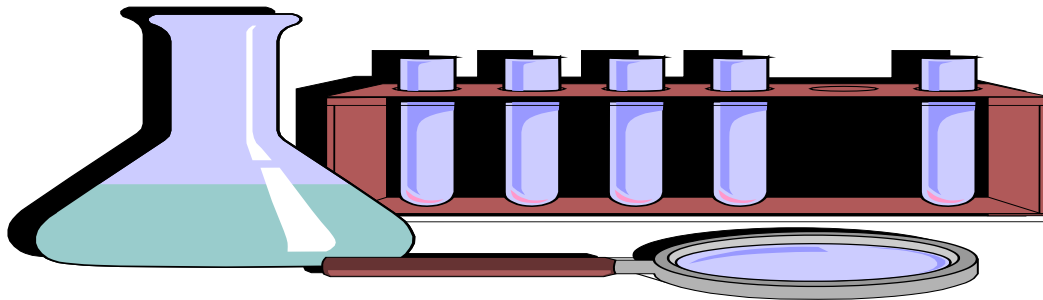


WELCOME TO: ULTRA BIO-LOGICS INC.

Yucca Extracts For Beverage Cosmetics Food and Animal Feed Applications



Internet Web Site: www.ublcorp.com

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BioSol YS-30S Pure Soluble Powdered Yucca Schidigera BioSol YS-50LC Pure Yucca Schidigera Liquid Concentrate

New Low Temperature Spray Dried Completely Water Soluble

Uses: Animal feed manufacturers, feed premixes, supplements, dietary supplement manufacturers, cosmetics, shampoo's, food and beverage applications

Now Available in Human Food and Animal Feed Grade

Contain No Inert Fillers or Chemical Preservatives

For many years, research has shown that natural saponins can effectively reduce and control ammonia and odor. Bio-Logics recognizes the need for a high-quality, long storage stable, water soluble, low-cost natural saponin product line.

Introducing: BioSol YS-30S

BioSol YS-30S is available in a wide range of liquids and soluble powders for use in the Agribusiness, Food and Beverage sectors.

BioSol-Yucca products are extracted from the only FDA approved Yucca, found in the southwest United States and Baja, Mexico.

We work closely with local groups in both regions to ensure a continuous stable supply while maintaining a healthy replanting environment for future generations

Packaging BioSol-YS-30S: 25 kg lined kegs / 55 pounds

Packaging For YS-50LC Liquid Concentrates: 20 Liter and 210 Liter drums

Status FDA USA : Yucca Schidigera FDA - U.S Food and Drug Administration as a natural food adjuvant under Title 21 CFR 172.510 and FEMA number 3121

Status CFIA Canada Feeds: Yucca Schidigera - Yucca Schidigera Dehydrated Pulp /Pulpe D shhydrat e CFIA = Schedule IV - Part I Class 1.24 ACIA = Annexe IV- Partie I Cat gorie 1.24

BioLogics BioSol YS-30S Pure Soluble Powdered Yucca

BioLogics YS-30S is a natural feed additive for livestock and poultry used to control odors, ammonia and other gas emissions, which can be detrimental to livestock performance.

BioLogics YS-30S is made with 100% natural Yucca schidigera from Puebla Mexico.

It is air dried, produced by mechanical methods and contains all of the general food solids composition common to this Yucca species.

BioLogics YS-30S is manufactured with the highest quality standards and has all the saponins and glyco components of the yucca schidigera plant.

SPECIFICATIONS

Contents Yucca schidigera powder

Appearance Light beige free flowing soluble powder..

As the product is natural, its appearance may vary slightly from batch to batch

Toxicity Non toxic

Shelf life Min. 2 years at room temperature

Heat stability Excellent

pH stability Excellent

Packaging 25 Kilo cartons

TYPICAL AVERAGE ANALYSIS

Moisture..... 5.88%

Crude protein5.46%

Crude fat0.69%

Crude fiber24.10%

Ash7.59%

Water Solubility Complete

Carbohydrates (min of 30% yucca solids and saponins) 56.38%

Free flowing soluble powder - BioLogics YS-30S is a free flowing completely water soluble powder, thereby enabling feed manufacturers to fully utilize computer based automatic dosage systems including spray dry application systems.

