



Manufactured By
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Degossypolized Cottonseed Protein (DGCSP) Production Process

The DGCSP production technology by soaked & repeated Degossypolization owned by China-Leader Biotech is the most advanced process in China and the product DGCSP thus produced is of the highest nutritive level in China and most welcomed by feed industry and breeding industry.

The process is based on several self-owned invention patents and utility-model patents. The process is briefly described as : after it is cleaned to remove impurities, black (Delinted) cottonseed is decoraticated and screen-separated to get cottonseed kernel; de-oiled wet cottonseed meal is soaked in methanol of low concentration in another set of soaked and repeated extractor to remove gossypol, sugar and other anti-nutritional factors; Degossypolized and de-sugared wet cottonseed meal is drained is off and then is removed from solvent in a newly patented extruder with moisture content in the resulted protein-containing cottonseed meal being less than 40%; the extruded protein – containing cottonseed meal is dehumidified and solvent removed in disc dryer and then, it goes to an original and unique humidifier (over which the Company has its intellectual property rights) to further recover residual solvent from meal and to reasonably regulate the moisture in the meal; Finally, DGCSP product is produced with little protein denaturation, high nutritive level and moderate moisture.

Features of DCP Production Process

1. Low temperature is kept for cottonseed treatment throughout the process so as to avoid protein denaturation to the maximum degree and so as to ensure DGCSP nutritional potency.
2. The powder content of the cottonseed flake from the preparatory section is small, which is well suited for oil extraction and gossypol removal. Optimal Control of the temperatures at various points in preparatory section could yield product with high level of digestibility and nutrition.
3. Application of one-step oil extraction process for cottonseed and use of drag-chain extractor are suited for spraying extraction of cottonseed flake with low residual oil. The de-oiled wet cottonseed meal was sent to another specialized soaking and repeating extractor and in methanol of low concentration, gossypol, sugar and other anti-nutritional factors are removed. The Degossypolization based on soaking in methanol of low concentration (85-90%) makes it possible to thoroughly remove gossypol in short period of time (about 35 minutes) & with little protein denaturation.

4. The above process has successfully overcome the defect of certain process which has to depend on long time soaking in methanol and then drying to avoid worsen testing result of free gossypol. Certain process produces large amount of alcoholic denatured and thermal denatured gossypol and meanwhile amino acid combines with gossypol and other anti-nutritional factors thus decreasing amino acid content in protein and decreasing digestibility.
5. By application of soaking Degossypolization process, residual oil in the meal could be further extracted to reduce oil residue in protein to less than 10%. By using methanol of low concentration, gossypol is removed while other anti-nutritional factors could also be removed such as aflatoxin, tannin, phytic acid, and various sugars. The moisture contained in methanol could extract out other water-soluble anti-nutritional factors to further improve nutritive level of the product.
6. By using liquid extractor, the methanol in wet cottonseed meal is removed not only to maximize the decreasing or methanol content in wet meal, to lighten the load of the dryer and to cut down coal consumption but also more importantly, to avoid protein thermal denaturation and alcoholic denaturation to its maximum to produce the product with high amino acid content and with better digestibility.
7. Since the liquid extractor has extruded out most methanol and moisture, only one low-temperature disc dryer is used to get the drying result. By using one-step drying process, the drying time is shortened and protein denaturation is small. In this way, the energy consumption for drying is economized and the nutritional level of DGCSP is maintained.
8. By using the originated humidifier over which the Company owns Independent intellectual Property, the residual solvent in cottonseed meal is further recovered to reduce solvent consumption and the moisture content in cottonseed meal is rationally regulated to yield in a cost-effective way a type of DGCSP product with little protein denaturation, high nutritional level and moderate moisture content.
9. The film evaporator is used to recover methanol to avoid liquid overflow in rectifying column so that the process is stabled.
10. The low temperature process makes it possible that pigment is not solidified into DGCSP nor into cottonseed oil. Therefore, the pigment content is low in crude oil to wholly guarantee oil quality and the color of DGCSP is light yellow or yellow.
11. The whole process of oil extraction, gossypol removal and solvent recovery is under slight negative pressure. Quantitative emission of tail gas under control. A series of measures are taken to ensure the separation and recovery of the solvent to minimize solvent consumption & further ensure the project have objective economic benefits.
12. The whole processing system is under automatic control, which makes production more stable and process parameter regulation more accurate and as a result, which achieves the effect of energy saving, consumption decreasing and product quality improvement.

