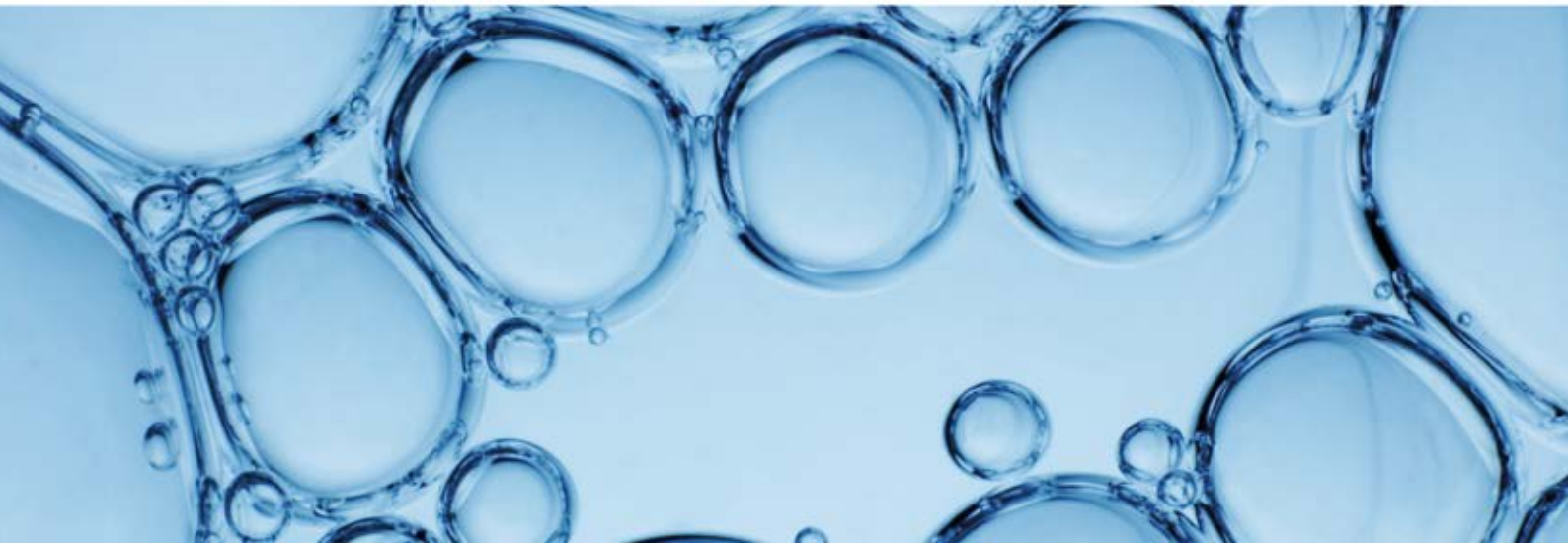
FOOD AND BEVERAGE FOAM CONTROL SOLUTIONS

MOMENTIVE®
SOLUTIONS FOR A SUSTAINABLE WORLD™



CONTENTS

WHY DOES FOAMING OCCUR IN FOOD AND BEVERAGE PROCESSING APPLICATIONS?

Foaming in food and beverage processing refers to the unwanted formation of stable bubbles or foam during the production or handling of food and drink products, and it can depend on different causes.

Protein Content

Natural proteins are known to denature and unfold, forming a stable network that traps air and creates foam.

Protein interactions with other ingredients, such as surfactants or stabilizers, can enhance foaming.

Mechanical Agitation

The mechanical action of mixing or stirring introduces air into the product.

Pumping liquids through pipes or nozzles can cause turbulence and air entrainment.

Temperature and Pressure

Sudden **temperature changes** affect the solubility of gases, including air or CO_2, leading to gas release and foam formation.

Pressure changes during processing or packaging can influence gas solubility.

Microbial Activity

Microbial fermentation processes can produce gases (such as CO_2) as byproducts, contributing to foaming in some particular food and beverage products.

Carbonation

In **carbonated beverages**, dissolved carbon dioxide (CO_2) is released from the solution, forming bubbles. The agitation of the liquid during processing or pouring can enhance foam formation.

Viscosity

High viscosity liquids trap air bubbles more quickly, forming foam and causing packaging problems, commonly in thick sauces, syrups, or viscous beverages.

Impurities and Contaminants

Oil and fat contamination, especially in the presence of surfactants, can contribute to foam stability.

Inadequate equipment cleaning may leave residual traces of detergents or cleaning agents in the equipment, leading to foam formation.

WHAT IS THE ROLE OF FOAM CONTROL AGENTS?

