



SAFETY ISSUES OF FAT/OIL APPLICATION IN ANIMAL FEED

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Fat/oil application in animal feed, i.e. to apply essential fatty acids (EFA) in the feed for poultry, livestock, fish and shrimp etc., since they cannot be synthesized by animal body. Fat/oil application is one of the most common processes in feed manufacturing. Not only to increase energy but also to add EFA, fat/oil application in feed can improve feed availability greatly. Therefore, fat/oil application technology has received much attention in feed industry. Since the safety of finished feed products mostly depends on the quality of feed ingredients including fat/oil, package quality, storage conditions and management etc., so bad quality fat/oil will cause serious feed safety problems. However, great importance still has not been attached to the safety problems caused by these factors. Hereby, we'd like to discuss on the safety issues of fat/oil application in animal feed.

1.THE FUNCTIONS OF FAT/OIL APPLICATION IN ANIMAL FEED

1.1 Adding energy in feed

The energy in fat/oil usually is 2.25 to 2.27 times that in carbohydrate. Energy density in animal diet can be improved easily after fat/oil application. With the same daily feed intake, the energy taken by animal from feed in which fat /oil is added is more than that without fat/oil. The energy taken from the diet applied with fat/oil (especially animal fat) is proved to be 20~30% higher than the acknowledged metabolizable energy, which is the so called extra caloric. Therefore, fat/oil application is an effective way to increase the energy in feed. After being applied with fat/oil, the feed can satisfy the requirement of obtaining an energy density higher than 12.55 MJ/kg very easily.

1.2 Providing essential fatty acids (EFA)

Poultry, livestock (exclude adult ruminants) as well as shrimp and fish need certain essential fatty acids, lack of these fatty acids such as linoleic acid and linolenic acid will impact their normal growth. Since different fat/oil contains different essential fatty acids, the fat/oil to be applied in feed should be selected according to different requirements, so as to provide the right EFA for the animals.

1.3 Minimizing the dust generation, ingredient segregation and static electricity

By applying about 0.5%~1% fat/oil in feed, the bad situation of dust generation and ingredient segregation during feed processing will get better, the carriers in premix will be able to carry more ingredients, and the mixing homogeneity and feed quality will be ensured. Meanwhile, the working condition as well as production safety will be improved.



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1.4 Improving feed palatability

The palatability of feed for poultry or livestock definitely will be improved after being applied with fat. And it is no doubt that the dust and fines reduction will be good for feed intake, thanks to intake amount increase.

1.5 Beneficial to the absorption of fat-soluble vitamin A and vitamin D

Fat is the carrier of fat-soluble vitamins. After combining with fat, the fat-soluble vitamin A and vitamin D will be sent to blood through digestive tract. Therefore, fat is the indispensable precondition for the absorption of fat-soluble vitamins.

1.6 Improving the feeding efficiency of feed

As for a certain animal, adding a proper amount of feed in which right kind of fat/oil is applied usually can improve the absorption of high protein (by over 10%), the survival rate of poultry/livestock (by 3%~4%) as well as the milk production of cows (by 2.6 kg). Therefore, fat/oil application is a good way for improving feeding efficiency.

1.7 Delaying animals' hunger sensation

The time required for fat/oil to pass through stomach is longer than that for carbohydrate or protein, which will be able to delay animals' hunger sensation and increase the availability of energy in diet.

1.8 Lubricating feed processing machinery

After applying fat/oil, the friction coefficient between feed mash and machines is reduced, which reduces the abrasion on machine parts, thus prolonging the service lives of machines and lowering production cost.

In a word, fat/oil application has a lot of advantages in feed production. Different fat/oil is of different compositions and performances. It is better to apply different fat/oil for different feed as required, so as to achieve the best feeding efficiency and economic benefit.

2.PROBLEMS CAUSED BY FAT/OIL APPLICATION

As we all know every coin has two sides, though fat/oil application have a lot of advantages in feed production, problems come with it too. Please pay attention to the following points when applying fat/oil in feed.

(1) Fat/oil (especially animal fat) is in solid state in winter. If the application system is not in good working conditions (e.g. due to bad heating system or bad nozzle atomization function), the feed will agglomerate after fat/oil application, thus influencing its flowability and homogeneity.

(2) Fat/oil is liable to adhere on feed processing machines after application (especially with high adding amount or bad application system), thus reducing the effective area of flow passage, causing blockage and reduced output, what is worse, also causing cross contamination in the finished product.

(3) If fat/oil adding amount exceeds 5%, but the equipment and technology for application cannot meet the requirement, fat/oil



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applied will only adhere onto the surface of the mixture, which in the subsequent pelletizing process will cause skidding of the press rollers and produce soft pellet. Generally, fat/oil adding amount between 4% and 6% should be applied in two steps or a high speed mixer should be used; if adding amount is up to 8%~10% or more than that, a high-speed mixer must be used.

(4) Fat/oil rancidity. Fat/oil or feed added with fat/oil is liable to be oxidized if exposed in circumstance with oxygen or microbe or enzyme. The oxidation product is a matter called Lipid Peroxidation (LPO), which will not only influence the color of the feed (turn brown) but also give out the smell (offensive odor) of it. The acid value of the fat/oil after being oxidized is increased dramatically. Worse still, if the rancid fat/oil is eaten by animals will cause serious diseases, such as the yellow-fat and organ diseases of livestock & poultry, and the thin back disease of fish.

