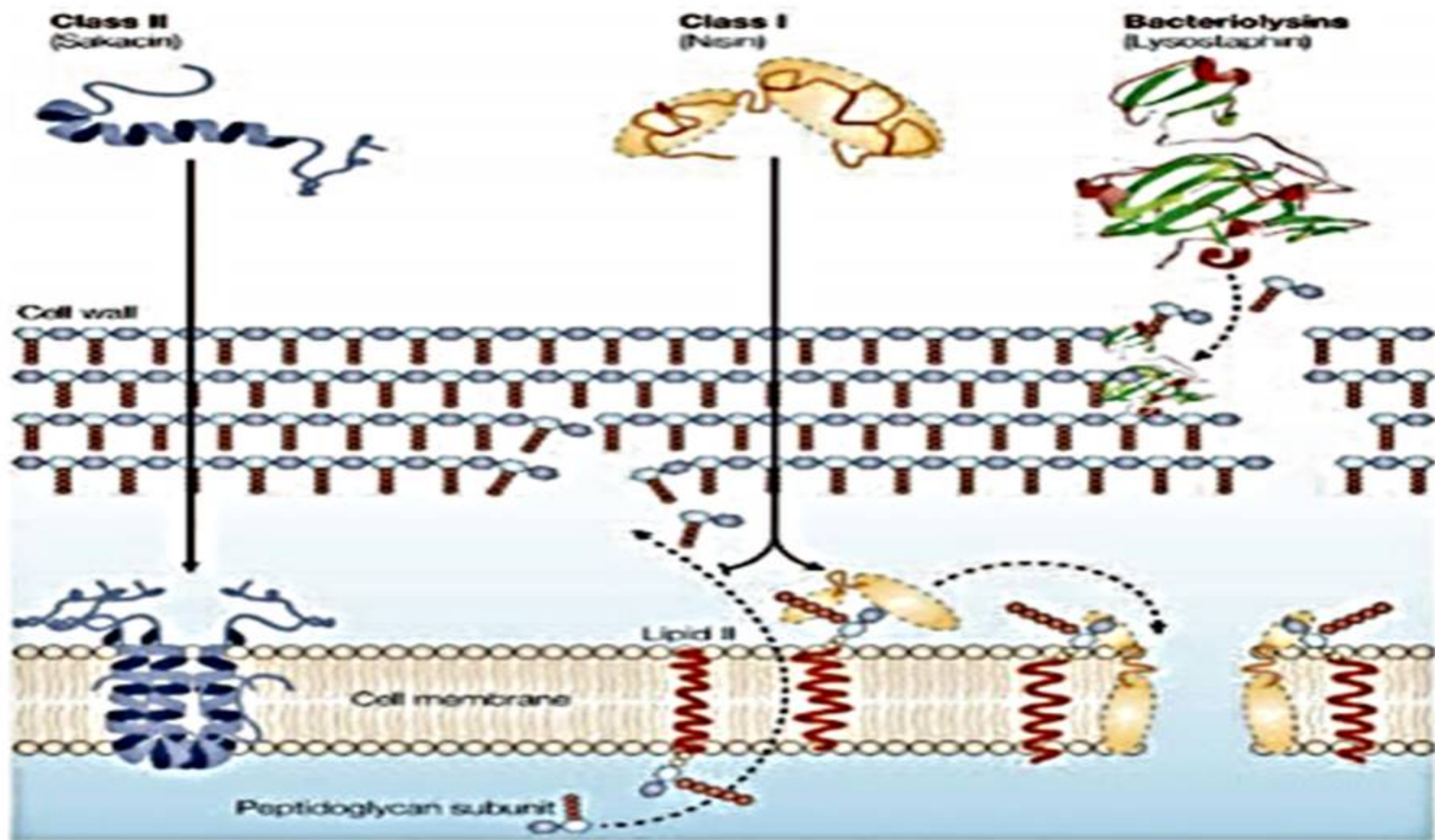


Fig. 8. Mode of action of bacteriocins by lactic acid bacteria (Cotter et al., 2013)