Synergy - Research indicates that there is an additional benefit from inclusion of *Yucca schidigera* extract in feeds, specifically, the animal's weight gain and feed utilization.

Gas reduction - BioLogics YS-30S reduces ammonia and other irritant gases in confined buildings, this creates healthier living conditions, including lower stress levels, helping to improve feed utilization and growth rates.

Odor reduction - BioLogics YS-30S reduces waste odor, creating a better environment for animals, employees, visitors and neighbors.

Sludge - BioLogics YS-30S improves the handling characteristics of sludge, making it easier to pump and/or spread.

Economical - BioLogics YS-30S is one of the most cost-effective products to add for improved performance, allowing producers to maximize returns.

USAGE LEVELS IN ANIMAL FEED

POULTRY

Broilers 100-200 g/ton

Turkeys 100-200

Layers 100- 150



SWINE

Nursing sows 120 g/ton

Starters 120

Growers 100

Finishers 60



CATTLE

Beef 400-800 mg/hd/day

Dairy 800 mg/hd/day



PET Foods

175g / ton



MATERIAL SAFETY DATA SHEET

Section 1 - Product Description

Product name BioLogics YS-30S

Chemical name None

Reference U.S. Code of Federal Regulations, 21 CFR 172.510

Section 2 - Physical Data

Boiling point NA

Density 550-650 gr/Lt

% Volatiles (volume) 0

Water solubility Complete

Odor/color Fine tan or light brown powder, negligible odor

Vapor pressure NA

Vapor density NA

pH (10% AQ solution) 4.0 +/- 0.2

Section 3 - Ingredients Pulverized Yucca Schidigera

Section 4 - Fire and Explosion Data

Flash point NA Extinguishing media H₂O, CO₂

Flammable limits NA Autoignition temperature NA

Cloud ignition temperature Not established

Special Firefighting Procedures Treat as a class A fire; use water, spray or fog in dusty areas Unusual Fire and Explosion Hazard All equipment should be dust tight; yucca powder may be explosive at high airborne concentrations

Section 5 - Reactivity Data This product represents no significant reactivity hazard. It is stable and will not react violently with water. Hazardous polymerization will not occur. There are no specific conditions to avoid.

Section 6 - Health Hazard Information Nuisance dust except as indicated below

Threshold Limit Value (TLV) Yucca schidigera extract, concentrated, 30 Brix
Osha permissible exposure limit (PEL) None

Short term exposure limit (STEL) Not established

Signs and symptoms of exposure Overexposure may irritate eyes, throat and lungs

Continued overexposure may lead to sensitivity. Pre-existing allergic sensitivity may be aggravated by continued overexposure.

Section 7 - Emergency and First Aid Procedures

Eye (contact) Flush with water on exposed areas. Seek immediate attention for the eyes

Skin (contact) Remove contaminated clothing. Wash affected area with water. If irritation occurs seek medical advice.

Ingestion (swallowing) In the advent of accidental ingestion, rinse mouth with water. Obtain medical advice.

Section 8 - Spill or Leak Procedures

Steps to be taken if material is released or spilled Small spills can be removed by vacuum cleaning; avoid use of compressed air to blow off dust or spills Remove larger spills with pan using gentle brushing technique.

Steps to be taken for waste disposal Incineration or sanitary landfill in accordance to local, state and federal regulations.

Section 9 - Special Protection Information

Respiratory protection Use NIOSH approved respirator

Ventilation USE local exhaust

Protective glove Not required

Eye protection Use chemical goggles

Other protective equipment None

BioSol YS-50LC



Pure Yucca Schidigera Liquid Concentrate

Food Beverage Feed and Fertilizer Manufacturers Ingredient

Uses: YS-50LC Yucca Schidigera Liquid Concentrate can be used to prepare natural shampoos cosmetics or liquid soaps. Natural fruit & vegetable washing soaps are a new application. Yucca's natural antibacterial and antiviral properties have also been utilized in new products. In the beverage industry, **YS-50LC** is used to prepare root beer, slush products, frozen carbonated beverages, foamy cocktail mixes, beer, juice and wine coolers. It is especially useful for maintaining natural foaming in low alcohol and non -alcohol root beers. **YS-50LC** is also used as an ingredient in formulating biological chelating agents for use in chemical and organic fertilizers to increase availability and biological activity.