3.ATTENTION POINTS OF FAT/OIL APPLICATION

3.1 Selection of fat/oil to be applied

Applying different kinds of fat/oil in feed as per the different functions they required can achieve the best results. Therefore, the following factors must be taken into account before application:

The safety of fat/oil, the objective of applying fat/oil, the influences on the quality of finished product, the economical efficiency of fat/oil application and etc.

3.2 Items to be considered before fat/oil application

(1) It is prohibited to applied rancid fat/oil in feed. Check the acid value of the fat/oil to be used before application, to ensure feed security.

(2) If fat/oil application is for enhancing energy in feed, both animal fat and vegetable oil are favorable. However, animal fat is more economic. (Attention: it is not suitable to apply animal fat in feed for ruminants.)

(3) If fat/oil application is for adding both energy and EFA in feed, it is suggested to apply vegetable oil in feed. Considering about the cost, a mixture of animal fat and vegetable oil is also available, in which the vegetable oil content should be 15%~20%.

(4) If the objective of fat/oil application is to prevent ingredient from segregation and ensure feed stability, mineral oil or vegetable oil is favorable.

3.3 Fat/oil application equipment & technology and operation management

(1) Fat/oil application equipment & technology

a. It is required to have excellent atomizing effect no matter how much fat/oil is added, so as to ensure the fat/oil not to be agglomerated.

b. If adding amount is larger than 4%~5%, the technology of applying fat/oil in two steps or a high-speed mixer should be



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used; if the adding amount is larger than 6%~8%, a high-speed mixer must be used. Otherwise, the fat/oil will be unable to penetrate into the inner of the fines, but only adhere on the surface, thus badly affecting its flowability and pelletizing performance.

c. If the fat/oil to be applied is in solid state under low-temperature, the application equipments such as storage tank and pipeline should be heated by a hot water jacket or through heat tracing by using a hot water pipe or an electric heater winding the fat/oil pipeline with excellent heat isolation performance, so as to ensure the flowability of fat/oil. In order to avoid browning problem, try best not to use steam for fat/oil heating (especially for other liquid like molasses).

d. Only after the micro ingredients have been completely added into the mixer and mixed uniformly, can the fat/oil application be carried out.

(2) Requirements for feed packaging

a. Since fat/oil is liable to be oxidized in air, less air in the package is better for the storage life of feed, so the bag should be fully filled with feed to diminish air space, better still, the bag can be sealed and glued so as to prevent air from penetrating into the bag, thus prolonging the storage time of finished product.

b. Pack the high fat/oil feed with laminated bag, which should be able to protect feed from light. By making the laminated bag with a lining or coating a dark layer on it can realize the function. (E.g. the bag for fish meal is black). More attention should be paid to the package of feed applied with fat/oil, especially in those high-temperature and high-humidity areas.

(3) Maintenance of fat/oil application equipments

If the application equipment is not in good working conditions, the fat/oil added into the mixer is easy to bond with fines and form agglomerate, which always adhere on those surfaces where mash flow can not reach. As time goes on, the accumulation expands gradually while the section area of the channel through which mash can flow reduced. Therefore, it is necessary to carry out regular cleaning after fat/oil application so that the mash can flow smoothly, and it can eliminate the bad agglomerate from influencing the quality of finished product as well. Pay more attention to the cleaning work, especially when the adding amount is more than 5% or when the nozzle is not in its best atomizing effect.

3.4 Precautions against fat/oil rancidity

Long-term exposed in light, heat, oxygen circumstances or long time contacting with elements like copper or iron, fat/oil will be oxygenized and turn rancid. Therefore, the above mentioned factors should be taken into account when designing the storage facilities for fat/oil or finished product added with fat/oil.

(1) The animal fat or vegetable oil to be applied in feed should comply with the edible standard;

(2) Tank for storing fat/oil: intensity of illumination $\leq 15XL$, temperature $\leq 28^{\circ}C$, relative humidity $\leq 75\%$. The tank should be fully filled with animal fat or vegetable oil, and the fat/oil must be mixed with a certain amount of antioxidant. Generally, the storage time of fat/oil is 3~6 months.



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(3) The minerals such as copper, iron and manganese etc. should be encapsulated, so as to minimize the direct contact of the minerals with vitamins and fat/oil.

(4) Warehouse for storing feed: intensity of illumination $\leq 15XL$, temperature $\leq 28^{\circ}C \sim 30^{\circ}C$, relative humidity $\leq 75\%$. The storage time should not exceed one month. The more the fat/oil added, the shorter the compound storage time. The storage time of premix added with fat/oil usually not exceed 15 days.

(5) Acid value is the most sensitive parameter when fat/oil rancidity happens. Once the acid value increases to over 40mgKOH/g, it must not be applied in feed any more.

CONCLUSION:

In a word, fat/oil application in feed benefits the growth of livestock, poultry, fish and shrimp, the enhancing of feed availability as well as the improving of EFA in feed. However, it also causes potential safety problems. In order to ensure feed safety, great importance must be attached to the receiving and storage of fat/oil to be applied as well as to the manufacturing, packing and storage of feed products.

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