

## **SCD Probiotics**

### **White Paper:**

*Application of SCD Probiotics Technology  
for Livestock Production*

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## **SCD Probiotics Technology**

### **Background**

SCD Probiotics ("SCD", LLC), based in Kansas City, Missouri, USA, is a company specializing in natural microbial-based products and services for human health, agriculture industry, industrial waste management and environmental sustainability. Through 10 years of research and development, SCD has selected 16 different microbial strains for production of various probiotic products. These include lactic acid bacteria such as *Lactobacillus*, and *Streptococcus*; yeast such as *Saccharomyces*; photosynthetic bacteria such as *Rhodospseudomonas*; and other beneficial bacteria such as *Bacillus*.

In essence, the SCD Probiotics Technology is a consortium of lactic acid bacteria, phototrophic bacteria, nutritional yeast and other beneficial microorganisms. The SCD consortium culture synergistically works to inhibit the growth of pathogenic harmful bacteria through competitive exclusion. In addition to competitive exclusion effects, the metabolites produced by the consortia and its chemical characteristics contribute to antimicrobial properties and health benefits. Average pH of the product ranges from 3.2-3.5. Some products with SCD Probiotics Technology microorganisms consortium, can for instance, include *Lactobacillus acidophilus*, *L. bulgaricus*, *L. casie*, *L. fermentum*, *L. Plantarum*, *Rhodoseudomonas palustris*, *Saccharomyces cerevisiae*, *Streptococcus thermophilus*, etc. These microorganisms have been known to be associated with human foods and are ubiquitously used in manufacturing of probiotic dietary supplement products for human, animal and aquaculture health.

While the traditional meaning of the word "probiotic" is applied to human and animal digestive microorganisms, SCD is on the cutting edge of developing technology to apply the



concept of “probiotics” to many fields globally including wastewater treatment, odor control, environmental bioremediation, agriculture, pest control, mold remediation, industrial and home agriculture, aquaculture, gardening, prevention of skin diseases, turf grass, composting and other fields.

### **SCD Probiotics Technology and Certifications**

All SCD products are manufactured under high and strict quality control standards. Products are manufactured in a food grade facility, utilizing food grade equipment, raw materials and utensils. SCD complies with the Food Grade current Good Manufacturing Practices (cGMP) Guidelines enforced in the United States by the Food and Drug Administration. GMP guidelines provide a system of processes, procedures and documentation to assure the product produced has the identity, strength, composition, quality and purity that it is represented to possess. Information about SCD Probiotics Technology can be found at [www.SCDProbiotics.com](http://www.SCDProbiotics.com)

Organic Materials Review Institute (OMRI) provides certifiers, growers, manufacturers and suppliers an independent review of products intended for use in certified organic production, handling, and processing (Organic Materials Review Institute, 2006). OMRI’s services are directed to all aspects of the organic industry with a primary focus on the decision makers who deal with the compliance status of generic materials and brand name products. With the OMRI *Generic Materials List* and OMRI *Products List*, OMRI provides guidance on the suitability of material inputs under the USDA National Organic Program standards (Organic Materials Review Institute, 2006). Many SCD products are certified with OMRI as “safe for use in organic production.” Please visit [www.omri.org](http://www.omri.org) for more information and to verify SCD’s registered status.



SCD's compliance with the above-mentioned regulatory agencies illustrates the safety and quality of the products manufactured as well as routine testing that has been conducted over the past two years. SCD products are routinely tested both in house and by third party independent laboratories for the incidence of pathogenic activity, heavy metals, and mycotoxins. Certificates of analysis of two of the products, ProBio Balance™ Plus and SCD ProBiotics Food™ are enclosed.

ProBio Balance™ Plus is recommended for use in livestock, agriculture and environment applications. It can be used to manufacture secondary products such as SCD Bio Klean™ and SCD Odor Away™ for specific applications in the area of odor control and environmental cleanliness. The secondary products are as below.

SCD Bio Klean™: This is an all-natural industrial cleaner containing exclusive microbes and their metabolites, which is recommended for treatment of industrial wastewater, grease, grime and dirt. SCD Bio Klean™ is an environmentally safe, and uniquely effective biological cleaner.