Foam control agents are substances added to inhibit or prevent foam formation. They work by disrupting foam stability and promoting the coalescence of bubbles. Choosing the right foam control agent is critical and depends on the specific application and compatibility with the processed product.

HOW DO FOAM CONTROL AGENTS WORK?

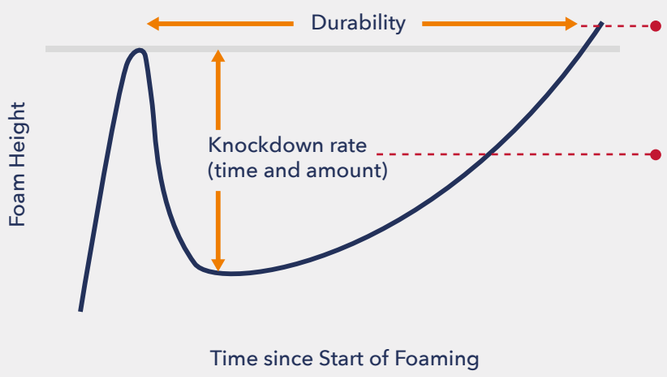
Antifoams prevent or inhibit the foam formation in a system and work by disrupting the stability of the foam structure. Antifoams typically contain hydrophobic (water-repellent) components, such as waxes, oils, or silicone-based compounds.

When added to a foaming system, antifoams migrate to the liquid-air interface and disrupt the surface tension of the bubbles, causing them to collapse. The hydrophobic components can also penetrate the foam film, weakening its stability.

Defoamers eliminate existing foam in a system and are particularly useful when the foam has already formed and needs immediate control.

Defoamers often contain a combination of hydrophobic compounds and surface-active agents. The hydrophobic nature of defoamers reduces the surface tension of the liquid, allowing bubbles to merge and coalesce. As bubbles coalesce, the foam structure breaks down, leading to the collapse of the foam.

It is not easy to measure foam control performance since various factors, including the nature of the foaming medium, temperature, and shear rate, have a substantial impact and may be challenging to foresee. However, **knockdown** and **durability** are relatively reliable parameters to measure antifoaming or defoaming performances.



Antifoams inhibit foam formation and promote efficient processing for longer durations.

Defoamers are very effective in controlling the foam by delivering quick knockdown.

An effective foam control agent generally meets the following requirements:

- Lower surface tension than the food and beverage substrate.
- Readily dispersible in the system.
- Very limited or low solubility in the system.
- Is inert.
- Leaves no substantial residue, taste, or odor.
- Complies with the latest quality and regulatory requirements.
- Halal, Kosher, and Pareve certification, as required.

WHY CHOOSE MOMENTIVE FOOD AND BEVERAGE FOAM CONTROL SOLUTIONS?

- Over 40 years of experience in the development of Foam Control Agents, scale-up, and application testing.
  - ESCA™, SAG™, and TSA solutions delivered consistent quality and performance.
- Silicone, non-silicone, and hybrid solutions to serve a wide range of food and beverage applications.
- Dedicated experts delivering technical, application, and regulatory support tailored to customer needs.
- Foam Control Agents compliant with safety and regulatory frameworks developed by established authorities such as:
  - US Food and Drug Administration (FDA)
  - European Union (EU)
  - German Federal Institute for Risk Assessment (BfR)
  - Japan Ministry of Health, Labor, and Welfare (MHLW)
  - FSSC 22000 (Food Safety System Certification 22000)

KEY FEATURES & BENEFITS

Process/technology experts

Consistency in the taste, texture, appearance, and odor of processed food and beverage products.