Cottonseed Protein

Cottonseed Protein is a type of quality protein, which is produced by low temperature Degossypolization of its raw material cottonseed. It has the features of low fiber content, high metabolic energy and high lysine effective value. Cottonseed protein is a high-grade protein ingredient in animal feed with its free gossypol being equal with or less than 50ppm (HPLC), its crude protein content being above 50% and its ratio of total amino acids to crude protein being as high as more than 95% and in addition, its amino acid composition being very similar to ideal balanced protein pattern. At present, because of several of its nutritive index are better than soybean meal while its price is RMB 100-200 lower than soybean meal per ton, cottonseed protein has been widely used in livestock feed and aquatic feed to partially replace vegetable and animal proteins such as soybean meal, corn protein powder and fish powder. The table on right shows the protein test index of the cottonseed protein produced based on the process developed by China Leader Biological Science & Technology Co. Ltd. Test index of similar products produced by any other processes could not reach up to such level.

Comparison on Amino Acid Content among Soybean Meal / Cottonseed Meal & DGCSP

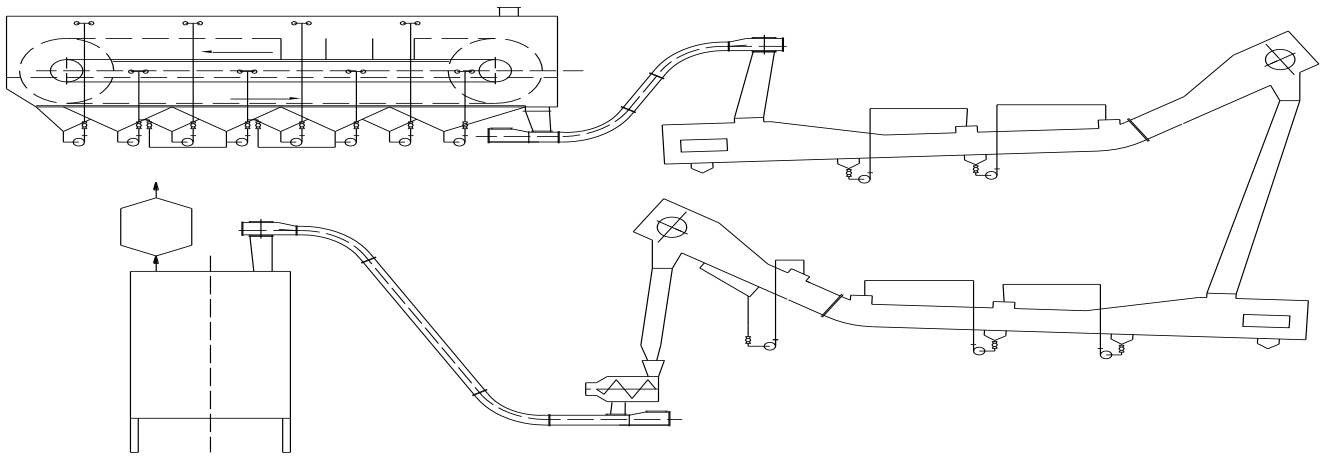
Items	Soybean Meal	Cotton Seed Meal	DGCSP
Lysine (%)	2.69	1.39	2.35
Methionine + Cystine (%)	0.98	0.71 (0.35+ 0.36)	1.49 (0.62+ 0.87)
Arginine (%)	2.82	3.14	5.87
Isoleucine (%)	1.85	0.96	1.68
Leucine (%)	3.16	1.76	2.98
Phenylalanine (%)	2.11	1.5	2.73
Alanine (%)	1.73	1.27	1.99
Threonine (%)	1.69	1.02	1.71
Valine (%)	1.78	1.25	2.16
Aspartate (%)	4.56	2.84	4.70
Serine (%)	1.90	1.18	2.08
Glutamate (%)	8.71	6.64	12.03
Glycine (%)	1.74	1.21	2.14
Tyrosine (%)	1.40	0.78	1.44
Histidine (%)	1.39	1.14	1.90
Proline (%)	2.43	1.59	2.01
Total Amino-Acids (%)	40.94	28.91	49.26
Crude Protein (%)	44.70	40.50	51.50
Portion of Total Amino-Acids in Crude Protein (%)	91.60	71.40	95.60
Digestible Energy of Pig (cal/g)	3370	2250	3290
Metabolic Energy of Chicken (cal/g)	2390	1860	2420
Dry Matter (%)	89.6	82.9	93.6
EAA/NEAA	1:1.25	1:1.35	1:1.09