SCD Odor Away™: This is an all-natural biological odor reducer containing exclusive microbes and their metabolites. SCD Odor Away™ is environmentally safe and distinctly effective at decreasing odors in livestock lagoon, holding areas and pens, waste treatment facilities and composting operations.

SCD ProBiotics Food™ (formerly ProBio Food™ ) is recommended for use in livestock and human health applications. It can be used to manufacture secondary products such as SCD Bio Livestock® for specific applications in the area of animal productivity and human health. The secondary products are as below.



SCD Bio Livestock®: This is an all-natural biological probiotic feed additive containing exclusive microbes and their metabolites. SCD Bio Livestock® is distinctly effective at improving the health of animals and avoids the need for antibiotics.

### **Livestock Applications of SCD Probiotics Technology**

A number of positive results have been reported when probiotics has been introduced to livestock production. An experiment done by Yongzhen and Weijiong (2006), showed a reduction in ammonia concentration in ppm of 69.70% when broilers and laying hens were given probiotics treatment in both the water and feed. The main contributors to foul odors are ammonia, hydrogen sulfide, mercaptan and methylmercaptan. Higher concentrations of ammonia not only influence the normal growth of animals, but also cause diseases. Probiotic treatment reduces the concentration of ammonia, thus reducing the incidence of diseases and improving the growth of the animal, including an increased egg production, weight gain and efficiency of feed utilization (Yongzhen and Weijiong, 2006).

In recent years, numerous reports in the literature can be found pertaining to the uses of probiotics or direct-fed microbial (DFM) bacteria, the addition of useful microorganisms cultures to diet or drinking water, to improve production performance and quality of products.

Anjum et. al (2006), showed great increases in body weight gain among broilers after only five weeks. Probiotic was introduced into the animals feed in three different ways:

1. 1ml/L EM in drinking water
2. 30g/Kg EM in biofeed
3. Both 1mL/L in drinking water and 30g/Kg in biofeed

After five weeks of treatment, average body wight gain in the control group, probiotic solution, Biofeed, and Probiotic Solution + Biofeed was 864, 1,217, 1,207, 1,361 grams, respectively



(Anjum et. al., 2006). Another study tested the effects of probiotics as an alternative to antibiotics (AB) (Safaloah and Smith, 1999). The broilers given 30g/kg of probiotics combined with AB had the greatest weight gain when compared to those not given any probiotics or AB. Even broilers given probiotics without AB had great weight gains. At 42 days of age, the control broilers had gained 2065.99 grams of weight compared to those with probiotics in their feed at 30g/kg and no AB with a gain of 2091.70. A decrease in serum cholesterol was also seen (Safaloah and Smith, 1999). Even though detail mechanisms of probiotics has yet been identified from these findings, significant production performances have been reported to be a function of improving feed bioavailability, balancing gastrointestinal microorganisms, and enhancing immunity when probiotic strains are ingested (Safaloah and Smith, 1999).

Hieu and Tho (2002), studied the effect of probiotics for treatment of diarrheic disease in piglets. It was found that antimicrobial properties of probiotics increased with dosage. The growth of *E. coli*, *Salmonella*, *Kleisiella*, *Shigella*, *Staphylococcus*, *Streptococcus* and *C. perfringens*, including antibiotic resistant strains, were completely inhibited when probiotics were used at 10mL (Hieu and Tho, 2002). The results differed significantly from the controls (distilled water and distilled water with pH of 3.5). Probiotics were effective in treating diarrhea in piglets due to complicated infection of enteric bacteria. Efficacy of probiotics in treating diarrheic disease in piglets did not differ significantly form conventional antibiotics such as Colistin (Hieu and Tho, 2002).

After 40 days the body weight gain of the probiotics treated cow was significantly higher than the control animal (Zhengao, 2006). Average increase of 1kg per day of milk production was observed in probiotics treated animal. In addition to increase milk production, the Beume Scale also increased 1-2 degrees compared to the control. Dahal (2006) reported that goat body weight gain increased 10% when compare to the control. Body weight gain in pig was not significantly noticed. However, Zhengao's studies has shown that probiotics treated swine gained 38.5% more body weight than the control within 67 days of treatment, while ratio of forge/pork decreased by 2.8%.



