



Biocide Comparisons: Bellicide vs Kathon FP 1.5

The following is a comparative analysis between two popular biocides – Bellicide (Bell Performance) and Kathon FP 1.5 (Dow Chemical). The intent of this comparison is to illustrate the key differences between the two biocide products, to enable the consumer to make the best decision for them.

Kathon FP 1.5 and Bellicide: Introduction and Background

Kathon FP 1.5 is manufactured by Dow Chemical and is in the same family as Dow Chemical’s Fuel Saver biocide. It has many white label versions, as well as a wide distribution network by other companies. It utilizes an isothiazolinone fuel chemistry. Bell Performance has offered its biocide solution Bellicide since 2010, for stored fuel users needing an effective solution to knock out fuel microbial problems. Bellicide utilizes a thiocyanate chemistry.

Essential Characteristics of Biocides

The best biocides should score highly in the following characteristics:













<p><i>Kills quickly</i></p> <p>Once mixed into the fuel or fluid, the most effective biocides will achieve the most complete kill rate in the shortest time. The best biocides (once properly mixed into the liquid so they can achieve contact with the microbes) can achieve a complete kill in as little as a couple of hours. It should be noted that quickness of total kill does depends on factors including the level of microbial contamination and the kinds of microbes being targeted.</p>
<p><i>Maintains a complete kill for the longest period of time</i></p> <p>The best biocides will maintain their complete kill rates for the longest time possible. Of course, how long this may be maintained is somewhat situation-dependent. But the most effective biocides will, all other things being equal, maintain a high kill rate for as long as four weeks, sometimes longer.</p>
<p><i>Resistance to pH changes</i></p> <p>The best biocides will work equally well in both acidic (pH < 7.0) and basic (pH > 7.0) environments. Maintaining effectiveness in acidic environments is especially important because fuels and liquid with severe microbial contamination will tend to be acidic, due to the acids produced by microbial respiration as they grow and thrive in the liquid. So a biocide that is less effective in an acidic environment would not be a good choice.</p>
<p><i>Effectiveness in both fuel and water phases</i></p> <p>This is essential when using a biocide in stored fuel. The presence of a water phase (a layer of water under the fuel) is always associated with microbial growth because microbes need the free water phase to grow and thrive. Some biocides have reduced effectiveness in the presence of water because their active “biocidal” ingredients react with water and change into neutral components. The most effective biocides will be equally effective at killing microbes in both phases and will not lose effectiveness in the presence of water.</p>

Low treat rate

Biocides offer benefits that have great monetary value to their users – the value gained from solving or preventing potentially costly problems. The best biocides should be effective at low treat rates, typically 1:5000 or better. The lower the treat rate, the more cost-effective they are to use. It should be noted that the effective treat rate that will be needed depends on factors including the level of microbial contamination and the kinds of microbes being targeted.

Bellicide vs. Kathon FP 1.5

Now that we’ve defined what separates a good biocide from a less-than-stellar one, we can compare Bellicide to Kathon FP 1.5 with respect to performance in these critical areas.

BIOCIDES TREATMENT		BELLCIDE	ISOTHIAZALONE (i.e. Kathon FP 1.5)
	Contact time to a complete kill (how long does it take to work?)		
	Effectiveness after 1 week (is it still working after one week?)		
	Effectiveness after 4 weeks (is it still working after four weeks?)		
	Sensitivity to pH (do microbial acids in the fuel keep it from working?)		
		 = Best Choice	 = Acceptable Choice



Bell Performance, Inc. tel 407-831-5021
1340 Bennett Drive fax 407-331-1125
Longwood, FL 32750
www.bellperformance.com
www.WeFixFuel.com

Summary of Biocide Performance

The above infographic gives a summary of how Bellicide and Kathon FP 1.5 perform with respect to the most important attributes related to biocide efficacy. We start with the data not related to kill rates and timing.

Sensitivity to pH – Bellicide is the least sensitive to acidic pH levels of fuel or liquid. Isothiazolinone (Kathon FP 1.5) can tend to lose effectiveness in more acidic environments, making it less effectiveness in the presence of severe microbe problems in fuel.

Effectiveness in water phase – This is not listed on the infographic but should be commented on. Bellicide and Kathon FP 1.5 both maintain effectiveness in the presence of water.

