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SILYMARIN

"Silymarin: A Comprehensive Review of Its Pharmacological Properties, Therapeutic Potential, and Applications in Nutraceuticals,Herbal & Pharmacological Medicine"

- **PRODUCT NAME : SILYMARIN**
- **Source: Silybum Marianum**
- **CAS No : 22888-70-6**
- **Molecular Formula: C25H22O10**
- **Molecular Weight: 482.46 g/mol**
- **Purity: >=98%**
- **Type of Compound: Flavonoids,Silybin**
- **Solvent: Chloroform, Dichloromethane, Ethyl Acetate, DMSO, Acetone, etc.**

INTRODUCTION

Carduus marianus, Silybum marianum, or Milk Thistle is an edible Mediterranean herbal with a very long history as medicinal plant. Probably, the currently employed standardized milk thistle extracts made from the fruits contain 30–65 % silymarin as active ingredient. Silymarin is a complex mixture of polyphenolic molecules, including seven closely related flavonolignans, i.e. silibin A, silibin B, isosilibin A, isosilibin B, silichristin, isosilichristin, silidianin and the flavonoid taxifolin, the most effective antioxidant of these molecules. Silymarin administered per os has become a frequently applied therapy for various liver disorders. Silymarin is classified by the WHO Anatomical Therapeutic Chemical (ATC) classification system as liver therapy. Approved indications are described as toxic and inflammatory liver diseases although at low doses it is also recommended for dyspepsia

PHYTOCHEMICAL CONSITUENT

1. Silybin (Silibinin) – The most bioactive flavonolignan, exhibiting hepatoprotective, antioxidant, and anti-inflammatory effects by inhibiting lipid peroxidation and modulating liver enzymes.
2. Isosilybin – A stereoisomer of silybin with anti-fibrotic and cytoprotective properties, inhibiting pro-inflammatory cytokines and oxidative stress.
3. Silychristin – Functions as a strong antioxidant, protecting hepatocytes by reducing oxidative damage and enhancing cellular defense mechanisms.
4. Silydianin – Supports liver protection by stabilizing hepatocyte membranes and promoting detoxification pathways.
5. Taxifolin (Dihydroquercetin) – A flavonoid with potent radical-scavenging activity, enhancing antioxidant defense and reducing inflammation.
6. Polyphenols – Contribute to overall antioxidant activity by neutralizing reactive oxygen species (ROS) and protecting liver cells.

CHEMICAL COMPOSITION & PHARMACOKINETICS OF SILYMARIN:

1. **Chemical Composition**
   - Silibinin (50–70%)
   - Isosilibinin (5%)
   - Silychristin (20%)
   - Silydianin (10%)

2. **Pharmacokinetics**
   - Absorption: Low bioavailability (~23–47%) due to poor solubility; enhanced by Phytosomes, Liposomes, and Nanoparticles.
   - Distribution: Accumulates in liver, intestines, kidneys, lungs, and skin.
   - Metabolism: Undergoes glucuronidation and sulfation in the liver (Phase I & II metabolism).
   - Excretion: 80% via bile, 20% via urine; enterohepatic recycling prolongs effects.
   - Half-life: ~6–8 hours, requiring multiple doses for sustained activity.

SILYMARIN: A SCIENTIFIC INVESTIGATION ACROSS SPECIES

1.Human Studies:

- **Hepatoprotective Effects**: Clinical trials demonstrate that silymarin exerts hepatoprotective activity in liver cirrhosis, hepatitis, and non-alcoholic fatty liver disease (NAFLD) by reducing oxidative stress, modulating inflammatory cytokines, and stabilizing hepatocyte membranes.
- **Antidiabetic Potential**: Research suggests silymarin enhances insulin sensitivity, decreases oxidative stress, and regulates glucose metabolism in diabetic patients.
- **Drug-Induced Liver Injury**: Silymarin has been studied for mitigating hepatotoxicity caused by chemotherapeutic agents, paracetamol, and mycotoxins by scavenging free radicals and upregulating antioxidant enzymes.

