

# BOOSTING BIO-FERMENTATION WITH ADVANCED ANTIFOAM SOLUTIONS



## MANAGING FOAM CHALLENGES IN BIO-FERMENTATION

Foam formation is a constant and costly threat in bio-fermentation processes, particularly in **pharmaceutical, food and beverage** applications. High aeration rates, complex media compositions, and protein-rich broths create the perfect environment for uncontrolled foaming.

### If left unmanaged, foam can:

- Reduce oxygen transfer
- Cause filter blockages
- Increase contamination risks
- Disrupt batch consistency

Whether you're producing antibiotics or enzymes, foam can silently erode process efficiency and product quality if not addressed early and effectively.



## PURPOSE-BUILT SOLUTIONS FROM LAB TO PRODUCTION

Momentive's **SAG™** and **Esca™** antifoams are specially formulated to solve these challenges at every stage, from lab to scale-up. Our solutions are designed to:

- **Maintain stable fermentation** by minimizing foam-related disruptions
- **Protect microbial cultures** from stress
- **Support consistent, high-quality production** across batches

## KEY BENEFITS

- **Biocompatible with a wide range of microbes**
- **Low dose, high efficiency for targeted foam control**
- **Support higher yields and consistent product quality**
- **Compliant and trusted in pharma, food and beverage applications**

With Momentive's antifoam technologies, you can focus on optimizing production while minimizing the risks and downtime caused by foam.



## FOAM-RELATED CHALLENGES IN FERMENTATION

Foam can impact aerobic fermentation efficiency and quality by:

- **Reducing fermenter capacity and overall yields**, limiting productivity
- **Damaging pumps, filters, and other downstream equipment**, increasing maintenance and operational costs
- **Increasing contamination and safety risks**, compromising product integrity and workplace safety
- **Disrupting mixing and oxygen transfer**, slowing microbial growth and process kinetics
- **Causing variability in product formulation and performance**, affecting consistency and quality

## OPTIMIZING FERMENTATION WITH ADVANCED ANTIFOAM SOLUTIONS

Using Momentive's antifoam emulsions and compounds can help:

- **Increase equipment capacity** by reducing foam volume
- **Reduce processing time** by minimizing downtime
- **Enhance process efficiency** through effective foam control at lower concentrations
- **Lower operational costs** by reducing maintenance, energy use, and resource consumption
- **Support higher yields and consistent product quality** by stabilizing fermentation conditions and preventing process disruptions



## ENSURING MICROBIAL COMPATIBILITY IN FERMENTATION APPLICATIONS

Microbial compatibility is a critical factor when selecting an antifoam for fermentation processes. Momentive's **SAG™**, **Esca™**, and **BC Simethicone antifoams** were rigorously tested with a wide range of relevant microbes commonly used in pharmaceutical, food and beverage fermentations. Using standard laboratory assays, these antifoams demonstrated **broad microbial compatibility**, with **no significant growth inhibition** observed across tested strains, supporting their safe and effective use in live fermentation systems.

Microorganisms for Testing	Type of Microorganism (Yeast/Bacteria)	ESCA™ FERM-S			ESCA™ NVD			ESCA™ FDK			BC SIMETHICONE PD30S			ESCA™ NP			ESCA™ FD20PK			SAG™ 471			SAG™ 5693		
		50 ppm	100 ppm	250 ppm	67 ppm	135 ppm	338 ppm	500 ppm	1000 ppm	2500 ppm	167 ppm	333 ppm	833 ppm	50 ppm	100 ppm	250 ppm	250 ppm	500 ppm	1250 ppm	50 ppm	100 ppm	250 ppm	50 ppm	100 ppm	250 ppm
<i>Saccharomyces cerevisiae</i>		-5.85	-7.03	-6.01	10.03	13	11.95	-7.77	-5.04	-3.42	11.71	10.31	9.96	-9.5	-2.8	-8.6	10.69	11.9	9.96	-7.18	-0.07	-1.5	-8.03	-8.07	-9.54
<i>Pichia pastoris</i>		-7.05	-3.46	-3.24	1.04	2.01	-0.07	4.56	-1.92	0.75	4.86	3.44	11.54	1.9	1.25	-0.12	2.25	1.1	6.85	-0.29	0.19	-2.09	2.86	1.9	-3.18
<i>Yarrowia lipolytica</i>		-2.02	-0.51	-4.9	4.88	6.87	4.02	-2.56	-5.06	-2.83	11.75	6.58	13.19	-4.2	-3.66	-8.76	9.8	10.98	13.52	1.53	-2.71	-7.79	1.43	-4.56	-2.91
<i>Lactobacillus rhamnosus</i>		-0.3	-1.63	-2.44	0.66	0.26	0.33	-1.24	-1.63	-2.33	2	0.45	1.24	-4.29	0.52	-1.83	0.4	1.41	-1.08	-0.86	0.92	-0.4	1.5	-0.02	-0.91
<i>Escherichia coli</i>		-0.1	0.58	0.08	0.52	-2.15	-3.58	-1.27	-2.11	-1.61	4.37	2.69	5.92	-7.78	-4.29	-3.06	6.1	3.73	4.63	1.4	1.37	-0.63	0.55	-6.66	-5.86
<i>Bacillus subtilis</i>		7.78	5.63	6.91	5.53	5.47	6.7	5.99	7.33	8.61	7.73	3.22	6.15	8.54	7.55	7.52	6.84	11.08	12.95	6.91	5.44	7.59	7.99	7.21	4.86
<i>Streptomyces sp.</i>		2.32	1.63	3.39	0.81	4.85	-4.57	-9	-7.33	-4.31	6.64	6.78	12.56	-6.68	-7.22	-3.81	6.64	6.87	0.37	1.59	0.27	-2.85	-0.69	2.24	2.32
<i>Corynebacterium glutamicum</i>		-1.28	-1.07	-1.78	2	2.88	3.97	1.08	0.41	-1.81	-1.71	13.62	4.84	-0.85	-0.3	0.92	4.78	6.61	8.65	-0.93	-1	-2.17	-1.25	-1	-1