Ammonia is not the only contributor to odor in agricultural applications. Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) also cause an increase in odor. BOD and COD are often seen as problem in the wastewater industry, where the primary purpose is to remove the suspended and soluble organic constituents measured as COD and BOD, as well as reduce fecal coliform.

Studies were conducted to determine the effect of probiotics technology for wastewater treatment around the world (Wood et al., 2004, Sun et al., 2006). In essence, studies indicated reductions in BOD, COD, pathogens and total coliforms in wastewater treated with probiotics solution. Wood et al. (2004) applied probiotics solution at a rate of 1:10,000 to the wastewater. Foul odors and total coliform were reduced significantly when wastewater was treated with EM solution. Average sulfide removal as well as sulfates removal were significantly increased by 70% and 110% (Wood et al., 2004). In addition, probiotics treatment significantly decreased ammonia in the water at the plant influent from an average of 1244 mg/l to 194 mg/l and at the plant effluent from 614 mg/l to 214 mg/l. Average fecal coliforms removal at the plant was significantly increased by 3 times after treatment with probiotics (Wood et al., 2004). Similar results have been shown in recent studies carried out in a sewer system of the city of Cartagena (Correa, 2008)

Sun et al. (2006) studied swine waste management using probiotics technology. Two by three latin square experimental design was used for the experiment with two different seasons as seasonal effects. Comparing to control, BOD and COD content were significantly decreased when probiotics solution at different dilution, including 1:1000, 1:5,000 and 1:10,000 were used (Sun et al., 2006). Consistent outcome was found with nitrogen and phosphorus content. Best result was obtained when probiotics solution was used in conjunction with sediment screening and aerobic pretreatment. The reduction of BOD, COD, N and P was affected by temperature, particularly cold environment (10-15°C).



### **Microbial Contamination**

A “pathogen” is defined as a biological agent that causes disease or illness to its host. (Wikipedia, 2006). Some harmful pathogens include *Escherichia coli*, which can lead to urinary tract infection and food poisoning. *Salmonella* leads to food poisoning and *Staphylococcus aureus* can lead to toxic shock syndrome (Wikipedia, 2006). *Clostridium perfringens* can also lead to food poisoning. These pathogens are extremely toxic and typically found in foods that are improperly sanitized (Todar, 2002). The above mentioned pathogenic bacterias are included in those routinely tested at SCD. For the past two years, every batch of SCD ProBiotics Food™ produced was sent to a third party laboratory for pathogen screening. The species tested includes; *Escherichia coli*, *Staphylococcus aureus*, *Clostridium perfringens* and *Salmonella*. Throughout the past two years of testing, the incidence of pathogenic activity among each species has been negative. The table below shows an average of the results (n=16).

**Table 1: Results of Microbial Testing - Pathogen Screening**

<b>TEST</b>	<b>APC</b>	<b>AnPC</b>	<b>LAB</b>	<b>Yeast</b>	<b>Mold</b>	<b><i>C.perfringens</i></b>	<b><i>Salmonella</i></b>	<b><i>S. aureus</i></b>	<b><i>E.coli</i> 0157:H7</b>
<b>AVERAGE</b>	1.08x10 <sup>8</sup>	1.32x10 <sup>8</sup>	1.17x10 <sup>8</sup>	4.62x10 <sup>5</sup>	<10	ND	ND	ND	ND

APC = Aerobic Plate Count

AnPC = Aerobic Plate Count

LAB = Lactic Acid Bacteria

All numbers are recorded in units of cfu/ml.

### **Physical and Chemical Contaminations**

When tested for heavy metals, SCD ProBiotics Food™ has shown levels below 10 parts per million (ppm) for the past two years. The heavy metals tested include; arsenic, cadmium, iron, lead, mercury and nickel. Lead and mercury have been shown to cause multiple health problems when ingested in drinking water, foods that have not been properly cleaned and even from houses with lead-based paint. People are typically exposed to mercury from vapors due



to a spill or break in elemental mercury that results from warm, un-ventilated spaces (Environmental Protection Agency, 2006). SCD conducted a nutritional analysis test to verify that SCD ProBiotics Food™ is suitable for commercializing as dietary supplement and the results are shown in the table below.

