LONG LIFE FRESH™ MILK

A NEW MARKET CATEGORY

MILLISECOND TECHNOLOGIES

WHAT EXACTLY IS LONG LIFE FRESH?

HEALTHIER & BETTER TASTING

This new generation of milk is healthier and tastes better than Extended Shelf Life milk. A premium product with superior durability.

Premium Profile

Maintains the exact nutritional value and fresh milk flavor profile consumers expect.

Plug-and-Play

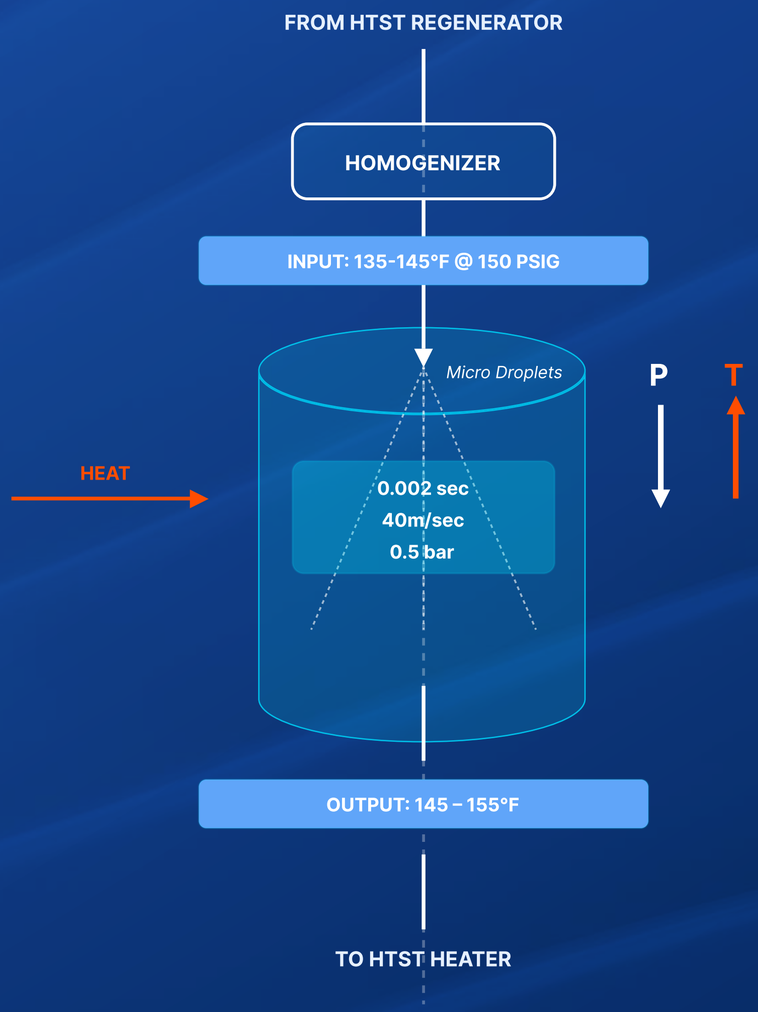
Direct integration into existing HTST lines with zero disruption to core workflow.

MILLISECOND TECHNOLOGIES

THE MILLISECOND METHOD

Comprises simultaneous reduction in pressure and spike in temperature, achieved by pushing liquid through a specially designed nozzle into a heated chamber.

Pressure Drop	150 PSIG
Temp Spike	10°F
MST Effect	0.002 sec
Velocity	40m/sec



RESULTS?

SHELF LIFE FOR SAFE CONSUMPTION

METHOD CATEGORY	@ 10°C STORAGE (DAYS)	@ 4°C STORAGE (DAYS)
Traditional HTST	5+/-3	21+/-3
MST TECHNOLOGY	**35+**	**45+**

MST Long Life Fresh Milk maintains integrity for **10+ days after opening**.

STRATEGY: DRIVE THE MARKET

MARKET CAPTURE

New Value Chain

Establishing the leadership position with a unique product offering.

Consumer Shift

Rising health consciousness advancing the case for nutritious dairy.

Market Decline

ESL capturing market share while conventional HTST is in decline.

MILLISECOND TECHNOLOGIES

A NEW MARKET CATEGORY

IT IS A CROWDED DAIRY MARKET AND MARGINS ARE IN DECLINE, HOW DO YOU MEET THE CHALLENGE OF CREATING AN IMPACT WITH HIGHER PROFITS?

"WE BELIEVE THAT WHILE OVERALL GROWTH IN DAIRY WILL LIKELY REMAIN LOW, SALES WILL RISE SHARPLY IN SOME PRODUCT CATEGORIES AND THAT WINNING IN A CHANGING MARKETPLACE REQUIRES NEW WAYS OF THINKING."