Yucca has long been used by the health foods industry in the America's as a healthy nutrient supplement product. It is pressed into tablets or it is mixed with water and alcohol to produce liquid tincture type products. These health food products are sold as premium healthful supplements. Yucca is also used in animal feeds for the reduction of waste odors and for increasing the absorption of nutrients, protection from protozoal diseases in feeds.

TYPICAL DATA

DESCRIPTION: pure, cold pressed natural yucca extract of the (*Yucca schidigera*)

CONCENTRATION: 50 Brix \pm 0.5 @ 20° C

INGREDIENTS: 99.92% Yucca schidigera extract

SAPONINS: 52%

APPEARANCE: Thick Brown Pourable liquid.

DENSITY: 10.8 lbs per gallon

pH: 3.8 \pm 0.2

PACKAGING: 20 and 210 Liter plastic drums with a guaranteed shelf life of two years when stored at 5 – 25° C.

Note: As a natural extract there may be some slight settling of insoluble solids found over time in the bottom of the drums. Simple mixing prior to use re-stabilizes the concentrate.

BioSol YS-50LC Pure Liquid Yucca Sarsaponin Concentrate

The principal components of **Yucca Sarsaponin** which are primarily responsible for Yucca Sarsaponin's superior surfactant qualities and bioactivity, are substances known as saponins.

WHAT ARE SAPONINS?

Saponins are sapogenin glycosides. Sapogenin glycosides are substances widely distributed throughout the plant kingdom. Each saponin consists of a sapogenin which constitutes the a glucon moiety of the molecule, and a simple sugar. The sapogenins found in Yucca Sarsaponin which make up the saponin content are steroidal in nature and are comprised of the following:

Sarsapogenin - Smilagenin - Markogenin - Samogenin - Gitogenin - Neogitogenin

The most dominant of the sapogenins found in Yucca Sarsaponin is Sarsapogenin. Sarsapogenin is composed of Carbon (77.83%), Hydrogen (10.65%), and Oxygen (11.52%).

YUCCA SCHIDIGERA & ITS STEROID SAPONIN

Research showing the presence of steroid saponins in the plant kingdom and their significance to plant growth was reported by two Frenchman over fifty years ago. (Ref.1) As steroid drugs were being developed, a massive screening effort for precursors of sex and cortical hormones was undertaken. The work was done at the Eastern Regional Research Laboratory of the U.S. Department of Agriculture. (Ref.2) This study showed that there were several families in the plant kingdom having a relatively high steroid saponin content, with the hydroxyl and carbonyl groups positioned for optimum activity. Included in this list was the Yucca genera.

Yucca schidigera and its water-soluble extract (steroid saponin) have had a long history of safe use as a food material for both humans and livestock. In 1965 it was approved for use in human food without restriction (21 CFR 172.510). This action was taken independently by the U.S. Food and Drug Administration and not as the result of an industry petition. (Ref.3) Yucca *schidigera* extract is now the most widely used natural foaming agent in the U.S. soft drink beverage industry.

NATURAL SURFACTANT

Saponins are by definition surface active. The word saponin comes from the Latin *sapo*, meaning soap. The *Merck Index* states..... "All saponins foam strongly when shaken with water. They form oil-in-water emulsions and act as protective colloids".

A recent magazine article explains that there arc very few natural alternatives to chemical surfactants such as sodium lauryl sulfate. Yet coming into use are naturally derived saponin containing products that compare favorably with SLS. Traditionally these natural surfactants have been quite expensive and some, toxic in nature. (Ref.4) Today however, the cosmetic formulary chemist who wants to produce a "sulfate free shampoo" can now contemplate using Yucca Sarsaponin as a replacement for SLS.

