ALLIANCE™
(https://debug.globalseafood.org)

Responsible Seafood ADVOCATE

Aquafeeds

Measuring shrimp feed water stability

1 December 2005

By Eugenio Bortone, Ph.D., PAS, Dpl. ACAN

Quantitative, replicable procedure eliminates subjective assessment of quality

Straightforward, standardized lab procedures are needed to ensure consistent water stability in finished feeds.

One of the most important and discussed quality parameters of aquafeeds is their water stability. In the case of shrimp feed, hydrostability is important because pellets must maintain their physical integrity long enough for the animals to detect and consume them. Poor hydrostability leads to wasted feed and increased organic loading of ponds and effluents, higher feed conversions, and reduced profitability.

Regardless of the method used, hydrostability measurements must provide a quantitative and replicable procedure that eliminates the subjective assessment of quality. Measurable attributes can be used as quality controls to assure that manufactured feeds perform as expected at farms.

Assessment

At farms, water stability is often assessed in many different, subjective ways. One is by simply putting some pellets in a glass with water and observing how quickly they disintegrate or how much leaching occurs. Another method is to tie a pellet at the end of a string and submerge it in water until the pellet breaks into pieces or disintegrates. Others use their expertise in chop stick handling to pick up moist pellets to evaluate and determine how pellets maintain their integrity.

The reality is that none of the aforementioned methods is a quantitative way to determine water stability. They do not offer a repeatable and quantitative method that can be shared by feed manufacturers and the farmers or biologists in charge of assessing feed quality at farms.

The ways to determine water stability used by researchers are more expensive and require special equipment, but yield more accurate quantitative data. The following method is particularly recommended for shrimp aquafeeds.

Sample collection

Collect approximately 10 grams of feed every three or four bags until 20 samples are collected for a particular run. Mix the pellets together by hand to form a composite sample for water stability analyis. Weigh two 25-gram subsamples of the pellets and subject them to the laboratory procedure that follows.

Test procedure

Put 25 grams of prescreened pellets with fines removed in an Erlenmeyer flask and add 100 ml of fresh 25 degrees-C water. Clamp the flask snuggly in an orbital agitator and run the agitator at 200 rpm for 30 minutes. After agitation, place the pellets on a No. 20 mesh screen and wash the fines off with tap water. This step will remove any fine pieces that disintegrated during the agitation and are smaller than the screen size.

After washing, allow excess water to drip off for several minutes. Place the screen in a convection oven for two hours at 130 degrees C, then remove it to cool to ambient temperature. After cooling, record the weight of each pellet sample.

Calculations of water stability

Begin with the formula:

$$\text{Water Stability (\%)} = \frac{\text{Dried Pellet Weight (g)}}{\text{Initial Pellet Weight (g)}}$$

Multiply the result by 100 to convert to a percentage. The percentage number then needs to be corrected for the moisture content of the initial sample. Therefore, it is necessary to know the moisture content of both the initial pellet sample and that of the dried pellet sample.

Example: If the initial moisture content of a product is 11 percent, and the moisture content of the final sample is 2 percent after drying, adjust both weights to an equal basis. The moisture is 11 minus 2 or 9 percent. Therefore, add 9 percent back to the dried product or multiply the final result by 1.09.

- Sample weight = 25 grams
- Final sample weight = 18.5 grams
- Moisture of initial sample = 11 percent
- Moisture of final sample = 2 percent
- Water stability = (18.5/25) x 100 = 74 percent
- Correction for moisture = 74 percent x 1.09 = 80.66 percent.

Interpretation of results

After values are obtained, how does a final value of 70 or 80 percent correlate with water stability? Higher percentages indicate higher feed water stability, since the values obtained indicate how the pellets hold their physical integrity after being subjected to the test treatment.

Feed samples are agitated to speed up the degenerative effects of water on feed pellets.

The amount of dry mater loss will vary depending on the formula. Feeds lower in protein – and higher in starch – have higher water stability values than feeds with high levels of protein and fat. As a guide when using the method described here, feeds with 35 percent crude protein and at least 30 percent starch should have a water stability of 80 percent or higher after one day of manufacture. Feeds with 40 percent crude protein and 6 to 8 percent fat should have a water stability of 75 percent or higher, and feeds with 45 percent crude protein and 8-10 percent fat should have 70 percent water stability.

The hydrostability of shrimp aquafeed formulas can be improved by increasing the levels of natural or artificial binders, or optimizing processing conditions by preconditioning mash moisture and temperature, and adjusting postconditioning residence time and temperature, pellet die working area, and meal particle size.

(Editor's Note: This article was originally published in the December 2005 print edition of the Global Aquaculture Advocate*.)*

Author

EUGENIO BORTONE, PH.D., PAS, DPL. ACAN

1521 Country Club Drive
Red Bay, Alabama 35582 USA

drbortone@aol.com (mailto:drbortone@aol.com)