SOURCE: MCKINSEY

Long Life Fresh™ Milk is a **virtually untapped market** with no competition and low cost of entry

TECHNOLOGICAL BENCHMARKS

PASTEURIZING METHODS COMPARISON

TECHNICAL METRIC	CURRENT FRESH (HTST)	HTST + MST (UNTAPPED)	ESL (HHST/UHT)
Heat Treatment	161F / 15 sec	161F / 15 sec	283F+ / 2 sec
Bacteria Kill	Some Survival	**Nearly Sterile**	Nearly Sterile
Fill Equipment	Limited Protection	Protected or Limited	Fully Protected
Target Shelf Life	10 – 21 Days	**45+ Days**	60 – 120 Days
CapEx Entry	Low	**Low**	High
OpEx	Low	Low	High
Competition	High / Saturated	**LOW/NONE**	High / Saturated

mst® MILLISECOND TECHNOLOGIES

REGULATORY SOLUTION

PASTEURISED MILK ORDINANCE NOW ACCOMMODATES MST

Seamless transition into Pasteurized Milk Ordinance through unanimous NCIMS approval.

2020 FDA flagged process as needing a change to the PMO. Advised MSTC to propose at 2020 NCIMS.

2023 Postponed from 2020 to 2023 due to COVID-19. Unanimously passed in 2023

2024 **Publication officially released in April 2024.**

mst® MILLISECOND TECHNOLOGIES

US INTELLECTUAL PROPERTY

PATENT COUNSEL: SNELL & WIMER

US PATENTS

US 20100322821A1

(19) **United States**

(12) **Patent Application Publication**
Volkov et al.

(10) **Pub. No.: US 2010/0322821 A1**
(43) **Pub. Date: Dec. 23, 2010**

(54) **LIQUID PRODUCT PRESSURE TREATMENT METHOD AND DEVICE**

(76) Inventors: **Andrie Alexandrovich Volkov**, Moscow (RU); **Nikolay Vladislavovich Arofikin**, Moscow (RU); **Alexander Yurievich Kolesnov**, Moscow (RU)

Correspondence Address:
SQUIRE SANDERS & DEMPSEY LLP
1 East Washington Street, SUITE 2700
PHOENIX, AZ 85004 (US)

(21) Appl. No.: **12/772,610**

(22) Filed: **May 3, 2010**

Related U.S. Application Data

(63) Continuation of application No. 11/821,216, filed on Jun. 22, 2007, now Pat. No. 7,708,941, which is a continuation-in-part of application No. PCT/IB2005/003879, filed on Dec. 22, 2005.

(30) **Foreign Application Priority Data**

Dec. 23, 2004 (RU) ..... 2004137687/13(040

Publication Classification

(51) **Int. Cl.**

A61L 2/025	(2006.01)
A61L 2/08	(2006.01)
A61L 2/07	(2006.01)
A61L 2/20	(2006.01)
A61L 2/04	(2006.01)
A61L 2/02	(2006.01)
B01J 19/00	(2006.01)
A23L 3/015	(2006.01)

(52) **U.S. Cl.** **422/20**; 422/22; 422/26; 422/28; 422/37; 422/38; 422/39; 422/243; 426/665

(57) **ABSTRACT**

A method and device related to a liquid product pressure and (optionally) temperature treatment method reduces the level of microorganisms in the liquid product to a preselected level. Utilizing the method, liquid product is diffused in a chamber with the speed of pressure variation of liquid product in one embodiment of about 10^9 Pa/sec. The preferred speed of the diffused drops is about 10 m/sec. The liquid product can optionally be heated before or during diffusion, and is preferably heated as a diffused liquid product by mixing it with superheated steam. The device includes a chamber and a diffuser in communication with the chamber. Optionally, the device may include a heating apparatus, such as a steam generator connected via a pressure control valve to a steam super heater, a cooling chamber connected via a pressure control valve with a condenser, a vacuum pump in communication with the chamber, units for condensation and collecting finished products and a vacuum control unit in communication with the chamber.

US010194680B2

(12) **United States Patent**
Arofikin

(10) **Patent No.: US 10,194,680 B2**
(45) **Date of Patent: Feb. 5, 2019**

(54) **STERILIZATION REACTOR AND METHOD PATENT APPLICATION**

(71) Applicant: **Millisecond Technologies Corp.**, New York, NY (US)

(72) Inventor: **Nikolay V. Arofikin**, Moscow (RU)

(73) Assignee: **Millisecond Technologies Corp.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 677 days.

(21) Appl. No.: **13/800,100**

(22) Filed: **Mar. 13, 2013**

(65) **Prior Publication Data**

US 2014/0261017 A1 Sep. 18, 2014

(51) **Int. Cl.**

A23L 3/00	(2006.01)
A23L 3/01	(2006.01)
A23L 3/015	(2006.01)
A23L 3/16	(2006.01)
A23C 3/037	(2006.01)
A23L 2/46	(2006.01)
B05B 15/62	(2018.01)
B05B 1/26	(2006.01)

(52) **U.S. Cl.**
CPC ***A23L 3/001*** (2013.01); ***A23C 3/0375*** (2013.01); ***A23L 2/46*** (2013.01); ***A23L 3/01*** (2013.01); ***A23L 3/0155*** (2013.01); ***A23L 3/16*** (2013.01); *B05B 1/267* (2013.01); *B05B 15/62* (2018.02)

(58) **Field of Classification Search**
CPC A23L 3/001; A23L 3/01; A23L 3/0155; A23C 3/0375
USPC 99/453, 470, 483, 471, 516, 473–476, 99/534; 426/237, 521, 520, 522, 511, 426/453, 483, 516
See application file for complete search history.

