Experts Answer

Lecithin Applications

Dr. Craig Russet

In this first edition of our new section "Experts Answer" Dr. Craig Russet of the Solae Company answers questions on lecithin applications in aqua feeds. If you have a technical question that you would like to ask an expert, please send it to the editor at victor@feedware.com.

What are the quality parameters that a lecithin buyer should look for? Is there anyway to tell lecithin's quality by its color or another physical parameter?

As with fats, moisture level should be low in lecithin. Moisture levels should be less than 1.5%; less than 1% is preferred. The challenge is that lecithin is hygroscopic and some moisture gain is not unusual in high humidity environments. Another quality measure is hexane insolubles (H.I. %). Fats and phospholipids are soluble in hexane, so H.I. basically measures non-lipid materials such as a small piece of soybean, sand, dirt, etc. that could find their way into the lecithin. There are two problems with H.I. contamination. One, if the lecithin is to be sprayed the H.I. may clog the nozzle. Further, the H.I. may be a focal point to create some oxidation.

Acetone insoluble (A. I. %) is a rough reflection of the phospholipids content of a lecithin. Fats and oils are soluble in acetone while phospholipids are not. Since lecithin is bought as a source of phospholipids, the desire is to have a high A.I. value. By definition, fluid lecithin should have at least 50% A.I., although conventional standard fluid lecithins contain on an average 62-63% A.I. The definitions are not so specific for dry lecithin. A relatively 'pure' dry lecithin will be 96 - 98% phospholipids. However, some companies sell "dry" lecithin that is on carriers such as rice hulls, corn cobs, wax, saturated fat, etc. In these cases, the dry lecithin may have only 25-33% phospholipids. While nothing is wrong with the lecithin mixed with a carrier, the end user needs to know the composition as well as the differential price.

Viscosity is a defining attribute of lecithin but it is not a reflection of quality. Color is also usually not a direct measure of quality. However, if the lecithin is very dark brown approaching black, this could indicate burning during processing, resulting in off-flavors and fatty acid destruction. Color of lecithin is best judged in a container roughly the dimensions of a laboratory test tube. Looking at lecithin color in a 55 gallon drum, a bucket or even a cup is less distinctive. The reason is that lecithin tends to be rather dark and the greater the mass the less differentiation. The lecithin should have a 'normal' smell characteristic of lecithin. No burnt or rancid odor should be present.

What is the maximum level of liquid lecithin that can be used in steam pelleting without adversely affecting pellet quality?

Lecithin is more slippery than fats and oils, so it provides greater lubrication power. Operators having difficulty pelleting due to die resistance use 0.5% lecithin to enable pelleting. At higher inclusion levels, the effect of lecithin on pellet quality mirrors what happens with added fats and oils. Pellet quality decreases as lipids are added whether in the form of an oil or lecithin. Formula and pelleting capabilities are also factors in determining the level of lecithin that can be added without affecting pellet quality beyond acceptable levels. A formulator who wants lecithin in the pellets as a source of phospholipids may add pellet binders to offset the lubricity of the lecithin. Also, by choosing the right die, a feed manufacturer may be able to use up to 3% lecithin without adversely affecting pellet quality.

What are the options available to a feed manufacturer to reduce the viscosity of lecithin so that lecithin can be mixed with other ingredients or handled easier in coating systems?

Viscosity of lecithin is directly influenced by heat. Lower temperature equals higher viscosity and vice versa. The influence of temperature on lecithin viscosity is curvilinear, meaning that at low temperatures, a small increase in heat causes a relatively larger decrease in viscosity. For example, a lecithin with a viscosity of 10,000 centipoise at 24 C, might have a viscosity of 5000 centipoise at 35 C. An increase in temperature to 46 C might lower the viscosity to 3000 centipoise and further increase to 57 C would reduce viscosity to 2250 centipoise.

Mixing an oil, such as soybean oil or fish oil, with the lecithin at a rate of 20% oil and 80% lecithin has a similar influence on viscosity as raising temperature by 11 C. In other words, a standard fluid lecithin with 10,000 centipoise viscosity when mixed with 20% soybean oil would have an approximate viscosity of 5000 centipoise.

What is the optimum mixing ratio of lecithin and fish oil to reduce the viscosity of the former while minimizing the use of the latter?

This question has been partially answered in the previous section. One, however, needs to bear in mind that the viscosity of lecithin is not constant. Even traditional standard fluid

lecithin may range in viscosity from 8000 to 12,000 centipoise. Differential refining of lecithin may result in "lecithins" with a viscosity of 6,000 centipoise or 16,000 centipoise. With appropriately sized and powered equipment (pumps, lines, spray nozzles), there is no need to lower the viscosity of lecithin with fish oil.

Can dry lecithin be easily mixed with other ingredients? Can it be dissolved in fish oil and applied?

Dry powder lecithin can be easily mixed with other dry ingredients. The key is to avoid exposure of the powder lecithin to the atmosphere prior to the time that it will be added. Powder lecithin is packaged to minimize exposure to air. If a container of powder lecithin is opened and not resealed after use and remains exposed to air over-night, the lecithin will pick up moisture. This will result in lumping and clumping which in turn will reduce mixability.

Powder lecithin does not 'dissolve' in oils, however it can be 'melted' into oils. This requires heat, time and proper mixing equipment. Ideally, the oil will be brought to a temperature of 55 - 60 C (sometimes as high as 70 C). The powder lecithin will be slowly added and mixed with the oil in a manner determined to minimize air incorporation. With time, the powder lecithin will melt and the mixing will help to homogenize the two. In this fashion and with difficulty, as much as 20% powder lecithin has been combined with an oil. The problem in doing this is obvious in the case of fish oil. Typically, the goal is to avoid heating fish oil for fear of facilitating oxidation. Further, even careful mixing may incorporate some air, adding to an oxidation concern. It is better to combine fluid lecithin with oils if a mix of lecithin and oil is desired. ■

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