In a comparative foam test using the Ross-Miles method, sodium lauryl sulfate initially foams more, but the foam stability after 20 minutes is clearly much greater with Yucca Sarsaponin. The subjective quality of the foam is a notable feature, which cannot be measured by mechanical foam measurement techniques. However, evidenced by its almost exclusive use as the foaming agent in root beers, Yucca Sarsaponin produces a rich, dense frothy foam that is unsurpassed by any other materials. (Ref.5) This is in marked contrast to the loose, airy foams, which are typical of anionic surfactants.

Yucca Sarsaponin is also much less irritating than sodium lauryl sulfate. A Chorioallantoic Membrane Vascular Assay comparing the two products was conducted and the test results classified Yucca Sarsaponin as a non-irritant and SLS as an irritant. (Ref.6) In fact, Yucca Sarsaponinis so mild that at a 20% usage level in shampoos, it has "no tears" properties.

With its light color and pleasant odor, Yucca Sarsaponin is quite compatible in most formulations. Its functionality is maintained at all pH levels from 2 - 10. It is completely water-soluble and the low viscosity facilitates the handling of Yucca Sarsaponin, yet it responds well to traditional viscosity-building techniques in formulations. At lower temperatures, unlike other surfactant solutions, Yucca Sarsaponin does not become opaque nor more viscous.

In terms of compatibility with other ingredients, Yucca Sarsaponin offers no surprises. It exhibits excellent physical compatibility with an ionic, amphoteric, and other non-ionic surfactants. By blending it with any of these other surfactants it will result in a significant increase in the foam density and richness. The characteristic silky feel of Yucca Sarsaponin lather is also imparted to surfactant blends.

Being that Yucca Sarsaponin is classified as a food grade material, it is of course non-toxic and highly biodegradable. One could even say that it is more than just biodegradable. An extract from Yucca *schidigera* is currently being used in Japan in the wastewater streams of food processing plants. At only 4 ppm it functions as a stimulant to the microorganisms to enhance biological breakdown of solids. (Ref. 7 & 8)

When the "naturalness", physical, safety, biodegradation and performance properties of Yucca Sarsaponin are added up, it becomes obvious that it is ideal for use in systems when the performance properties of high foaming, mildness and silky feel are important. It is truly a formulary chemist's delight to work with!

NATURAL WETTING & DISPERSING AGENT

As a natural surfactant, Yucca Sarsaponin also acts as strong wetting and dispersing agent. Some unique applications of these properties have been suggested in a trade publication. (Ref.9)The use of Yucca Sarsaponin in these formulations is demonstrated by the following examples. As a natural wetting agent, Yucca Sarsaponin could be used as a bleaching and dyeing assistant in hair dyes. An extract from Yucca *schidigera* has in fact been patented in Japan for its use as a bleaching aid in the recycling of waste paper. (Ref. 10)

Yucca Sarsaponin has also been proven to be a very strong natural dispersing agent. This unique functionality of saponins is clearly demonstrated in a recent U.S. patent. In it saponins are used to replace chemical surfactants and protective colloids in the aqueous dispersion of pigments, waxes, triglycerides, polymers, and many other materials. (Ref. 11) A possible application for Yucca Sarsaponin in cosmetics would be as a natural pigment-dispersing agent in liquid face makeup.

In any bubble bath or bath oil product Yucca Sarsaponin should be incorporated into the formulation to disperse lime soap curd. Interestingly, one of the first commercial applications for Yucca *schidigera* extract was in swimming pools as a natural clarifying and dispersing agent specifically used to eliminate the calcium ring on pool tiles and decking.