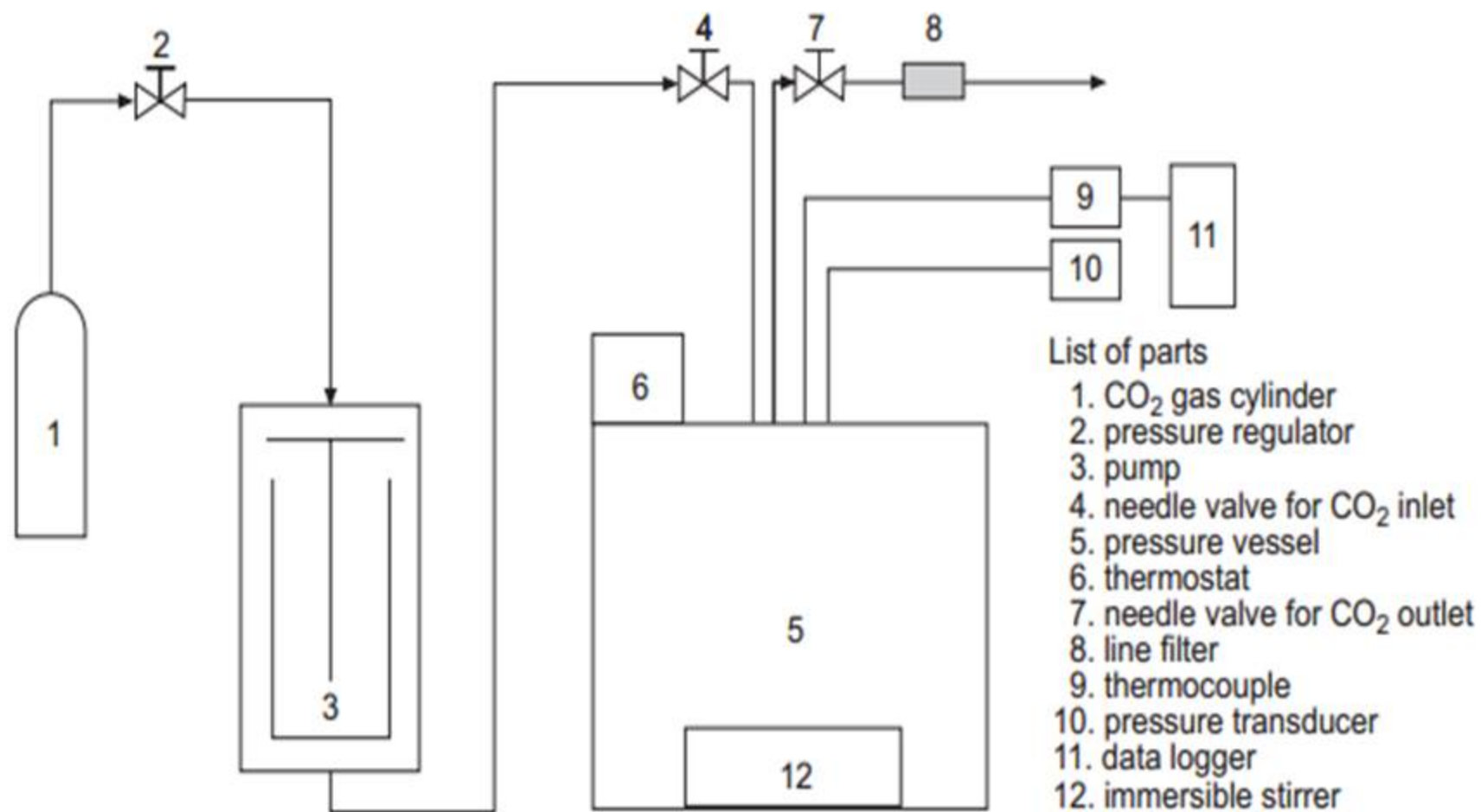


Fig. 9. Schematic diagram of the apparatus for the pressurized CO<sub>2</sub> treatment ( *Hong et al., 1999*).