Values in the table indicate growth inhibition %. Test results, actual data may vary. Study conducted in 2025.

Compatibility of yeast and bacterial strains was assessed using colony-forming unit (CFU) count, with each test performed in triplicate. Microbial compatibility classification, based on growth percentage inhibition and represented using colour coding:

- **0-20% Growth inhibition → Compatible**
- **> 20-50% Growth inhibition → Moderately toxic**
- **> 50% Growth inhibition → Toxic**

Negative values indicate slight growth enhancements relative to the control. As no statistical analysis was performed, these differences should not be considered significant and may be interpreted as equivalent to zero inhibition. Where possible, microorganisms were isolated from commercial products to better reflect real application conditions.

## PRODUCT SELECTION TABLE

Product	Composition	Active %	Dosage Rates (ppm)	Sterilizability		Diluent Compatibility		21CFR 173.340 US FDA	FSSC 22000
				Autoclavable	Microfiltration	Aqueous	Polyol		
SAG™ 471 Antifoam	Silicone Antifoam Compound	100	50-250	•		•	•		
SAG™ 5693 Antifoam	Silicone Antifoam Compound	100	50-250	•			•		
AF9000NE Antifoam	Silicone Antifoam Compound	100	50-250	•			•		•
Esca™ Ferm-S Antifoam	Hybrid Antifoam Compound	100	50-250	•			•		•
Esca™ NP Antifoam	Non-silicone Compound	100	50-250		•		•		•
Esca™ NVD Antifoam	Non-silicone Compound	100	50-250		•		•		•
BC Simethicone PD30S Antifoam	Simethicone Emulsion	30	10-100				•		
Esca™ FDK Antifoam	Silicone Emulsion	10	50-500				•		•
Esca™ FD20PK Antifoam	Silicone Emulsion	20	25-250				•		•
Esca™ FD30K Antifoam	Silicone Emulsion	30	10-100				•		•

## GENERAL CONDITIONS FOR USE

- Apply antifoams preventively to suppress foam formation. Silicone-based products are also effective for foam knockdown during active fermentation.
- Optimize dosing according to media type and microbial tolerance. Dosage requirements are influenced by media composition, fermenter design, aeration, and agitation. Compatibility with aqueous and/or polyol diluents is critical to ensure accurate dosing, maintain microbial performance, preserve oxygen transfer, and support efficient downstream processing.
- Most antifoam residuals can be removed by filtration or centrifugation post-process. We offer autoclavable grades compatible with a wide range of microbes. Non-silicone options are available for sterile filtration setups.
- 21 CFR 173.340 US FDA: Secondary direct food additives permitted in food for human consumption; Defoaming agents.
- BC Simethicone PD30S antifoam meets UK API GMP standards and is suited for pharmaceutical API grade bio-fermentation.

## CASE STUDY



### TRIPLING ANTIBIOTIC PRODUCTION BY OPTIMIZING FOAM CONTROL WITH SAG™ 471 SILICONE ANTIFOAM

An antibiotic manufacturer who used to treat *Clostridium difficile*, achieved a dramatic increase in production yields by refining its fermentation process and switching to a more effective antifoam agent.

To boost throughput, the manufacturer increased airflow rates in the fermenters, aiming to enhance oxygen transfer, accelerate microbial growth, and reduce cycle times.

However, the higher aeration led to excessive foam formation that proved difficult to control using conventional polyol-based antifoams like polypropylene glycol (PPG). Foam accumulation required larger dosages, complicating process control and downstream processing.

After evaluating alternatives, the team transitioned to Momentive's **SAG™ 471 silicone antifoam**, paired with optimized process conditions. The results were significant:

- **Batch frequency increased** from 1-2 per week to 5-6 per week
- **Cycle time dropped** from 3-4 days to just over 1 day
- **Output nearly tripled**, substantially improving productivity

#### RESULTS AT A GLANCE

3-4

MORE BATCHES PER WEEK

UP TO 104

MORE KG PRODUCED PER WEEK

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