The Japanese utilize a Yucca schidigera product in a toilet basin product to eliminate malodors and toilet bowl ring. (Ref. 12) Still another saponin-based product in Japan is used as a bathing agent and natural detergent and is claimed to act as a skin "soothing agent". (Ref. 13)

NATURAL EMULSIFIER

As defined previously, saponins form oil-in-water emulsions. Their potential use as a natural emulsifier in cosmetic systems is demonstrated in the following patents:

- ➔ An oil-in-water type emulsion using only saponins as the emulsifying agent (Ref. 14)
- ➔ To provide a transparent water-soluble preparation of vitamin E by using saponin (Ref. 15)
- ➔ To prevent the formation of precipitate in a high protein liquid composition by using saponin (Ref. 16)

NATURAL PRESERVATIVE

"Saponins are generally good antifungal and anti-bacterial agents." (Ref. 17) Another author reports, "Many saponins exhibit significant fungi toxic activity under experimental conditions..." (Ref. 18) Several recent patents and research papers originating in Japan citing the saponins found in *Yucca schidigera* extract would indicate that Yucca Sarsaponin exhibits both bacteriostatic and fungistatic activity.

In the Japanese patent it states, "Yucca's antibacterial action is significantly better than that of conventional natural antibacterial agents and equal to that of chemically synthesized antibacterial agents. It is a potential alternative to such synthetic agents". (Ref.19) The effective pH range of this activity was 3-9 at a temperature range of 0-40° C. The Japanese research performed with a Yucca extract (Foamation 50) showed it to be effective against various strains of Bacillus and Pseudomonas, and yeast and mould species such as Aspergillus, Penicillium, and Saccharomyces. (Ref.20)

Several other patents demonstrate how saponin containing materials are effective as water-soluble preservatives (Ref.21) and also as anti-oxidants. (Ref.22)

Several features of Yucca Sarsaponin therefore make it ideally suitable as a natural preservative in cosmetic formulations:

- ➔ **Food grade, non-toxic & non-irritant**
- ➔ **Provides functionality to the formulation**
- ➔ **Water soluble at all pH ranges**
- ➔ **Active against a range of yeast, mold, and bacteria**
- ➔ **Active at a wide pH range**

BIG-ACTIVITY

There are literally hundreds of saponin based botanicals that have been used for centuries by the indigenous people throughout the world. Bio-active saponin plants have been harvested for their many different medicinal uses and topical skin applications. There is a plethora of research papers, patents, and literature citing many of these uses. The following excerpts from literature are not intended to be an exhaustive summary of the published data, but rather a brief overview showing the kinds of data that have been generated dealing with saponins in topical applications.

An extract from Yucca Glauca was widely used in the Southwest to treat bumps and mild abrasions. "It is an anti-inflammatory and reduces erythema up to 50% when applied prior to UV light, and up to 85% when applied afterwards." (Ref.23)

Yucca Glauca.... "was therefore tested for cell renewal, fibroblast proliferation, and anti-irritancy and was found to be effective in each case". (Ref.24)

A recent French patent on the use of saponins from Prunella extract for topical use claims to have anti-inflammatory, anti-aging, anti-radical properties, and also to regulate the regeneration and differentiation of keratinocytes. (Ref.25)

In a Japanese patent assigned to Shiseido Cosmetic Co., a product consisting of saponins and other materials as an external medicine for dermal treatment is claimed to treat rough skin and to prevent skin aging. (Ref.26)

Another French patent using saponins for the topical treatment of the scalp, claims to renew the epidermis, stimulate hair regrowth, delay hair loss, and counter the effects of ageing on the skin and hair. (Ref.27)

The inhibition of urease and the binding of ammonia by *Yucca schidigera* is very well documented in several research papers. (Ref.28 & 29) This activity of Yucca Sarsaponin could be exploited for its use in a natural body deodorant as explained in a recent magazine article.... "Sudorific glands produce urea at skin level. The commensal flora, useful bacteria normally present on skin, excretes the urease enzyme, which degrades urea into ammonia. This affects the pH and increases skin permeability, leaving it more open to irritation and the formation of odors, particularly in the armpits and skin folds where the sudorific glands are more prevalent." (Ref.30) A similar application of *Yucca schidigera* in personal care products to decrease malodors is also claimed in a Japanese patent. (Ref.31)

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REGULATORY: Mohave Yucca (*Yucca schidigera*) is approved for use in food and beverages by the FDA under CFR 172.510, FEMA number 3121. Allowed for use in organic production under 7 U.S.C 605 and N.O.P. 205.602, EU# 88/388. Exempt from the requirement of a tolerance as specified in 40 CFR 180.1001

ADVANTAGES

Research in several universities, in addition to many successful trials and studies that have been conducted on farms worldwide, show that the use of *Yucca schidigera* extract in animal feed improves the health conditions of turkeys, broilers, layers, swine, cattle, horses and pets by reducing the emission of odor and ammonia.