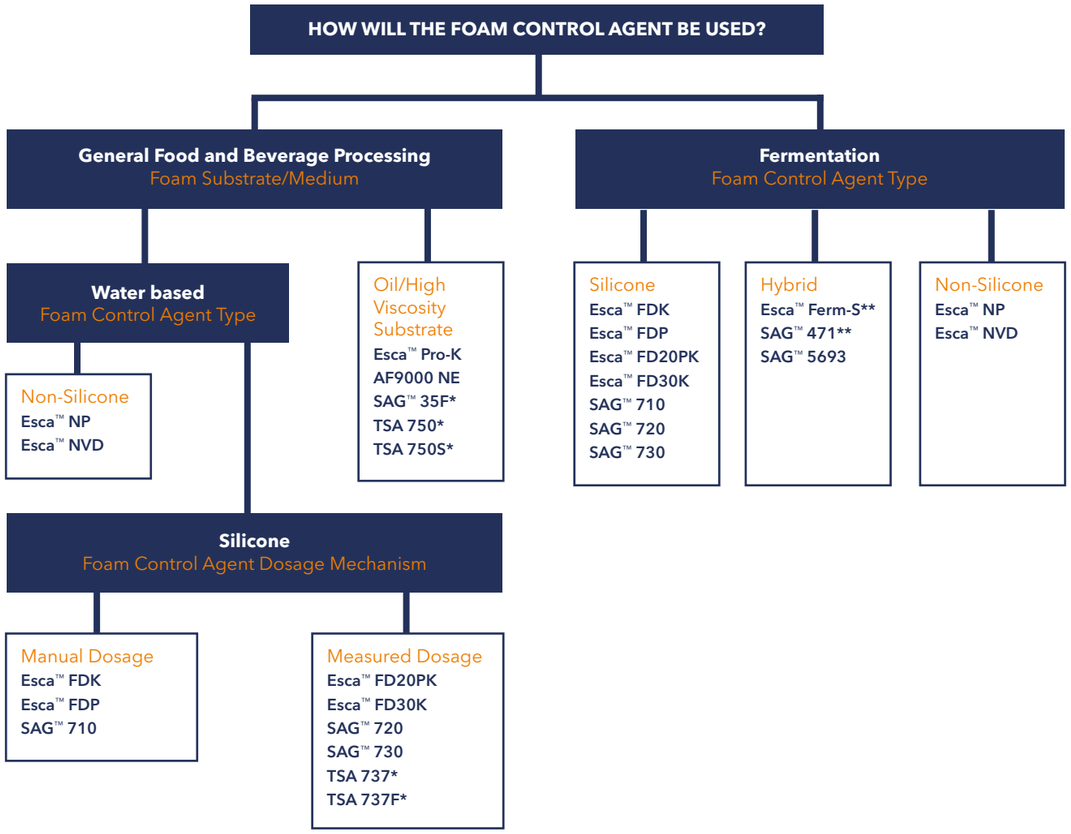
Production professionals

Boost operational efficiency by controlling equipment malfunctions and unwanted material in vessels, pipes, and valves.

Regulatory and compliance team

Adherence to best-in-class compliance and quality management systems, ensuring safety and quality in food and beverage production.

FOAM CONTROL AGENT SELECTION TREE



* Foam Control Solutions compliant with Japan Food Sanitation Act.
** Not compliant with US FDA 21 CFR 173.340.

PRODUCT OVERVIEW

Product	Composition	Active %	Typical Viscosity [cP]	Typical Dosage in ppm (as supplied) *	Fermentation Process	Water Compatibility	Kosher	Halal	21CFR 173.340	FSSC 22000	Commercially Available			
											AMR	EUR	APAC	JAPAN
SAG™ 710 Antifoam	Silicone emulsion	10	750 - 2000	<100	•	•	•	•	•		✓			
SAG™ 720 Antifoam	Silicone emulsion	20	750 - 2000	<50	•	•	•	•	•		✓			
SAG™ 730 Antifoam	Silicone emulsion	30	750 - 2000	<30	•	•	•	•	•		✓			
SAG™ 471 Antifoam	Hybrid compound	100	1500 - 3500	100 - 1000	•		•	•			✓	✓	✓	
SAG™ 35F Antifoam	Silicone compound	100	600 - 2000	10 - 50				•						✓
SAG™ 5693 Antifoam	Hybrid compound	100	300 - 400	100 - 300	•		•	•	•		✓	✓	✓	✓
AF9000 NE Antifoam	Silicone compound	100	600 - 2500	<10	•		•	•	•		✓	✓	✓	
Esca™ FDK Antifoam	Silicone emulsion	10	500 - 1400	<100	•	•	•	•	•	•	✓	✓	✓	
Esca™ FDP Antifoam	Silicone emulsion	10	400 - 5000	<100	•	•	•	•	•	•	✓	✓	✓	
Esca™ FD20PK Antifoam	Silicone emulsion	20	1000 - 4000	<50	•	•	•	•	•	•	✓	✓	✓	
Esca™ FD30K Antifoam	Silicone emulsion	30	1000 - 4000	<30	•	•	•	•	•	•	✓	✓	✓	
Esca™ Ferm-S Antifoam	Hybrid compound	100	300 - 1500	100 - 1000	•		•	•		•	✓	✓	✓	
Esca™ NP Antifoam	Non-silicone compound	100	300 - 400	100 - 1000	•	•	•	•	•	•	✓	✓	✓	
Esca™ NVD Antifoam	Non-silicone compound	100	40 - 150	100 - 1000	•	•	•	•	•	•	✓	✓	✓	
Esca™ Pro-K Antifoam	Silicone compound	100	2000 - 6000	<10			•	•	•	•	✓	✓	✓	
TSA 737 Antifoam	Silicone emulsion	35	1000 - 4500	100 - 1000	•			•						✓
TSA 737F Antifoam	Silicone emulsion	35	1000 - 4500	<10	•			•						✓
TSA 750 Antifoam	Silicone compound	100	500 - 1500	10 - 150		•		•						✓
TSA 750S Antifoam	Silicone compound	100	500 - 1500	10 - 150		•		•						✓