(56) **References Cited**

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1,819,023	A	8/1931	Grindrod	
2,374,805	A	5/1945	Camelford	
2,944,479	A	7/1960	Walsh et al.	
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(Continued)

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FR	2735039	12/1996

(Continued)

OTHER PUBLICATIONS

USPTO; Office Action dated Jun. 27, 2008 in U.S. Appl. No. 11/821,216.

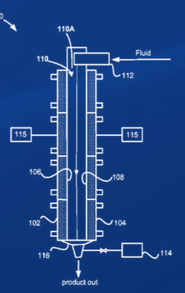
(Continued)

Primary Examiner — Phuong T Nguyen
(74) *Attorney, Agent, or Firm* — Snell & Wilmer L.L.P.

(57) **ABSTRACT**

A method and device to treat liquid to reduce the amount of microorganisms in the liquid to a preselected level and/or to mitigate the growth of microorganisms are disclosed. Utilizing the method or device, liquid product is sprayed into a cavity of a reactor using a nozzle that produces a flat spray to provide means for efficient heating and treatment of the liquid.

31 Claims, 4 Drawing Sheets



US011096406B2

(12) **United States Patent**
Arofikin et al.

(10) **Patent No.: US 11,096,406 B2**
(45) **Date of Patent: Aug. 24, 2021**

(54) **KILLING MICROBES WITH PRESSURE DROP AND HEAT**

(71) Applicant: **Millisecond Technologies Corp.**, New York, NY (US)

(72) Inventors: **Nikolay Arofikin**, Moscow (RU); **Phillip R. Frechette**, Calle, PR (US)

(73) Assignee: **Millisecond Technologies Corp.**, New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 545 days.

(21) Appl. No.: **15/567,594**

(22) PCT Filed: **Apr. 22, 2016**

(86) PCT No.: **PCT/US2016/029045**
§ 371 (c)(1),
(2) Date: **Oct. 18, 2017**

(87) PCT Pub. No.: **WO2016/172627**
PCT Pub. Date: **Oct. 27, 2016**

(65) **Prior Publication Data**

US 2018/0092385 A1 Apr. 5, 2018

Related U.S. Application Data

(60) Provisional application No. 62/209,039, filed on Aug. 24, 2015, provisional application No. 62/152,689, filed on Apr. 24, 2015.

(51) **Int. Cl.**

A23L 3/24	(2006.01)
A23C 3/03	(2006.01)

(Continued)

(52) **U.S. Cl.**
CPC ***A23L 3/24*** (2013.01); ***A23C 3/03*** (2013.01); ***A23L 2/42*** (2013.01); ***A23L 2/46*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC ... A23L 3/24; A23L 3/22; A23L 3/015; A23L 2/46; A23L 2/42; A61L 9/00;
(Continued)

(56) **References Cited**

U.S. PATENT DOCUMENTS

1,711,097	A	4/1929	Kratzer
1,819,023	A	8/1931	Grindrod

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2594134	3/2015
CN	2031204 U	1/1989

(Continued)

OTHER PUBLICATIONS

CN; Office Action dated Oct. 18, 2017 in Application No. 201480026887.

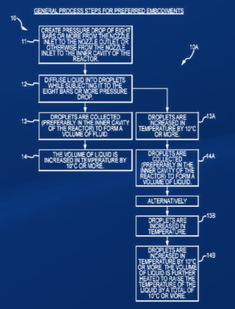
(Continued)

Primary Examiner — Regina M Yoo
(74) *Attorney, Agent, or Firm* — Snell & Wilmer L.L.P.

(57) **ABSTRACT**

A method and device are described that reduce the amount of pathogens in a liquid and/or to mitigate the growth of pathogens. Utilizing the method or device, liquid product is subjected to an 8 Bar or greater pressure drop. The liquid product is then heated to increase its temperature by at least 10° C. while it is in the droplet phase and/or after being collected into a liquid volume.

21 Claims, 8 Drawing Sheets



MILLISECOND TECHNOLOGIES

WHERE IS IT HAPPENING?

VAQUERÍA TRES MONJITAS (VTM)

Highest quality Puerto Rican milk for 100+ years. Commercially operating Grade A facility under FDA/PMO regulations. Launched MST milk with immediate market capture.

Fastest growing product in the PR market.

Daikin Dairy (FL)
Unit installed; commissioning scheduled Q1 2026.

Ready for rollout in Continental US

OPERATIONAL ROI DRIVERS

EFFICIENCY & SAVINGS ROADMAP

Logistics Savings
Less frequent runs and handling costs.

Yield Enhancement
Maximum production efficiency and product yield.

Zero Return Policy
Complete elimination of retail return waste.