Attributes of Biocide Efficacy: Kill Studies Background

Because the purpose of a biocide is to kill microbes, the data relating to how fast and how completely it kills microbes is going to be the primary determiner of biocide value. Thus, the three remaining data points in the infographic comparison – *Contact Time / Effectiveness After 1 Week / Effectiveness After 4 Weeks* – are derived from the results of comparative kill studies conducted at independent testing laboratories.

Pertinent details on the comparative kill studies are listed here:

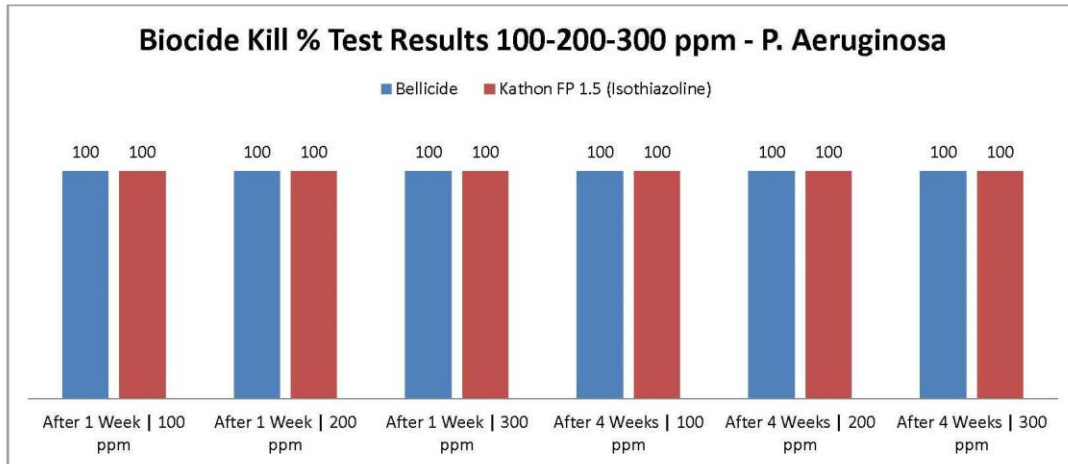
- Bellicide was tested in the laboratory to demonstrate its effectiveness against three other leading fuel oil microbicides. One of the other three microbicides was Kathon FP 1.5.
- Multiple treat rates were used during the studies (100 ppm, 200 ppm, 300 ppm) to determine each biocide's level of effectiveness at killing different strains of microbes relative to treat rate.
- The test method used is contained in the SIM publication #2, "*Proposed Procedures for the Screening of Microbial Inhibitors in Hydrocarbon/Water Systems.*"
- The microorganisms used in the study include the bacterium *Pseudomonas aeruginosa* (abbreviated as *P. aeruginosa* or *Ps. aeruginosa*) and the fungus *Hormoconis resinae* (formerly known as *Cladosporium resinae*, abbreviated as *H. resinae*). These microbe strains were selected because they are common contaminants in the field, they grow well in large numbers, and they grow well both in water and at the fuel-water interphase.

Kill Study Data

The data for kill effectiveness on the two microbe strains (*P. aeruginosa* and *H. resinae*) can be summarized by the charts below. The data is expressed in terms of percent kill (at 1 week and 4 weeks) of the total microbe count relative to the count in identical untreated fuel oil samples. For perspective, the average microbial count (between the two microbe strains) at 1 week in untreated fuel was about 6.4×10^6 per ml of fuel, and the average count at 4 weeks in untreated fuel was 6.0×10^5 per ml of fuel.



Kill Study Results Comparison – Multiple Treat Rates (100, 200 and 300 ppm)