**Table 2:**  
**Test Results of SCD ProBiotics Food™ for Heavy Metals And Nutritional Analysis**

Test	Average for all samples taken	Units
Arsenic	<10	Ppm
Cadmium	<10	Ppm
Iron	<10	ppm
Lead	<10	Ppm
Mercury	<10	ppm
Nickel	<10	Ppm
Protein – Combustion	0.13	%
Fiber, Dietary, Total	0.2	g/100g
Carbohydrates, Calculated	3.2	g/100g
Calories, Calculated	13.3	Calories/100g
Sugars (Fructose, Glucose, Sucrose, Maltose, Lactose)	<2.0	%
Saturated Fatty Acids	<0.01	g/100g
Total Fat	0.02	g/100g
Calcium	48	mg/100g
Iron	1.6	mg/100g
Sodium	120	mg/100g
Cholesterol	<1.0	mg/100g
Beta Carotene	<44	IU/100g
Total Vitamin A	<44	IU/100g
Vitamin C	<0.44	mg/100g

Wikipedia (2006), defines “mycotoxin” as a toxin produced by a fungus under specific conditions of moisture and temperature. Mycotoxins can result in obvious problems making people and animals sick. Mycotoxins are structurally diverse secondary metabolites of fungi that grow on a variety of feeds and foods consumed by animals and man, respectively. Most of



the research has been conducted on aflatoxins, ochratoxins, T-2 toxin, deoxynivalenol (DON), trichothecenes, fumonisins and zearalenone. Mycotoxins exhibit many different biological effects in the animal and man. They can be carcinogenic, teratogenic, genotoxic, hepatotoxic, nephrotoxic, haematotoxic, immunosuppressive, estrogenic, tremorgenic or mutagenic (Dirheimer, 1998). Mycotoxins are usually a result from contaminated feed for animals, which results in contaminated meat for people (Wikipedia, 2006). SCD ProBiotics Food™ has shown results of <2 parts per billion (ppb) mycotoxins.

### **Conclusion**

SCD ProBiotics Food™ has been shown to be safe for use in the environment of animals and other agricultural applications, such as waste treatment. From previous testing over two years, the incidence of pathogenic activity, heavy metals and mycotoxins has been non-detected or zero. Furthermore, SCD ProBiotics Food™ contains beneficial probiotic cultures that have been used for years in foods for humans and animals. The probiotic cultures and Purple Non-Sulfur Bacteria (PNSB) contained in SCD ProBiotics Food™ product are safe and beneficial for animal health. Probiotics have been widely used in dairy product, dietary supplements and incorporated into livestock silage to enhance the intestinal health of the host. PNSB have also been applied as animal feed due to the nutritious property of their biomass, which is rich in high quality protein, vitamin and carotenoids.

### **SCD Probiotics Technology Benefit Analysis**

The successful application of SCD Probiotics Technology is expected to have the following impact on livestock applications

- Reduce mortality in the farm.
- Reduce or eliminate the use of antibiotics
- Control odors in animal housing as well as leachate lagoons.
- Improve the feed conversion ratio
- Reduce sludge accumulation and coliforms in the lagoons.
- Overall reduction in the cost.



**General Protocol for the use of SCD Probiotics in Livestock application:****Poultry:**

SCD Bio Klean™ should be used for over all cleanliness and to prevent contamination of the environment with pathogens. The product is to be diluted 1:20 (5%) with water and all equipments and housing structures are to be washed with this. The same dilution should be sprayed on the bedding and also sprayed on the floor and walls of the animal houses. If the farm employs a misting system it is recommended that SCD Bio Klean™ be added to the water at a dilution of 1:10,000 (0.01%)

SCD Bio Livestock® should be added to the drinking water provided to the animals at a dilution rate of 1:500 (0.2%). This can be done from early stages of the animal

SCD Bio Livestock®, molasses and commercial feed should be mixed at 1:1:20 ratio and fermented for approximately 10 days at normal room temperature. This fermented is then incorporated with commercial feed at 4% and fed to the animals. SCD Bio Klean™ should be used for treating waste generated in the farm. The protocols will vary depending on the farm conditions. Ask an SCD representative for protocols.

\*SCD Probiotics is not affiliated with, sponsored by or endorsed by EM Research Organization, Inc. or their affiliates.



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