* Dosages are also subject to country-specific regulations and recommendations. Above dosage suggestions are typical recommendations as supplied. Customers should exercise their discretion, and Momentive is not liable for the final dosage decisions of the customer.

APPLICATION RECOMMENDATIONS

FRUITS, VEGETABLES & ANIMAL FEED

Silicone emulsion | Silicone compound | Hybrid compound | Non-silicone compound

	Application	Typical Use During Processing	Product Recommendation*
FRUITS 	**MARASCHINO CHERRIES**	Pumping of sugar solutions	Esca™ FDK, Esca™ FD20PK, Esca™ FD30K SAG™ 710, SAG™ 720, SAG™ 730 Esca™ NP
	PINEAPPLE PUREE	Removal of water to produce the purée	Esca™ FDK, Esca™ FD20PK, SAG™ 710, SAG™ 720 AF9000 NE Esca™ NP
VEGETABLES 	**WASHING**	During processing and water removal	Esca™ FD30K, SAG™ 730 Esca™ NP
ANIMAL FEED 	**MIXED FODDER**	During processing and water removal	Esca™ FDK, SAG™ 710 AF9000 NE

SAVORY FOODS

	Application	Typical Use During Processing	Product Recommendation
BREAD & CEREALS 	**BREAD**	Added to dough	Esca™ FDK, SAG™ 710 Esca™ NP, Esca™ NVD
	CEREAL AND BAKERY PRODUCTS	Added during processing	Esca™ FDK, Esca™ FD20PK, SAG™ 710, SAG™ 720 AF9000 NE Esca™ NP, Esca™ NVD
PASTA 	**SPINACH PASTA IN READY-MADE MEALS**	Added to spinach/water mix	Esca™ FD30K, SAG™ 730
STARCH / POTATOES 	**POTATO FLAKES, CHIPS AND FRENCH FRIES**	In caustic baths, during potato washing and peeling processes. In starch-based foam during potato washing	Esca™ FDK, Esca™ FD30K SAG™ 710, SAG™ 730 TSA 737F Esca™ NP, Esca™ NVD
	CORNSTARCH	Processing of cornstarch from sweet potatoes	Esca™ FD30K, SAG™ 730 Esca™ NP, Esca™ NVD
DAIRY 	**WHEY**	Continuous process of forcing whey through an electric dialysis machine	Esca™ FDK, SAG™ 710
	PUDDING	During processing	Esca™ FDK, Esca™ FD30K SAG™ 710, SAG™ 730
	DAIRY AND CHEESE	Wide temperature range and under agitation during production and bottle filling	Esca™ FDK, SAG™ 710 AF9000 NE, Esca™ Pro-K
SOYBEANS / TOFU 	**SOY SAUCE**	Soy sauce processing	Esca™ FDK, Esca™ FD30K SAG™ 710, SAG™ 730
	SOYBEAN PROTEIN	Soy protein processing	Esca™ NVD
	SOYBEANS	Within cookers	Esca™ FDK, Esca™ FD20PK SAG™ 710, SAG™ 720
MEAT / POULTRY / SEAFOOD 	**GELATIN**	Harsh conditions when cooking animal fat	AF9000 NE, Esca™ Pro-K
	MEAT	High temperature rendering process	Esca™ Pro-K
		Cleaning and sanitation	Esca™ FDK, SAG™ 710 AF9000 NE
	POULTRY	Rendering of inedible poultry byproducts	Esca™ FDP
	SEAFOOD	Brine freezing of crab and lobster	Esca™ FDP, Esca™ FDK, SAG™ 710
	SHRIMP	Washing	SAG™ 710 AF9000 NE, Esca™ Pro-K

