

OVERVIEW OF NUTRITIONAL CHARACTERISTICS OF DDGS IN AQUACULTURE FEEDS

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Corn distillers dried grains with solubles (DDGS) is a high energy, mid-protein, high available phosphorus ingredient. Plant protein sources have traditionally been considered to be inferior to fish meal in aquaculture feeds, but when two or more complimentary plant protein sources (DDGS and soybean meal) are included in the diet, the potential exists to replace all of the fish meal in the diet. Furthermore, DDGS does not contain antinutritional factors found in other protein sources such as soybean meal (trypsin inhibitors), rapeseed meal (glucosinolates and erucic acid), and cottonseed meal (gossypol), and contains low levels of phytate compared with other plant derived feed ingredients.

Crude fat content of DDGS is approximately 10% (as fed-basis), and approximately 55.7, 7.8, 0.14% of total fat is linoleic acid, linolenic acid, and DHA, respectively. As a result, DDGS has a high omega 6 to omega 3 ratio. Average values of crude fiber, ADF, NDF, and TDF content of DDGS are 6.6, 11.1, 37.6, and 31.8% respectively, and the majority (96.5%) of TDF is insoluble fiber. Fiber digestibility of DDGS has not been determined in fish, but studies conducted with other monogastric species indicate that fiber digestibility is significant but variable. Starch content in DDGS is low and can range from 2 to 9% depending on the extent of starch fermentation to ethanol. It is not known if the starch present in DDGS is digestible or in the form of resistant starch. It appears that fish with greater ability to utilize high fiber diets perform well at high dietary DDGS inclusion rates compared with some species with very little lower gut fermentation. Despite the relatively high crude protein content in DDGS (27%), lysine, methionine, threonine, and tryptophan content is relatively low relative to fish requirements. As a result, diets requiring high protein levels must be supplemented with crystalline amino acids when significant amounts of DDGS are added. Apparent amino acid digestibility of DDGS in rainbow trout diets has been determined, and are relatively high (> 90% for all essential amino acids except threonine), but have not been determined for other fish species. The phosphorus content in DDGS (0.75%) is higher than other plant based ingredients, and much of the phosphorus from phytate is released during corn fermentation in ethanol production, making it more digestible for monogastric species. However, phosphorus digestibility and availability values have not been determined in fish.

Addition of DDGS to aqua feeds appears to have beneficial effects on improving the immune status and resistance to some diseases in fish. Researchers have presumed that the factors contributing to these positive responses are biologically active compounds derived from yeast, which comprises approximately 4% of DDGS. Limited data have been published on the levels of these compounds in DDGS, but the β -glucan content of DDGS average 7.6%.

Limited data are available regarding the xanthophyll content and bioavailability in DDGS, and its impact on flesh color in fish, but the few values reported in the literature indicate that it can be highly variable and range from 3.5 to 29.8 mg/kg.