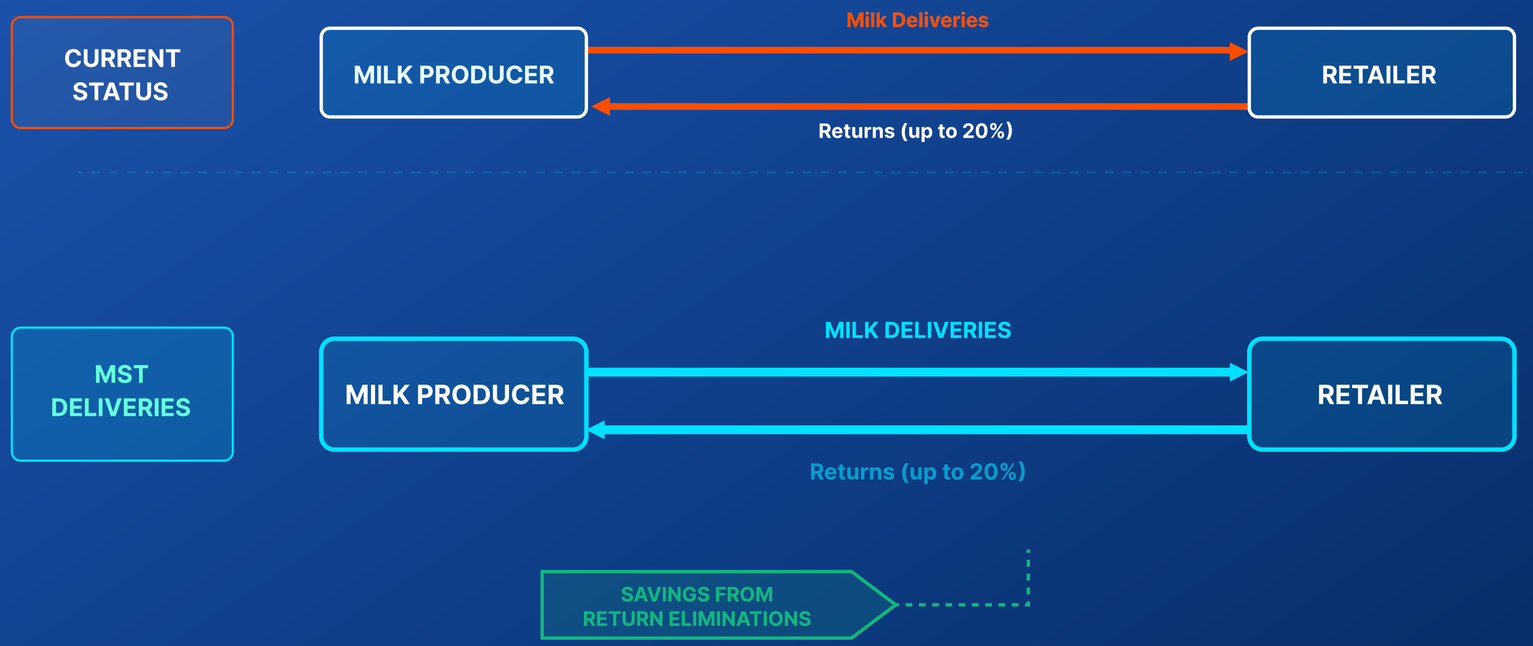
Revenue Premium
Strategic premium positioning in the health category.

MILLISECOND TECHNOLOGIES

COMPOUNDED SAVINGS FROM THE NEW PRODUCT

COST REDUCTION – PRODUCER

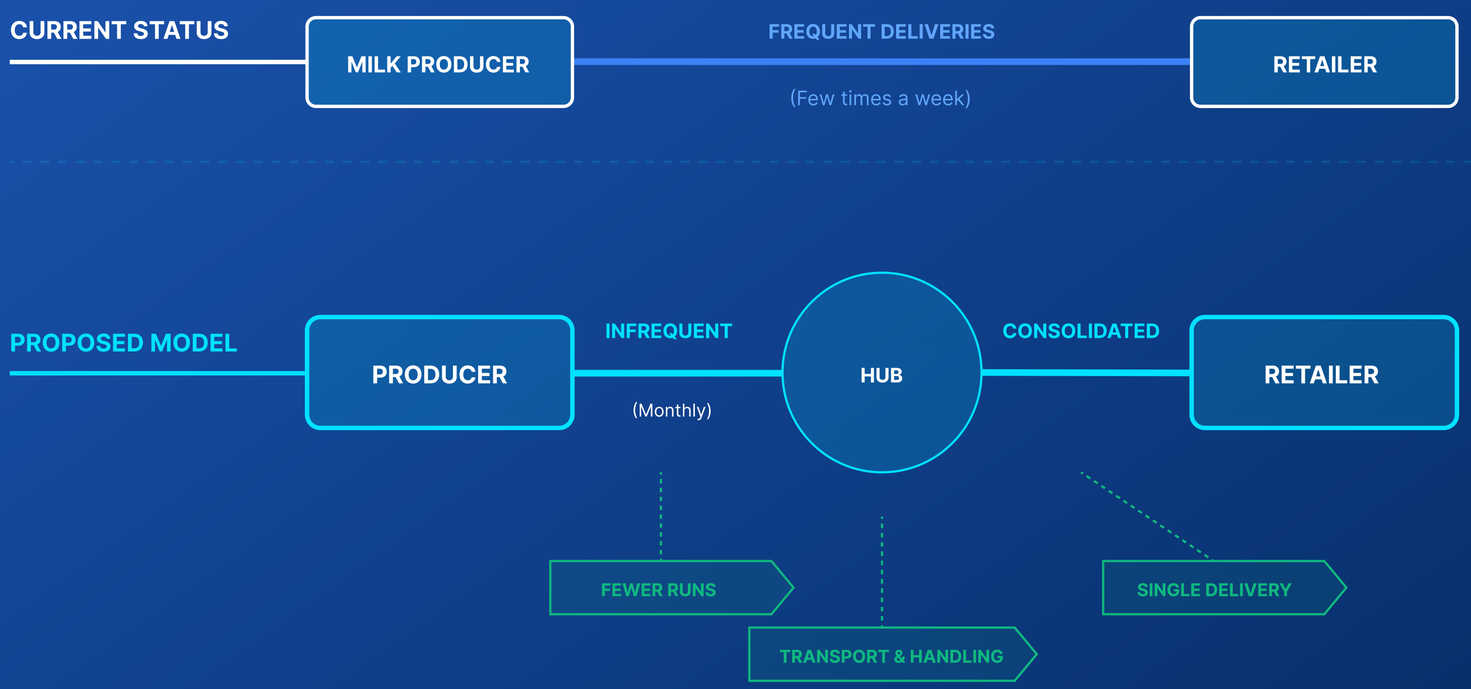
Most of the longer shelf-life benefits are realized via elimination of returns.