Note: EAA/NEAA means Essential Amino Acid / Non Essential Amino Acid

KOH Protein Solubility of DGCSP

- There are big differences on the KOH protein solubility of Degossypolized cottonseed protein produced by different processes.
- KOH Protein Solubility is inversely proportional to thermal denaturation and alcoholic denaturation of Degossypolized cottonseed protein:
 - 1) The higher the protein drying temperature and the longer the protein drying time, the more serious the protein thermal denaturation is, i.e. the lower the protein solubility.
 - 2) The higher methanol concentration in Degossypolization and the longer the degossypolizing time, the more serious protein solubility decreasing is.
- KOH solubility of Degossypolized cottonseed protein is proportional to its amino acid digestibility.

Features of Soaked & Repeated Degossypolized Process for Cottonseed Protein



#Oil Extractor of Drag Chain Type #Soaked & Repeated Degossypolization with Low Concentration of Methanol in 2 or 3 Extractors #Solvent Removal By Extrusion Pressing Lightly Dried, Low Protein Denaturation #50~55 % Protein Content In Final Product

Features of Soaked & Repeated Degossypolization Process

1. By using soaked & repeated Degossypolization extractor, methanol and cottonseed meal more fully contact each other to result in better Degossypolization.
2. Deoiled wet cottonseed meal is washed with big quantity of low concentration and more quantity of anti-nutritional factors and various types of sugar are extracted out to result in over 50% KOH protein solubility, high amino acid content, high digestion rate and higher nutrient level of final product
3. Solvent removal by extrusion pressing decreases drying load, reduces protein denaturation and makes protein KOH solubility equal with or higher than 50%. It could minimize denatured gossypol content to result in high content of amino acid in cottonseed protein in high protein digestion rate.
4. The technology could raise the ratio of material to solvent as to 1 (material) to 2 (solvent).

Features of Soaked & Repeated Degossypolization Equipments

1. Due to the fact that all oil is extracted by oil extractor, the selected extractor is more than twice bigger than the extractor for the same black cottonseed processing capacity. Besides, our production line uses two sets of such big extractor, one for oil extraction and one for gossypol removal. Consequently, the full set of equipment is more expensive.

2. Oil extraction and gossypol removal use their own specialized extractor to result in low oil residue in the meal, in better degossypolisation effect and more importantly, in removal of large quantity of anti-nutritional factors from the meal together with gossypol removal to ensure high nutrient level of cottonseed protein.

The DGCSP produced by ABOVE process has a quality standard being much higher than industrial standard and has the highest nutritional level with highest content of total amino acid, lysine, methionine, cystine etc. and with highest digestibility. It has been highly rated by feed industry.

Gallery

Factory Layout (Effect Picture)



Pretreatment Workshop ---Decorticator



Pretreatment Workshop - Equipments



Soaked Degossypolization Workshop - Oil Extractor



Soaked Degossypolization Workshop - Gossypol Extractor with a Processing Capacity of 300 Tons Black Seeds Per Day



Production Line with a Processing Capacity of 150 Tons Black Seeds per Day



Soaked Degossypolization Workshop – Methanol Recovering Equipment



Complete Production Line for Degossypolized Cottonseed Protein - Pulverizing & Packing Process



Experimental Observations Using Degossypolized Cottonseed Protein (DGCSP) to Replace Soybean Meal in Compound Animal Feed