SAVORY FOODS

	Application	Typical Use During Processing	Product Recommendation
BRINE 	**PICKLING**	To increase the speed of pickle packing	**Esca™ FDK, Esca™ FD30K** **SAG™ 710, SAG™ 730**
FLAVOR / SPICES 	**FLAVORS AND FRAGRANCES**	During processing	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720** **AF9000 NE**
	FOOD COLORANTS	During manufacturing	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
	LIQUID SEASONINGS	Blending	**Esca™ FDK, Esca™ FD30K** **SAG™ 710, SAG™ 730**
	VACUUM PACKING OF FOOD AND SEASONINGS	Vacuum line to reduce clogging	**Esca™ FDK, SAG™ 710**
VEGETABLE OIL 	**SUNFLOWER OIL**	During frying and cooking	**AF9000 NE** **Esca™ Pro-K** **SAG™ 35F, TSA 750, TSA 750S**
	MARGARINE	Process and cleaning	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**

SWEETS

	Application	Typical Use During Processing	Product Recommendation
CONFECTIONERY 	**SWEETS**	During processing	**AF9000 NE**
	TOFFEE AND SOFT ICE	Process and cleaning aid	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
DESSERTS 	**FLAVORED DESSERTS AND PUDDING TOPPINGS**	Preparation process	**Esca™ FDK, SAG™ 710**
JAM 	**JAM**	Boiling of fruit-and-sugar mixture	**Esca™ FDK, SAG™ 710**
	MARMALADE	Process and cleaning aid	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
SUGAR 	**MAPLE SYRUP**	Bottling	**Esca™ FD20PK, Esca™ FD30K** **SAG™ 720, SAG™ 730**
	SUGAR BEETS	Washing, sugar extraction, and sugar purification; typically added upstream from raw juice, in or after the carbonator.	**Esca™ FDK, Esca™ FD30K,** **SAG™ 710, SAG™ 730** **TSA 737F** **Esca™ Ferm-S, Esca™ NP**

BEVERAGES

	Application	Typical Use During Processing	Product Recommendation
ALCOHOL 	**VODKA AND WINE**	Within fermentation tanks	**Esca™ FDK, SAG™ 710** **SAG™ 5693**
	SPIRITS AND LIQUOR	During mash-processing and cleaning of processing equipment	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
	BEER	During wort boiling and fermentation	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
BEVERAGES  	**NATURAL JUICES AND CARBONATED BEVERAGES**	During container filling	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
	SOFT DRINKS	During mixing, but before bottling	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
		During bottle-filling operations	**Esca™ FDK, Esca™ FD20PK, Esca™ FD30K** **SAG™ 710, SAG™ 720, SAG™ 730**
	TANK CLEANING	Introduced during cleaning of tanks used for process water (e.g. in brewery operations)	**Esca™ FDK, Esca™ FD20PK, Esca™ FD30K** **SAG™ 710, SAG™ 720, SAG™ 730** **AF9000 NE**
	FRUIT JUICES	Process and cleaning aid during production	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
	SUGAR-FREE SOFT DRINKS	To reduce spillage or loss of product during the dilution of drinks prior to and during the bottling stage	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
	TEA	During extraction process	**Esca™ FDK, Esca™ FD20PK** **SAG™ 710, SAG™ 720**
BIO-ETHANOL 	**FERMENTATION**	During wheat fermentation	**SAG™ 5693, Esca™ Ferm-S** **Esca™ NVD**

QUALITY AND REGULATORY COMPLIANCE

Momentive takes pride in developing food and beverage foam control solutions that conform to globally recognized quality and compliance standards.

Momentive Foam Control Agents are compliant as Processing Aids or as Food Contact Substances in accordance with regulatory frameworks of multiple countries and regions, such as, but not limited to:

United States Food and Drug Administration (FDA):

- 21 CFR 173.340: Defoaming agents
- 21 CFR 173.310: Boiler additive
- 21CFR 176.180: Components of paper and paperboard in contact with food
- 21 CFR 176.200: Defoaming agents used in coating
- 21 CFR 176.210: Defoaming agents used in manufacturing of paper and paperboard
- 21 CFR 177.1200: Cellophane

European Union (EU):

- Commission Regulation (EC) No 1935/2004 (as amended)
- Commission Regulation (EU) No 10/2011 (as amended)

Germany - German Federal Institute for Risk Assessment (BfR):

- XV - Silicones
- XXXVI - Paper & Board for food contact
- XXXVI/2 - Paper & Paperboard for Baking

Japan:

- Ministry of Health, Labor, and Welfare (MHLW)

China:

- National Food Safety Standard on the Use of Additives in Food Contact Materials & articles

Mercosur:

- Mercosur Regulations on Food Contact Materials

- FSSC 22000 (Food Safety System Certification 22000)
- National Sanitation Foundation
  - 3H – Release agents for food contact
- M1 – Mold release agents for food packaging

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