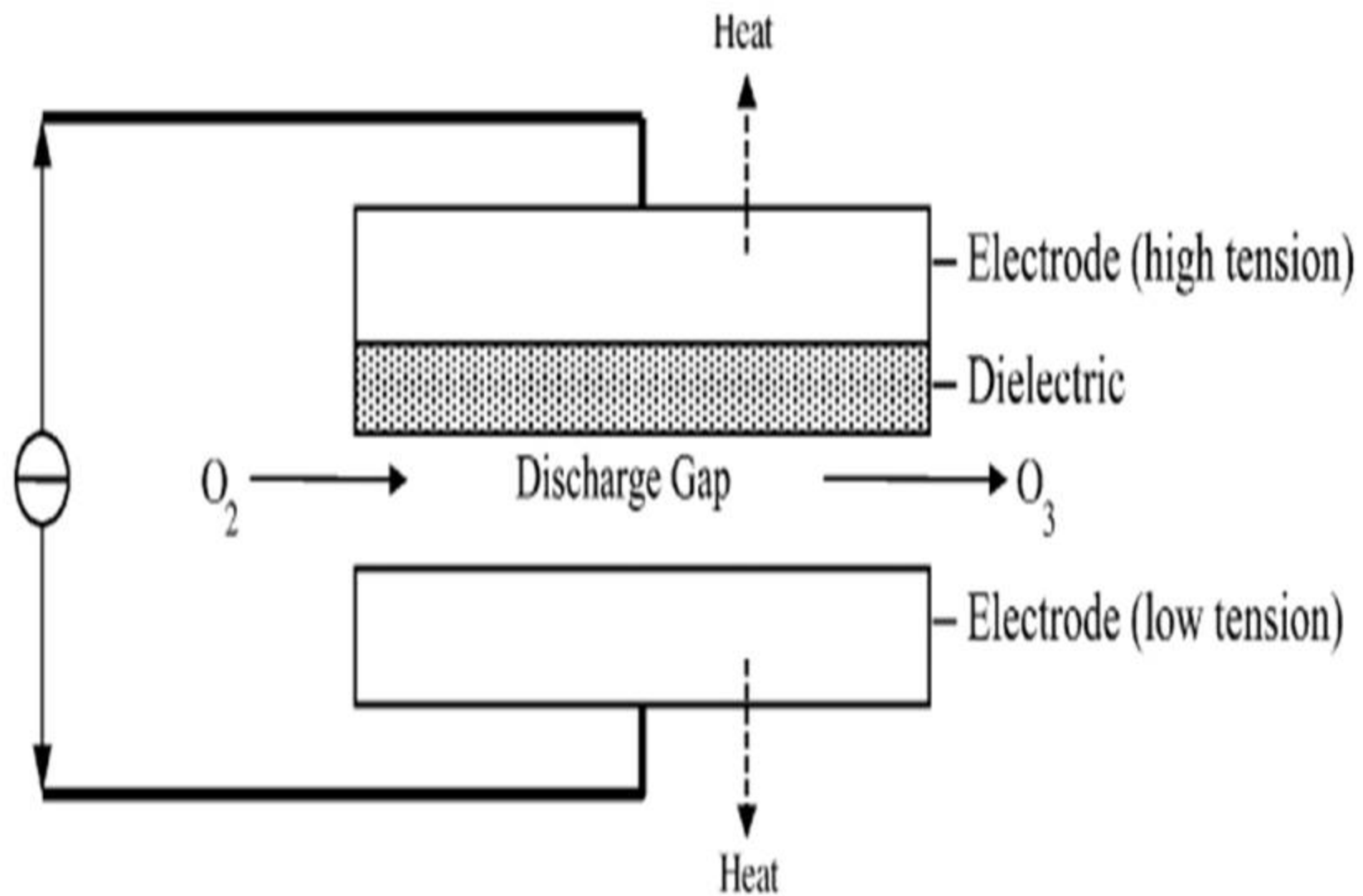


Fig. 10. Schematic diagram of ozone generation by corona discharge method (Rice et al. 1981).