1. Report on Degossypolized Cottonseed Protein (DGCSP) Feeding Experiment – Lactating Dairy Cows



Zhou Jianming et al,
China Agriculture
University



Sanyuan Green Lotus
Dairy Center, Beijing

Abstracts From The Results

During the period of nearly 1 year, feeding experiments on about 400 lactating dairy cows and experiments on large herd of cows for feeding cost and milk production have been run in areas like Beijing, Tianjin, Ningxia and Xinjiang. The experiments show that by substitution of 50% ~75% soybean meal in concentrated feed formula (i.e. 10-15% portion of soybean meal) with DGCSP for feeding lactating dairy cows, each cow yields 13.83% (2.88kg) more milk on average during the experimental period of time. Remarkable economic benefit has been realized without producing adverse effects on the healthy reproduction of the experimental dairy cows.

2. Report on Degossypolized Cottonseed Protein (DGCSP) Feeding Experiment – Pacific White Shrimp



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Lab of Nutrition and
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for Aquatic Animals,
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University

Abstracts From The Results

Baby shrimps of about 0.17g by weight are selected as experimental objects. DGCSP replaces fish powder protein by 0%, 20%, 35% and 50% respectively (the feedstuff for control group contains 36% fish powder protein). After feeding the shrimps for 8 weeks, the growth and body composition of the shrimps are determined and analyzed. The results show that when DGCSP substitutes fish powder protein by 20%, there is no apparent difference in the weight gain rate, specific growth rate, feed coefficient and protein efficiency ratio as compared with the control group.

3. Report on Degossypolized Cottonseed Protein (DGCSP) Feeding Experiment – Perch



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Abstracts From The Results

Japanese Sea Perches (*Lateolabrax japonicus*) weighing 5.04 ± 0.02 g are selected as the experimental object and the feedstuff is added with 0%, 15.2%, 30.5% and 46% DGCSP respectively to replace 0%, 25%, 50% and 75% of fish powder protein. Besides, in 75% fish powder-replacement Group (A), lysine and methionine are balanced in reference with the control group. The results after the experiment on growth for 8 weeks show that there are no apparent differences in various items of growth parameters for the experimental group (25% fish powder protein replaced) as compared with the control group and there no apparent difference in specific growth rate and nutrients apparent digestion rate for the 50% fish powder protein replaced group as compared with the control group whereas its feed conversion rate and protein efficiency are substantially lower than the control group ($P < 0.05$). When 75% fish powder protein is replaced, various growth index are apparently worse as compared with the control group. However, when the amino acids are balanced, the protein efficiency is substantially improved in the same group. No substantial difference is shown in the results of analysis on apparent digestion rate of various nutrients and on body composition of the fish among different experimental groups. It means that in the feed for Japanese Sea Perch, DGCSP could replace as much as less than 50% of fish powder protein (Note: the basic formula contains 45% fish powder protein) which is beneficial to the substantial cost cut-down.

4. Report on Degossypolized Cottonseed Protein (DGCSP) Feeding Experiment – Red Trout



Xue Ming, Luo Lin,
et al;
Aquatic Product Lab,
Animal Feed
Research Institute,
China Agriculture
Academy

Abstracts From The Results

Red Trouts weighing 39.18 ± 0.07 g are selected as the experimental object and the feedstuff is added with 0%, 15.2%, 30.5%, 46.5% & 61% DGCSP respectively to replace 0%, 25%, 50%, 75% & 100% of fish powder protein. Besides, in 75% fish powder-replacement Group, amino acids (lysine & methionine) are balanced in reference with the control group. The results after the experiment on growth for 8 weeks show that there are no apparent differences in various growth index, nutrient digestion rate, amino acid digestion rate and fish body composition index for the experimental groups (25% and 50% replacement of fish powder protein) as compared with the control group (0% replacement) and there are no apparent differences in dry matter digestion rate, protein digestion rate and energy digestion rate for the group -75% replacement as compared with the control group. There are no apparent differences in fish body composition (dry matter, crude protein, crude fat, ashes and the like) in the feedstuffs among different groups.