COMPOUNDED SAVINGS

COST REDUCTION - SWITCHING TO WAREHOUSE DISTRIBUTION

Most of the longer shelf-life benefits are realized via a switch to warehouse distribution.



RETAIL VALUE

Management Efficiency

Savings from more efficient shelf management (less frequent restocking, out of date removal & date code monitoring).

Yield Gains

Savings from elimination of milk discarding. Efficiency & Yield savings.

ENGINEERING SOLUTION

MILLISECOND TECHNOLOGIES

INTEGRATION

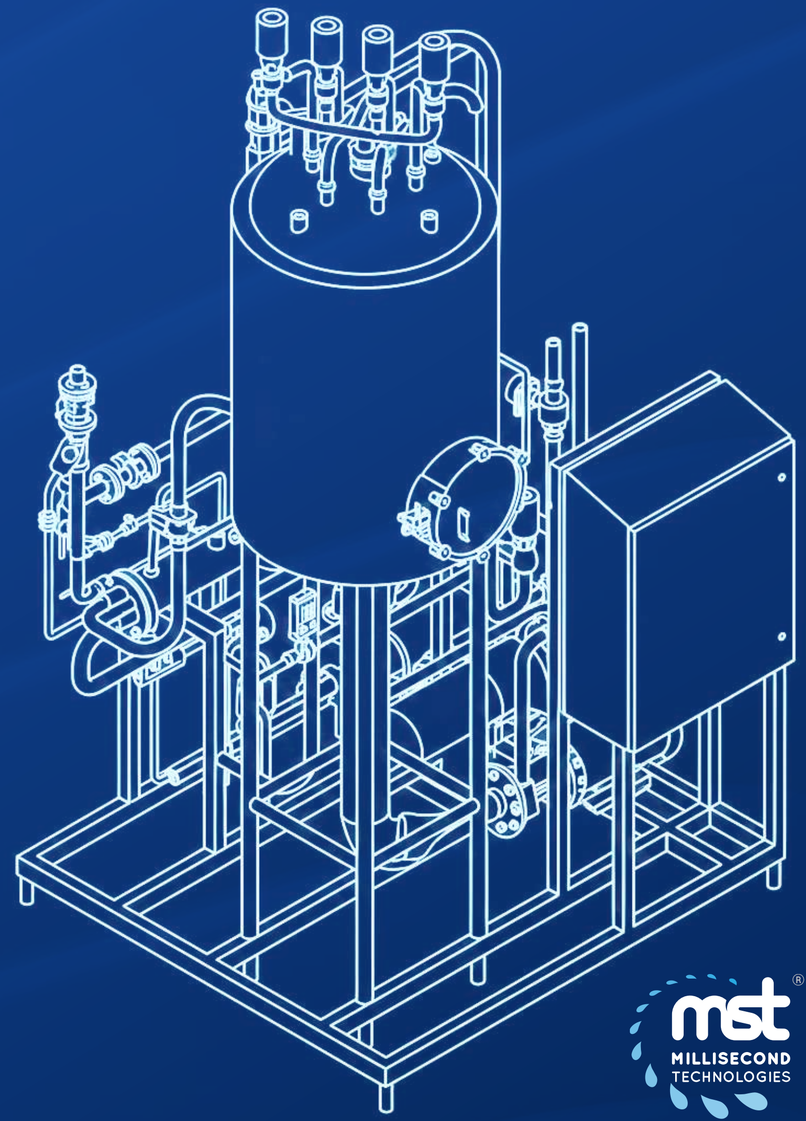
HTST LOOP

PRE-PROCESSING

RAW STORAGE → BALANCE TANK → PHE REGEN → HOMOGENIZER → MST®

PASTEURIZED STORAGE → PHE COOLER → HOLD TUBE → PHE HEATER

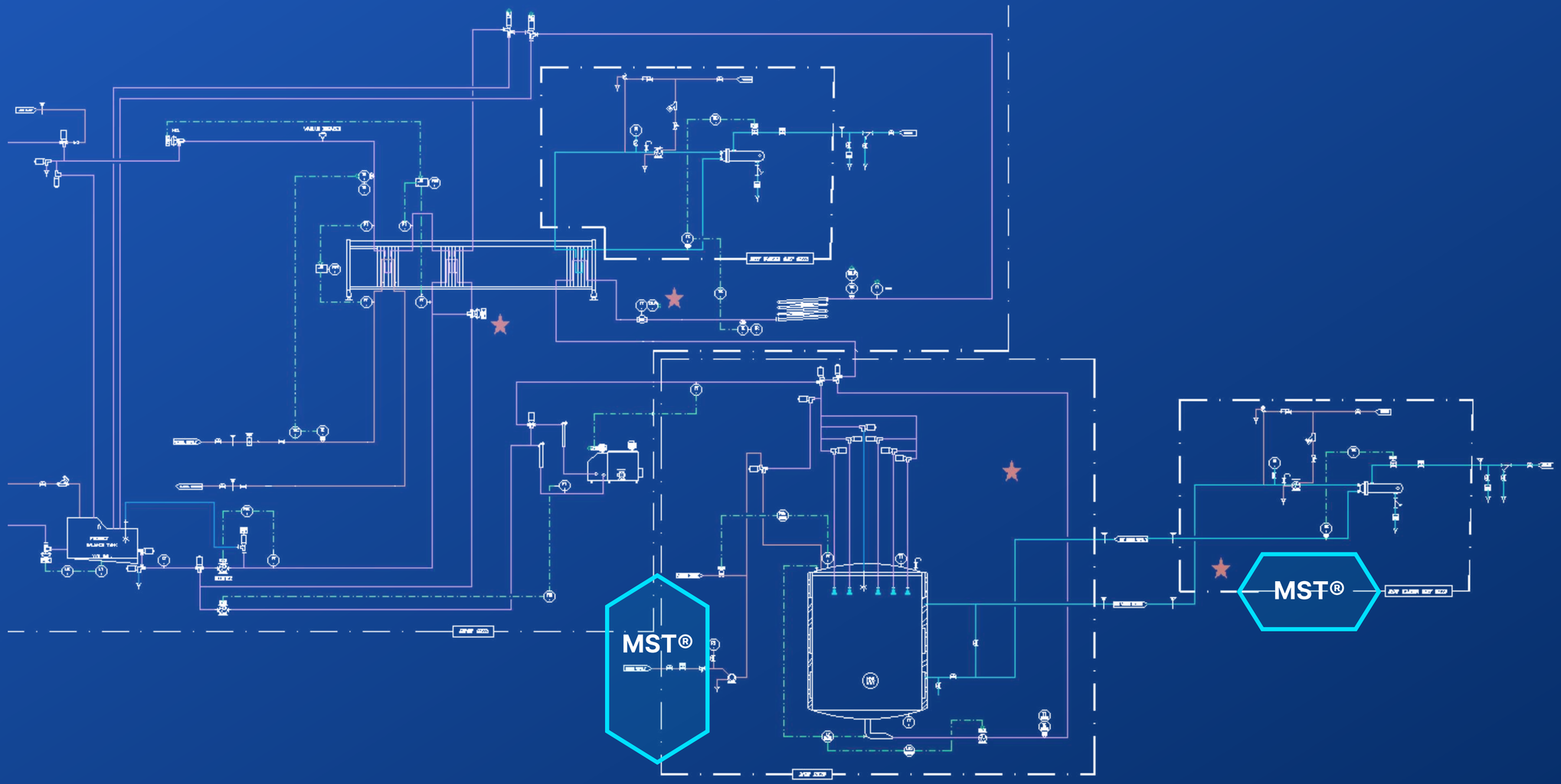
PASTEURIZATION



The addition of MST® greatly enhances HTST effectiveness resulting in longer fresh milk shelf life.

INTEGRATION

MST® INTEGRATED INTO HTST AFTER REGENERATOR



MILLISECOND TECHNOLOGIES

SUMMARIZING:
WHAT IS MST® ?

A revolutionary new and patented technology that integrates with the traditional HTST Fresh Milk processes to produce long life product with all the same nutritional values that consumers of fresh milk desire.

Extended Freshness
Holds up in the refrigerator from
3-4 times beyond the date code of regular HTST Fresh Milk.

Long life Fresh® optimizes distribution through the Supply Chain:

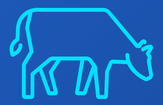
- Fewer and longer production runs
- Higher Quality Product
- Allows a change in distribution
- Fewer trips to the stores
- Simplify shelf stocking in the store
- Eliminates returns and disposals
- Allows for a greater distribution territory
- And more

TRADEMARK: "LONG LIFE FRESH®" MILK

MILLISECOND TECHNOLOGIES

POTENTIAL MST® FOOD APPLICATIONS

Dairy Beverages



- Long Life Fresh Milk
- Flavored Milks
- Coffee Milk Beverages
- Cream
- Ice Cream or Shake Mix

Non-Dairy

- Soy Milk
- Coconut Water, Coconut Milk, Coconut Cream
- Nut Milk
- Non-Dairy Creamer
- Premium Juices

INSTITUTIONAL FOUNDATION

MILLISECOND TECHNOLOGIES CORP.

NY based US C-corp, 100% owner of MST technology and IP portfolio. Validated through rigorous tests at Purdue University and The University of Tennessee.