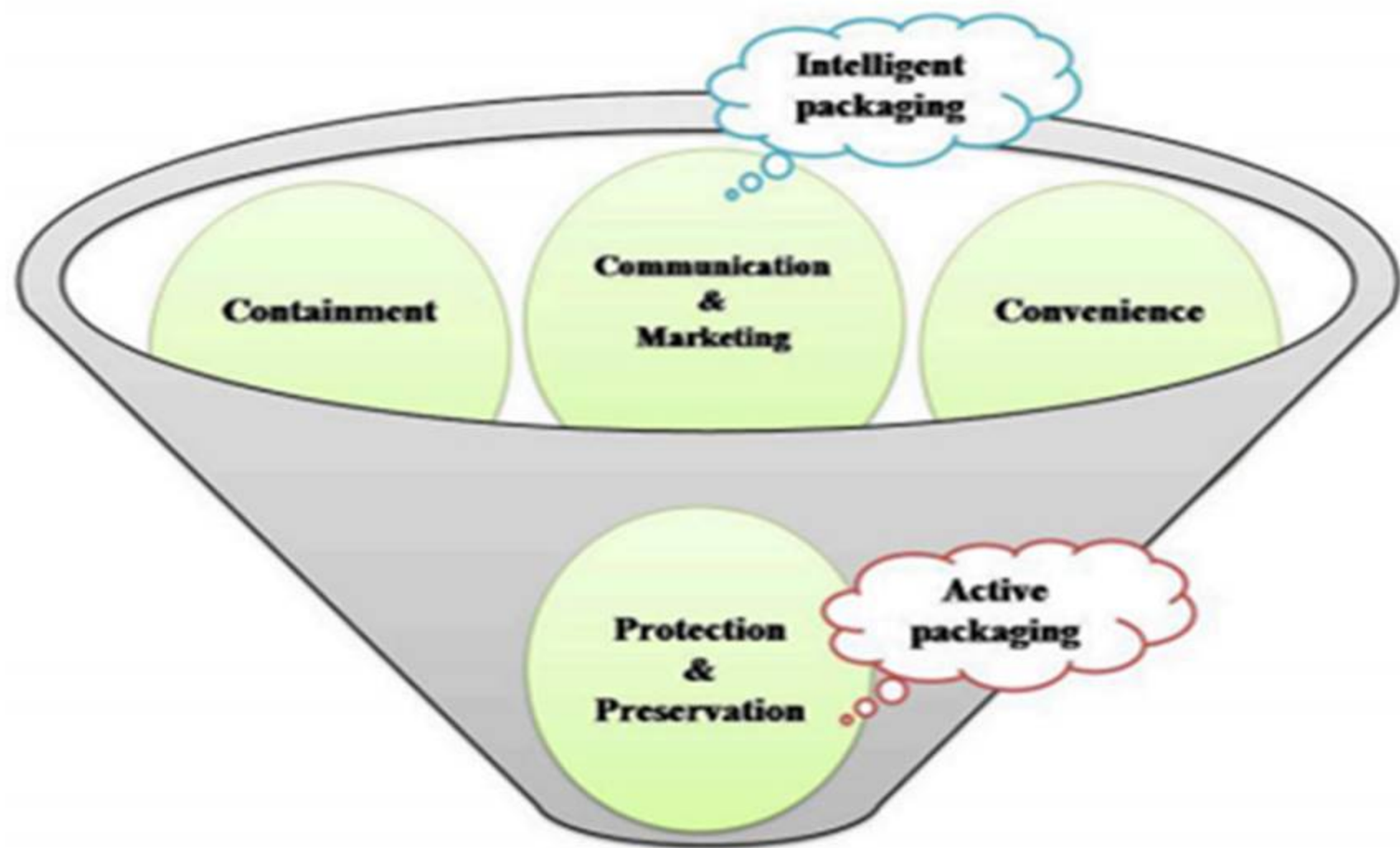


Fig. 11. Mode of action of active packaging and intelligent packaging([Sharma](#) et al., 2017)