



Investigating the Effect of Emulsifier on the Stability of Silicone Antifoam Emulsion

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Abstract: Silicone antifoam emulsions are widely used in various industries to control foam formation during the manufacturing process. Foam can be a problem in many industrial processes, reducing efficiency, increasing costs, and even product defects. Silicone antifoam emulsions offer an effective solution to this problem, providing excellent foam control properties across a wide range of applications. The stability of silicone antifoam emulsions is influenced by various factors such as emulsifier type and concentration. By carefully considering these factors during formulation, processing, and storage, it is possible to develop highly stable silicone antifoam emulsions that effectively control foam in diverse industrial applications. This study investigated the effects of multiple emulsifiers on the stability of silicone antifoam emulsions. Using the foam system based on an anionic surfactant, functional tests of antifoams were performed. The results showed that the use of an emulsifier improves the stability of silicone antifoam emulsion. However, the improvement of emulsion stability performance is more observed in Span 60 than in the other emulsifiers.

Keywords: antifoam; silicone antifoam; emulsion; emulsifier; stability.

Introduction

Different classifications have been made for antifoam materials. In most cases, these compounds are classified as silicone and non-silicone antifoams, or water-soluble and oil-soluble antifoams. Silicone emulsion antifoam is one of the most important and widely used antifoams [1]. Emulsion stability, including antifoam emulsion, is one of the important challenges of these compounds [2]. Various factors such as emulsifier type and concentration, silicone oil viscosity, pH and ionic strength, temperature and shear stress, and storage conditions, play a role in emulsion stability. Emulsifying substances play a role as one of the factors affecting the stability of emulsions. The percentage of emulsifiers for silicone antifoam emulsion typically ranges from 1% to 5% of the total formulation. When selecting emulsifiers for silicone antifoam emulsions, it is essential to consider their compatibility with silicone oils, their emulsifying properties, HLB value, regulatory compliance, and application-specific requirements to ensure the stability and effectiveness of the antifoam emulsion. Considering that the best amount of HLB for preparing antifoam is reported to be 1 to 3, choosing an emulsifier based on HLB is a suitable method for preparing antifoam emulsions. [3]. The purpose of this research was to investigate the effect of emulsifiers on the stability of silicone antifoam emulsions. Due to the foam problems caused by the surfactant sodium lauryl

sulfate (SLS), this substance has been used as a foaming agent.

Experimental Section

By choosing 4 types of emulsifiers, sorbitan monooleate (Span 80), sorbitan monostearate (Span 60), glycerol monostearate (GMS) and oleic acid, carboxymethyl cellulose (CMC) additive, polydimethylsiloxane (PDMS-1000) and water, according to table (1), several antifoam emulsions were prepared.

The stability of the emulsions was assessed through visual observation of phase separation, creaming, or coalescence over time. Furthermore, the defoaming performance of each emulsion formulation was evaluated using a standard foam test method to correlate stability with defoaming efficacy.

To test the performance of antifoams, 1% SLS solution was used to create foam. Based on this method, 50 ml of water was added in a 100 ml graduated cylinder and then 3 cc of 1% SLS solution was added as a foaming agent. It was stirred uniformly by adding the same amount of antifoam material and placing the cap on each of the cylinders. Then, the performance of antifoams in removing foam was compared.

Results and Discussion

Table (1) shows the formulation of silicone antifoam emulsion and its stability and performance as an

antifoam. The results show that Span 60 and GMS emulsifiers have the best performance in emulsion stability. By using oleic acid and Span 80 emulsion, an unstable emulsion was created. The comparison between the stable emulsions obtained from Span 60 and GMS showed that the emulsion obtained from Span 80 is more stable.

Since the main purpose of preparing antifoam is to eliminate foam, in addition to stability, these emulsions must also perform well as antifoam.

Some samples did not show proper performance as antifoam despite their good stability. The high viscosity of the emulsion (samples 3, 5, and 6), despite the stability of the emulsion, can be considered as one of the causes of the inefficiency of these emulsions as antifoam.

The performance test results of the prepared antifoams showed that among the stable antifoams, samples 1, 2, and 4 had good performance compared to other antifoams.

As the results of this research showed, in addition to the important role of emulsifiers in emulsion stability, the choice of emulsifier type, compatibility with formulation components, and its usage rate are of great importance.

stability of silicone antifoam emulsions. As the results of this research showed, in addition to the important role of emulsifiers in emulsion stability, choosing the type of emulsifier, compatibility with formulation components and the amount of use of these compounds are also of great importance. Since the main purpose of preparing antifoam is to remove foam, these emulsions should also have a good performance as antifoam.

Some samples, despite good stability, did not perform well as antifoam. The high viscosity of these compounds can be one of the reasons for the ineffectiveness of these emulsions as antifoam.

The use of emulsifiers in the formulation of antifoams can be practical research in this field, taking into account things such as low toxicity, economic considerations, ease of access, and compatibility with the consumption environment.

References

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Table1: Formulation of silicone antifoam emulsion

No	PDMS (gr)	Emulsifier (gr)	Water (gr)	CMC (gr)	*Stability
1	10	GMS (1)	83	2	++
2	10	GMS (2)	83	2	++
3	10	GMS (3)	83	2	++
4	10	Span60(1)	83	2	+++
5	10	Span60(2)	83	2	+++
6	10	Span60(3)	83	2	+++
7	10	Oleic acid(1)	83	2	-
8	10	Oleic acid(2)	83	2	-
9	10	Oleic acid(3)	83	2	-
10	10	Span80(1)	83	2	+
11	10	Span80(1)	83	2	+
12	10	Span80(1)	83	2	+
13	10	-	83	2	-

***Emulsion Stability:** Good stability (+++), Stable (++), Relatively stable (+), unstable (-)

Conclusions

The findings of this research showed that the presence of an emulsifier is one of the important factors in the