2013 Purdue Microorganism Challenge.

2019 Commercial MST Production Launch.

PHARMA Pharmaceutical Research Division.

APPENDIX I
SCIENCE BEHIND MST LONG LIFE FRESH MILK

"We found that there were Thermoduric Psychrotroph Spore Formers, Gram Positives Rods, in the Store-Bought Milk Tested. At low numbers they germinate and grow slowly over time."

Food Science

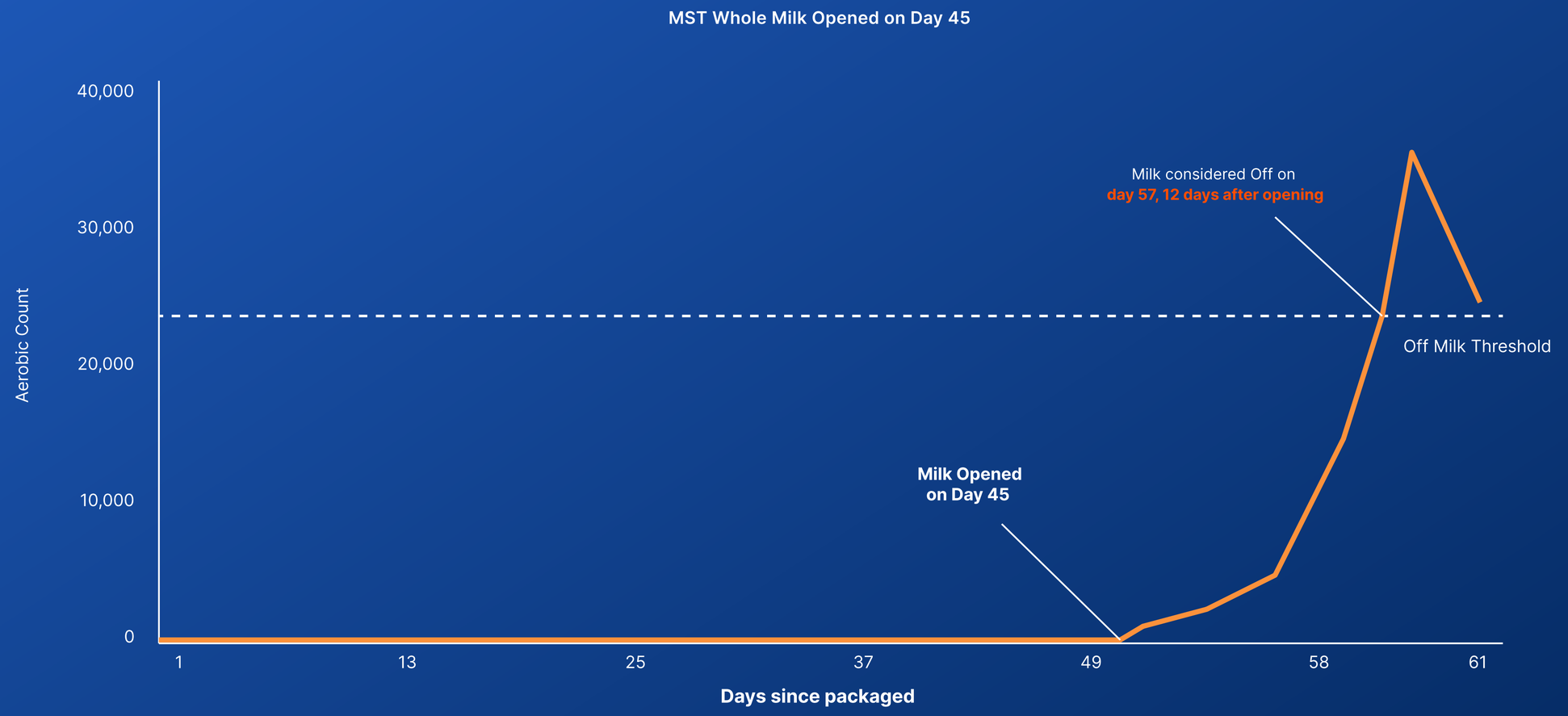
GERMINATION STUDY RESULTS: PAENIBACILLUS SP. (H8237)