	<p>The research shows that addition of certain quantity of DGCSP in the feed for red trouts will not have apparent influence on the growth, feedstuff apparent digestion rate & body composition of red trouts. With general consideration of various parameters, it is optimal for replacing 25-50% crude protein of fish powder (basic formula contains 45% fish powder). At this level of replacing quantity, there are no significant difference in the ingestion and growth of red trouts as compared with the control group (0% replacement) while the feed cost per kilo is substantially reduced. By contrast, it was reported by Cheng & Hardy in 2002 that when the cotton meal from high temperature oil pressing process is added to 15% in the feedstuff for baby red trouts, the weight gaining rate and feedstuff conversion efficiency were substantially reduced.</p>
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5. Report on Degossypolized Cottonseed Protein (DGCSP) Feeding Experiment – Laying Hens & Broilers

<h3>Laying Hens & Broilers</h3>	
 <p>Zhu Wentao, et al Technical Development Co. of Xinjiang Tiankang Group Co. Ltd.</p>	<p><u>Abstracts From The Results</u></p> <p>417 New Roman broilers of 38 weeks 'age are selected for the experiment which are divided by random into four groups: control group (fed only with soybean meal), experimental group I (DGCSP replacing soybean meal by 100%), experimental group II (DGCSP replacing soybean meal by 70%) & experimental group III (DGCSP replacing soybean meal by 30%) for feeding experiments. The experimental results show that there are no apparent difference in laying rate and in weight of egg while feedstuff consumption trends toward decreasing. It is possible to completely replace soybean meal by DGCSP and the deduction of feed consumption is beneficial to profit increasing.</p>
<h3>Broilers</h3>	
 <p>Wang Yin, et al Beijing Agriculture College</p>	<p>One day old chicks are selected for the experiment and are divided into the control group (fed only with soybean meal), experimental group 1 (5% DGCSP) & experimental group II (10% DGCSP). The feeding experiment is conducted for 3 weeks. The experimental results show that the adding of DGCSP does not have adverse influence on weight gaining of chicks nor on palatability & utilization rate of the feedstuff. DGCSP is a protein source ideally suited for chicks.</p>
 <p>Beijing Huadu Broilers Co. Ltd.</p>	<p>There are 26800 broilers in both control group & experimental group. The nutritive levels of both control group & experimental group are completely consistent at different stages & the amino acids are adjusted for balance. The chicks for both control group & experimental group are bought together and the conditions are also completely consistent in immunification, feeding & medication. The chicks are fed till they are ready for sale. The experimental results show that when the broilersration contains 10-12% DGCSP, there is no adverse influence on production performance of broilers as compared with the ration of only soybean meal. In addition, the feedstuff cost reduced.</p>

Application Direction of Degossypolized Cottonseed Protein (DGCSP)

1. Application Direction of Degossypolized Cottonseed Protein (DGCSP) – Aquatic Feed

 <p>Normal Aquatic Feed High Grade Aquatic Product Breeding</p>	<p>RECOMMENDATION</p> <p>In light of the previously described experimental results, partial replacement of fish powder by DGCSP in aquatic feed could bring good results. It is recommended that DGCSP is to be used in high grade aquatic product breeding and in normal aquatic feed, which is beneficial to the reduction of breeding cost and feedstuff cost.</p>
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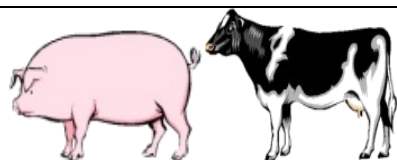


2. Application Direction of Degossypolized Cottonseed Protein (DGCSP) – Poultry Feed

 <p>Laying Hens, Broilers & Ducks</p>	<p>RECOMMENDATION</p> <p>Replacement of soybean meal and the like by DGCSP in poultry feed could raise the meat-to-feed ratio and reduce the feeding cost and the feed processing cost.</p>
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3. Application Direction of Degossypolized Cottonseed Protein (DGCSP) – Other Special Feeds



High Productive Dairy Cows, Calves

RECOMMENDATION

The experiments show that application of DGCSP in breeding dairy cows could significantly improve the index like milk yield, milk fat content and milk protein content. The feedstuff containing DGCSP for piglets and calves is both safe and reliable and is beneficial to the improvement of breeding survival rate and meat-to-feed ratio and to the reduction of breeding cost and feed processing cost.