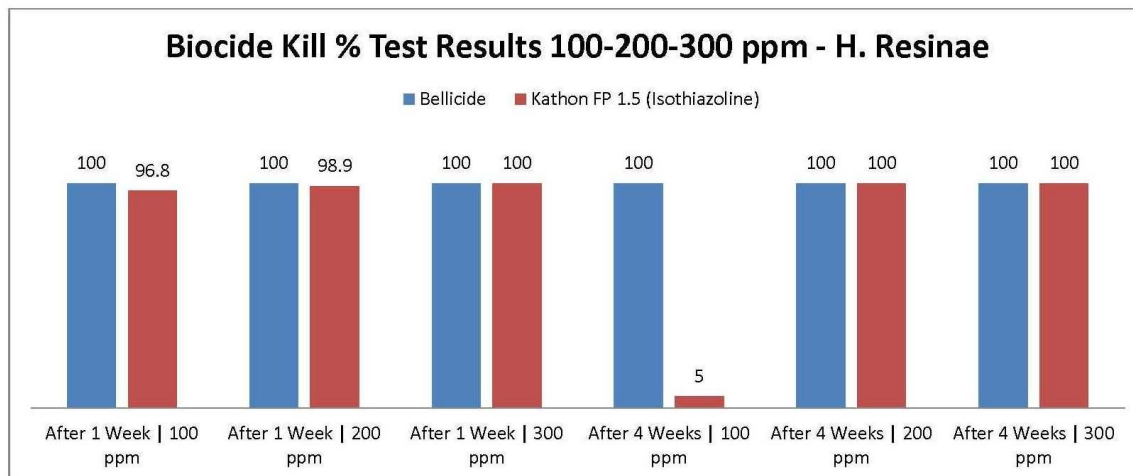


Results After 1 Week

- Both Bellicide and Kathon maintained a full 100% kill rate at all treat rates (100, 200 and 300 ppm).

Results after 4 Weeks

- Both Bellicide and Kathon maintained a full 100% kill rate at all treat rates (100, 200 and 300 ppm).



Results After 1 Week

- Bellicide and Kathon (isothiazoline) both maintained virtually 96.8 -100% kill rate at all treat rates (100, 200 and 300 ppm) after 1 week..

Results after 4 Weeks











- Bellicide clearly performed best, as the only product to maintain full 100% kill rate after 4 weeks, even at the lowest 100 ppm treat rate.
- Kathon was ineffective after 4 weeks at 100 ppm. Doubling the treat rate to 200 ppm and above restored the Kathon kill rate to a full 100% over this time period.



Kill Study Conclusions

The overall conclusion reached from this testing was that the Bellicide chemistry provided the best efficacy at all levels tested. The Kathon FP 1.5 chemistry did reasonably well (better than some other chemistries tested), but could not match Bellicide’s kill effectiveness for four weeks at the lowest treat rate.

Bellicide vs. Kathon FP 1.5

Solving bacteria and fungus problems in fuel is serious business.
 It's important to make the right choice. Here's what you need to know.

BIOCIDES TREATMENT	BELLICIDE	ISOTHIAZALONE (i.e. Kathon FP 1.5)
 Contact time to a complete kill (how long does it take to work?)		
 Effectiveness after 1 week (is it still working after one week?)		
 Effectiveness after 4 weeks (is it still working after four weeks?)		
 Sensitivity to pH (do microbial acids in the fuel keep it from working?)		

 = Best Choice  = Acceptable Choice

Comments on Attributes of Biocide Efficacy

The above kill study data thus informs the conclusions on biocide effectiveness that were expressed in the previous infographic.

Contact Time to a Complete Kill – Market data shows that Bellicide achieves maximum microbe kill in as little as 2 hours. Kathon FP 1.5 took the longest time period (>8 hours) to achieve its maximum kill.

Effectiveness After 1 Week – The kill study data showed both Bellicide and Kathon FP 1.5 remained highly effective after 1 week. Kathon Fp 1.5 did not quite achieve 100% kill at treat rates below 300 ppm, whereas Bellicide did.

Effectiveness After 4 Weeks – The kill study data was equally clear that Bellicide maintained its 100% kill rate for the longest period of the time – the entire 4 week test period. Kathon FP 1.5 could not maintain 100% kill rate at 100 ppm, but needed higher treat rates to do that.

Summary and Conclusion

- Bellicide kills faster than Kathon FP 1.5.
- Bellicide maintains a complete kill rate significantly longer than Kathon FP 1.5, especially after 1-2 weeks.

In choosing the right biocide, you want to choose the one that kills quickly and completely while maintaining its complete kill for the longest period of time. And you want it to maintain its effectiveness in the commonly encountered situations of water presence and high acid environments.

In our opinion, the data shows that Bellicide from Bell Performance fulfills all of these criteria to a greater and more complete extent than any of its name-brand competitors.