Educational Information / Research Ref. Yucca

Saponins: Surprising benefits of desert plants

Peter R. Cheeke, Ph.D. Professor of Comparative Nutrition OSU/LPI Affiliate Investigator

Saponins are natural detergents found in many plants, especially certain desert plants. Saponins are also present in small amounts in some foods, such as soybeans and peas. The two major commercial sources of saponins are *Yucca schidigera*, which grows in the arid Mexican desert country of Baja California, and *Quillaja saponaria* (soapbark tree), found in arid areas of Chile. Saponins have detergent or surfactant properties because they contain both water-soluble and fat-soluble components. They consist of a fat-soluble nucleus, having either a steroid or triterpenoid structure, with one or more side chains of water-soluble carbohydrates (sugars). *Yucca* saponins have a steroid nucleus (steroidal saponins), while the *quillaja* saponins have a triterpenoid nucleus. As a consequence of their surface-active properties, saponins are excellent foaming agents, forming very stable foams. *Yucca* and *quillaja* extracts are used in beverages, such as root beer and slurpies, to provide the foamy "head." Because of their surfactant properties, they are used industrially in mining and ore separation, in preparation of emulsions for photographic films, and extensively in cosmetics, such as lipstick and shampoo. *Quillaja* bark has been used as a shampoo in Chile for hundreds of years, and Native Americans used *yucca* to make soap. The antifungal and antibacterial properties of saponins are important in cosmetic applications, in addition to their emollient effects.

Mature desert Yucca *Yucca* and *quillaja* saponins have both current and potential applications in animal and human nutrition. *Yucca* extracts are extensively used for ammonia and odor control in pig and poultry-raising facilities and in dog and cat foods. *Yucca* saponins, and perhaps other components of *yucca* as well, have ammonia-binding activity. When added to the diet, *yucca* saponins pass through the digestive tract unabsorbed and are excreted in the feces. In the excreta, the *yucca* components bind to ammonia and certain other odiferous compounds and prevent them from being released into the air. In recent studies in England, feeding of *yucca* extract to dogs and cats was shown to reduce fecal odor and reduce emission of volatile compounds contributing to fecal odor. Many pet foods and "kitty litter" products now contain *yucca* extract to reduce these noxious odors.

New applications for saponins in animal husbandry are being explored, especially the effect of saponins on protozoal diseases. Saponins form strong insoluble complexes with cholesterol. This has many important implications, including cholesterol-lowering activity in humans, discussed later in this article. Many protozoa enter the body via the digestive tract or cause their pathological effects in the gut. Saponins react with cholesterol in the protozoal cell membrane, causing the cell to rupture and lyse. Giardiasis (beaver fever), for example, is a disease with symptoms of severe diarrhea associated with the protozoan *Giardia lamblia*, often found in untreated drinking water, that can infect the small intestine.

Research currently in progress at Agriculture Canada in Lethbridge, Alberta, has shown yucca extract to be very effective in killing *Giardia* trophozoites, which are the infective stages released in the gut when the oocytes, or eggs, sporulate, although no studies with humans have yet been done. Other important protozoal diseases of livestock, including coccidiosis and equine protozoal myoencephalitis, may be amenable to treatment with saponins. Ruminant animals (cattle, sheep and other cud-chewing animals with a complex stomach) have a large population of rumen protozoa. The rumen protozoa reduce the efficiency of fermentation in the rumen, and increases in animal performance often occur when the protozoa are removed (a process called defaunation). Yucca saponins are effective in suppressing rumen protozoa, again by reacting with cholesterol in the protozoal cell membrane, causing it to lyse.