MILLISECOND TECHNOLOGIES

MST INACTIVATES SPORE FORMERS RESULTING IN

45 DAY SHELF LIFE + 10-12 DAYS AFTER OPENING

Food Science



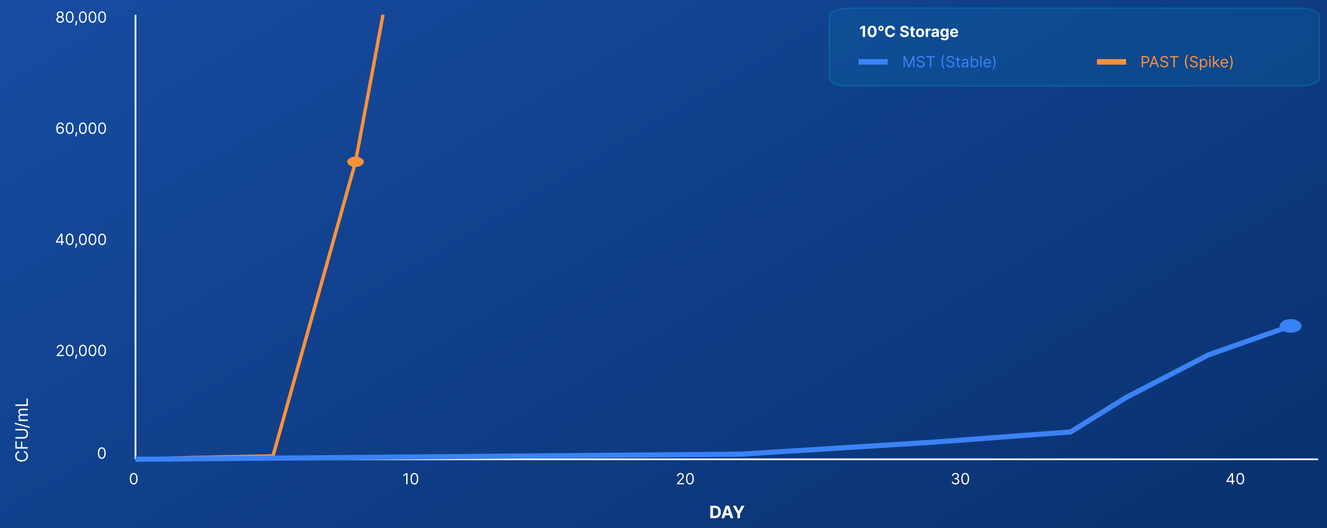
MILLISECOND TECHNOLOGIES

THE UNIVERSITY OF TENNESSEE KNOXVILLE

ELEVATED STORAGE TEMPERATURE SHELF-LIFE STUDY
(IMPORTANT FOR WARMER CLIMATES)

THE UNIVERSITY OF TENNESSEE KNOXVILLE

DAY	MST + PAST (CFU/ML)	PAST (CFU/ML)
2	0	200
5	0	800
8	145	53,500
12	510	510,000
15	715	-
19	690	-
22	915	-
29	3,120	-
34	5,150	-
36	11,250	-
39	18,750	-
42	24,400	-



Visualizing the stability of MST treated milk at elevated temperatures vs traditional pasteurization failure.

MILLISECOND TECHNOLOGIES

APPENDIX II
INTERNATIONAL
INTELLECTUAL PROPERTY

INTELLECTUAL PROPERTY INDEX I

STERILIZATION REACTOR AND METHOD

REGION	REGISTRATION ID	PRIORITY DATE / ISSUE	STATUS
AU (Main)	2014244186 / 2018204275	24-Apr-2015 / 12-Nov-2020	Granted
BR (Americas)	1120150227490 (BR1120150227490)	11-Sep-2015 / 07-Apr-2020	Granted
CA (Americas)	2903503	01-Sep-2015 / 13-Oct-2020	Granted
CN (Asia)	ZL201480026887.X / ZL201910900063.5	11-Nov-2015 / 27-Dec-2022	Granted
EP (Multi)	EP 2968625 (Valid Across Central EU)	13-Oct-2015 / 22-Nov-2022	Granted
EP (Multi)	EP 2968625 (Valid Across North/West EU)	13-Oct-2015 / 23-Nov-2022	Granted
EP (Multi)	EP 2968625 (Valid Across Nordic/South EU)	13-Oct-2015 / 23-Nov-2022	Granted
MX (Americas)	366771 (MX/a/2015/012513)	11-Sep-2015 / 24-Jul-2019	Granted
NZ (Oceania)	707324 / 743173	24-Apr-2015 / 01-Sept-2020	Granted
US (Domestic)	10,194,680 / 11,064,718	13-Mar-2013 / 20-Jul-2021	Granted
ZA (Africa)	2015/07523	09-Oct-2015 / 30-Mar-2022	Granted
RU (Eurasia)	2668376	13-Mar-2014 / 28-Sep-2018	Granted

MILLISECOND TECHNOLOGIES

INTELLECTUAL PROPERTY INDEX II

KILLING MICROBES WITH PRESSURE DROP AND HEAT

COUNTRY	ID NUMBER	PRIORITY DATE	PATENT NO. / ISSUE	STATUS
AU	2016250989	23-Nov-2017	2016250989 / 17-Dec-2020	Granted
CA	2987733	29-Nov-2017	2987733 / 29-Aug-2023	Granted
CN	201680035230.9	15-Dec-2017	-	Pending
EP	16725955.5	23-Nov-2017	3291683 / 05-June-2024	Granted
NZ	737654	23-Nov-2017	737654 / 01-Feb-2022	Granted
US	15/567,594	18-Oct-2017	11,096,406 / 24-Aug-2021	Granted
US (Cont.)	17/411,043	24-Aug-2021	-	Pending
RU	2017119160	22-Apr-2016	-	Granted

MILLISECOND TECHNOLOGIES

TRADEMARK APPLICATIONS

ASSET MARK	REGION	STATUS	REGISTRATION ID	FILING / GRANT
Corporate Logo	United States	Registered	97/799,922	Filing: 02/17/23
Corporate Logo	European Union	Registered	18130250	Grant: 02/15/20
Corporate Logo	Great Britain	Registered	3432294	Grant: 01/10/20
LONG LIFE FRESH	United States	Allowed	90/004,678	Filing: 06/16/20