2. Livestock Animal Studies:

- **Antioxidant and Hepatic Protection**: In ruminants, silymarin supplementation improves liver enzyme profiles, enhances antioxidant status, and reduces the impact of mycotoxin-induced hepatic damage.
- **Growth and Performance Enhancement**: Studies in pigs indicate that dietary silymarin supplementation improves growth performance, feed conversion ratio (FCR), and immune function while modulating liver detoxification pathways.

3. Poultry Studies

- **Hepatoprotective Role**: Silymarin protects against mycotoxin-induced hepatotoxicity in broilers by stabilizing hepatocyte membranes and enhancing glutathione peroxidase activity.
- **Immunomodulation**: Silymarin enhances immune function in poultry by upregulating cytokines such as IL-4, IFN-γ, and IL-10, leading to improved resistance against infectious diseases.

SILYMARIN FORMULATIONS

1. **Standardized Silymarin Extract (Powder & Capsules):**
- This is the basic form. It contains a measured amount of silymarin, typically standardized to a certain percentage of silybin.
- Powder and capsules are common delivery methods.
- Bioavailability is limited due to poor water solubility.

2. **Silymarin-Phytosome (Enhanced Bioavailability):**
- Silymarin is complexed with phospholipids (like phosphatidylcholine), forming "phytosomes."
- This improves its lipophilicity (fat solubility), enhancing absorption through cell membranes.
- Significantly better bioavailability compared to standard extracts.

3. **Nano-Silymarin (Liposomal & Micellar Formulations):**
- Silymarin is encapsulated in nanoparticles like liposomes (lipid vesicles) or micelles (spherical structures).
- This increases its surface area and enhances solubility, leading to better absorption.
- Nano formulations can also increase targeted delivery.

4. **Silymarin Complex (Blended with Other Actives):**
- Silymarin is combined with other beneficial ingredients (e.g., vitamins, antioxidants, other herbal extracts).
- This aims to create synergistic effects, addressing multiple health concerns simultaneously.
- The other actives are chosen to work in conjunction with the sylmarin.

HEALTH BENEFITS

1. **Liver protection:** Silymarin can help repair liver cells damaged by alcohol and other toxins, and protect new liver cells from being destroyed.
2. **Anti-inflammatory:** Silymarin can reduce inflammation, which is why it's often suggested for people with liver inflammation or hepatitis.
3. **Brain health:** Silymarin may have neuroprotective effects that support brain health. It can reduce damage to brain dopaminergic neurons and increase dopamine levels.
4. **Breast milk production:** Silymarin may boost breast milk production in lactating mothers.
5. **Asthma:** Silymarin may help to reduce inflammation in the airways of people with allergic asthma.
6. **Antioxidant:** Silymarin has antioxidant properties that increase the superoxide dismutase activity within the erythrocytes and lymphocytes.
7. **Anti-neoplastic:** Silymarin has anti-neoplastic effects that include growth inhibition and induction of endothelial cells apoptosis.

APPLICATION

1. **Pharmaceutical Industry**

- **Hepatoprotective Agent:** It is utilized as a key ingredient in medicines that are designed to protect the liver.

2. **Food and Dietary Supplements:**

- **Animal Feed:** In the animal husbandry industry, silymarin is used as a feed additive to improve the liver health of livestock, particularly poultry, and to mitigate the effects of toxins.
- **Nutraceuticals:** Silymarin is a popular ingredient in dietary supplements and nutraceutical products aimed at promoting liver health.It's added to functional foods and beverages for its antioxidant properties.

3. **Cosmetic Industry:**

- **Antioxidant Properties:** Silymarin's antioxidant properties make it valuable in cosmetic formulations, where it's used to protect the skin from oxidative stress and environmental damage.

STABILITY AND EFFICACY

Stability:

- Complex composition aids stability.
- Affected by pH, temperature, light, moisture.
- Formulation is crucial for shelf life.

Efficacy:

- Proven hepatoprotective effects.
- Poor bioavailability is a challenge.
- Variable clinical results, ongoing research.

Bioablability of Silymarin

1.Low water solubility: Limits absorption.
2.Poor oral bioavailability: Small amount reaches bloodstream.
3.First-pass effect: Liver rapidly metabolizes it.
4.Research focuses on: Enhancing absorption via new formulations (liposomes, nanoparticles, phytosomes, SEDDS).