The blood cholesterol-lowering properties of dietary saponins are of particular interest in human nutrition. One of the most prominent research programs on this subject was that of Dr. Rene Malinow at the Oregon Regional Primate Center, whose research (published in the American Journal of Clinical Nutrition in 1997) demonstrated unequivocally the cholesterol-lowering properties of saponins. This desirable effect is achieved by the binding of bile acids and cholesterol by saponins. Bile acids form mixed micelles (molecular aggregates) with cholesterol, facilitating its absorption. Cholesterol is continually secreted into the intestine via the bile, with much of it subsequently reabsorbed. Saponins cause a depletion of body cholesterol by preventing its reabsorption, thus increasing its excretion, in much the same way as other cholesterol-lowering drugs, such as cholestyramine.

Although there are reports of the development of synthetic saponins as drugs for treating high blood cholesterol, yucca and extracts are natural phytochemicals currently used in foods and beverages and as herbal products. Interestingly, recent research by scientists in Canada and Africa has suggested that the very low serum cholesterol levels of Masai tribes people in East Africa, who consume a diet very high in animal products, cholesterol, and saturated fat, are likely due to the consumption of saponin-rich herbs.

Masai village in East Africa. The binding of bile acids by saponins has other important implications. Bile acids excreted in the bile are called primary bile acids. They are metabolized by bacteria in the colon, producing secondary bile acids. Some of the secondary bile acids are promoters of colon cancer. By binding to primary bile acids, saponins reduce the formation of the secondary bile acids.

Research at the University of Toronto has shown that feeding saponins to laboratory animals reduced the number of preneoplastic colon lesions in mice. The Canadian researchers also found that saponins had a dose-dependent inhibitory effect on growth of human carcinoma cells in culture. Major current interest in quillaja saponins concerns their effects on the immune system.

Specially purified saponin fractions designated as Quil A are used as adjuvants for vaccines. (Adjuvants are substances that increase the effectiveness of vaccines.) Quillaja saponins increase the effectiveness of both injected and oral vaccines. In the case of injected vaccines, Quil A is used to prepare immunostimulating complexes (ISCOM). ISCOM's are prepared by attaching a portion of the protein envelope of a virus to Quil A. The association of the viral protein with saponin facilitates its transport across cell membranes. Quillaja saponin-based ISCOM's are presently being evaluated in development of experimental vaccines against HIV, the virus responsible for AIDS. Besides having adjuvant activity, quillaja saponins have a direct stimulatory effect on the immune system. For example, pretreatment of mice with quillaja saponins enhances their resistance to a disease challenge. Saponins enhance the effectiveness of oral vaccines by improving their absorption as a result of increasing gut mucosal permeability, which facilitates absorption of large molecules contained in vaccines.

The desert plants Yucca schidigera and Quillaja saponaria are rich storehouses of phytochemicals with many useful and important functions in human and animal nutrition. In many respects, we have just scratched the surface in our understanding of the many biological effects of steroidal and triterpenoid saponins and their potentials for improving human health.

Yucca Plant Saponin in the Treatment of Hypertension and Hypercholesterolemia. With D.H. Harris, M.D. and Tom Laga, Ph. D. Journal of Applied Nutrition. Vol. 30, No. 3 & 4, 1978.

Yucca contains natural steroidal-like saponins that are effective anti-inflammatories and anti-spasmodics which are known to reduce pain associated with arthritis.

Yucca schidigera has been used for years by the Southwestern Indians for pain and inflammation caused by arthritis and rheumatism. It is also said to reduce joint inflammation and has been used with success for allergies and to strengthen the immune system.

Rheumatoid Disease, Has One Investigator Found its Cause and Cure? Modern Medicine: 38-47, February 15, 1976

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Relieves Osteoarthritis

Rheumatoid Arthritis

Gout

Bursitis

Restores Joint Mobility Pain

Prevents Crippling and Deformity

New and Effective Approaches to the Prevention and Treatment of Arthritis. Journal of Applied Nutrition, Vol. 28, Winter 1976.

Arthritis News Today. A monthly newsletter for patients who have arthritis and for their physicians. 1979-1982. **Fight Back Against Arthritis. Book - In press. 1982.**

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