Focus Base PS 12 – Fish Tank Study

The primary emulsifier for **Focus Base PS 12** is built from sodium sulfonate/succinic anhydride chemistry. This combination allows one to formulate a more robust emulsion system. Advantages over standard sodium sulfonate include:

- Improved hard water stability
- Reduced soap and sludge build-up
- Reduced corrosion and microbiological problems

To demonstrate the benefits of **Focus Base PS 12** over a standard sodium sulfonate emulsifier, two soluble oils based on naphthenic oil were made. The first soluble oil used 15% by weight of an emulsifier base that contained sodium sulfonate as the primary emulsifier. The other soluble oil used 15% by weight of **Focus Base PS 12**. Emulsions of the two soluble oils were made by diluting them 1:19 (5%) in tap water with an approximate hardness of 30 ppm. These emulsions were then added to separate 10-gallon aquariums equipped with a mounted water circulator (see Figure 4). The water circulator assists with circulating the emulsions uniformly and helps to aerate them as well. Additional test parameters can be found in the "Experiment Details" section below.

Study Results and Conclusions

During this 60-day study, several characteristics were evaluated. These include pH, microbiological growth and corrosion tests (see the "Experiment Details" section for more information).

pH measurements for both systems can be found in Figure 1 below. As metalworking fluids age, pH values tend to drift lower (less alkaline). Each fluid had rather comparable pH profiles.

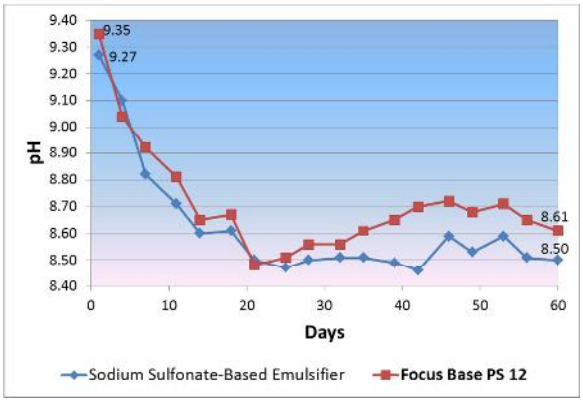

Figure 1: pH Measurements of Emulsion Systems

Both bacterial growth and fungal growth were monitored by dipslides. In both emulsion systems, no fungal growth was evident at any point during the study. Bacterial growth was measured eight separate times during the 60-day period (see Figure 2). With the exception of the first measurement, the two fluids showed virtually the same bacterial count for the first half (first ~ 30 days) of the study. However, while the bacterial count remained unchanged for the fluid containing **Focus Base PS 12** after the initial measurement, the other fluid showed the bacterial count increase to values greater than 10^7 cfu/mL[1].

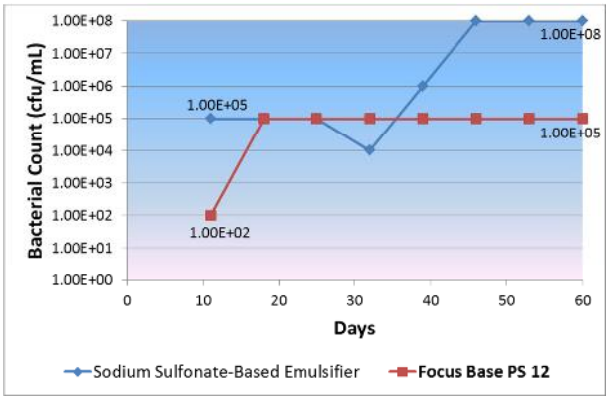

Figure 2: Bacterial Count of Emulsion Systems

Corrosion analysis was also performed during this study. A modified IP 287 method[2] (cast iron chip on filter paper test) was used to assess corrosion properties. The amount of corrosion on the filter paper was quantified as a percentage of rust on the paper. The results are illustrated below (Figure 3).

[1] cfu/mL = colony forming units per milliliter; bacterial counts greater than 10^7 were simply expressed as 10^8 graphically.

[2] Modification to the method include 1) using cast iron chips from Techsolve (per ASTM D 4627) and 2) reporting the corrosion as a percentage rather than a break point.

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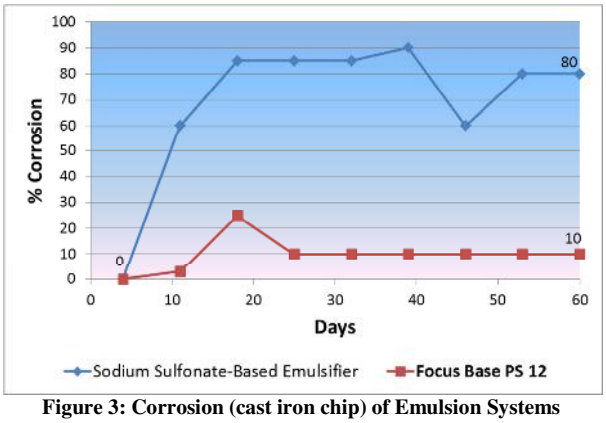

Figure 3: Corrosion (cast iron chip) of Emulsion Systems

In addition to the quantitative analyses, there were also qualitative differences that were observed between the two emulsion systems. The fluid containing the sodium sulfonate-based emulsifier had noticeable particles begin to form after only two weeks of testing. These particles persisted for the remainder of the study. Conversely, the fluid containing **Focus Base PS 12** ran clean for the entire duration of the test. This study was terminated after 60 days because not only did the fluid that contained the sodium sulfonate-based emulsifier exhibit exceptionally high bacterial count and very poor corrosion properties, the odor of the fluid became rather rancid.

Experiment Details

Figure 4: Photo of 10-gal Aquarium with Circulator

This emulsion study was conducted in the following manner:

- Both emulsions were made and transferred to the aquarium on a Monday. The initial volume in the tank was marked with a Sharpie® pen to indicate the starting water level.
- A small, but equal, amount of defoamer was added to both emulsions to reduce the risk of overflowing when the aquariums were unattended. No biocide was used on either fluid.
- Aeration was initiated on the first day and continued until Friday.
- On Friday and every Friday thereafter, the aeration was ceased (intended to mimic weekend shut-downs of sump systems).
- Every Monday the aeration was recommenced and allowed to run until Friday.
- Tap water (~ 30 ppm water hardness) was added to each aquarium weekly on Mondays to make up for any water lost due to evaporation. Enough water was added so that the volume was restored to its initial water level.

During this study various quantitative properties were measured:

- pH measurements were taken on the second day of the test and every Friday and Monday thereafter (twice a week).
- Bacterial/fungal growths were measured using Sani-Check BF dipslides from Biosan Laboratories. Measurements were made weekly on Fridays beginning on the second Friday.
- Cast iron chip corrosion tests were conducted on the same days and intervals when microbiological growth was tested.

These emulsions were run until failure occurred with an emulsion system. Failure can include any of the following:

- Bacterial count is consistently above 10^7 cfu/mL.
- Fungal count is consistently above 10^5 cfu/mL.
- Corrosion is consistently at or above 80%.
- System has become rancid (i.e. odor from aquarium is putrid).
- Emulsion breaks down.
- pH falls below 8.0.

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