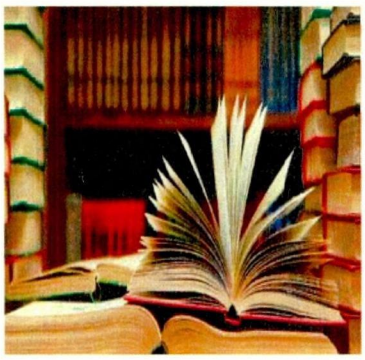


2.0 REVIEW OF LITERATURE

The review of literature pertaining to the present study "**To evaluate the Antioxidant potential, Hepatoprotective and Thrombolytic effect of *Alternanthera sessilis***" is discussed under the following headings:

2.1 IMPORTANCE OF MEDICINAL PLANTS

2.2 PHYTOCHEMICAL CONSTITUENTS

2.3 ANTIOXIDANTS-"A Nature's Unseen Gift"

2.4 FREE RADICALS AND REACTIVE OXYGEN SPECIES

2.5 TRADITIONAL MEDICINE VS MODERN MEDICINE

2.6 HEPATOTOXICITY

2.7 HEPATOPROTECTIVE ACTIVITY OF MEDICINAL PLANTS

2.8 BIOSAFETY SCREENING OF MEDICINAL PLANTS

2.9 THROMBOSIS AND THROMBOLYSIS

3.0 *Alternanthera sessilis*- "A Miracle of the world"

2.1 IMPORTANCE OF MEDICINAL PLANTS

Prehistoric people primarily depend on plants for their survival. In the beginning plant use was restricted to food, medicine and shelter but with the passage of time man explored the potential of plants for a number of other purposes. Hence, their dependency on plants increased both directly and indirectly. In developing countries medicinal plants provide a real alternative for primary healthcare system. According to an estimate between 35,000 and 70,000 plant species are used in folk medicine worldwide .Products from hundreds of species are being collected from remote forests and meadows and traded to international markets and consumed. About 70 to 80% of the world population use traditional medicine for curing their illness and ailments. The percentage of people using traditional medicine decreased in developed countries due to the availability of health facilities (Haq *et al.*, 2011).

In recent years, more attention has been paid to herbaceous medicines and their origin namely medicinal plants mainly due to the proof of the side effects of chemical and the human tendency to use more natural products to maintain their health. Medicinal preparations derived from natural sources, especially from plants, have been in widespread use since time immemorial. In fact, plants remain the main source of medicines for a large proportion of the world's population, particularly in the developing world, despite the advent of the pharmaceutical chemistry during the early twentieth century, which brought with it the ability to synthesize an enormous variety of medicinal drug molecules and allowed the treatment of previously incurable and/or life threatening diseases. There are many thousands of medicinal plants in use throughout the world, with a tremendous range of actions and degrees of potency (Niyaki et al., 2011)

2.2 PHYTOCHEMICAL CONSTITUENTS

The world is rich with natural and unique medicinal plants. Medicinal plants are now getting more attention than ever because they have potential of myriad benefits to society or indeed to all mankind, especially in the line of medicine. The medicinal value of these plants lies in bioactive phytochemical constituents that produce definite physiological action on the human body (Krishnaiah *et al.*, 2009). Phytochemicals are divided into two groups, which are primary and secondary metabolites. Primary metabolite is directly involved in normal growth, development, and reproduction while secondary metabolites are organic compounds that are not directly involved in the normal growth, development, or reproduction of organisms. Secondary metabolites often play an important role in plant defense against herbivory and other interspecies defenses. Primary constituents comprise common sugars, amino acids, proteins and chlorophyll while secondary constituents consists of alkaloids, terpenoids and phenolic compounds (Khatun *et al.*, 2010).

2.3 ANTIOXIDANTS-"A Nature's Unseen Gift"

Antioxidants are micronutrients that have gained importance in recent years due to their ability to neutralize free radicals or their actions (Vadlapudi and Naidu, 2010). Antioxidants also known as free radical scavengers function by offering easy electron targets for free radicals. In absorbing a free radical, antioxidants stabilize the lone free

radical electron and make it stable enough to be transported to an enzyme, which combines two stabilized free radicals together to neutralize. Hence, compounds that inhibit or scavenge the ROS/ RNS are of great interest as possible protective agent to help human body from the oxidative damage (Kuriakose *et al.*, 2010).

Antioxidants have been detected in a number of agricultural and food products including cereals, fruits, vegetables and oil seeds. Antioxidants are increasingly being recommended because they act directly on oxidative processes and may be a method to prevent diseases ad health problems related to aging. Thus, there is a constant search for antioxidant natural resources and isolation of antioxidant biomolecules (Aguirre and Borneo, 2010).

There is nowadays a growing interest in searching natural antioxidants for three main reasons: (i) numerous clinical and epidemiological studies have demonstrated that consumption of fruits and vegetables rich in this type of compounds is associated with reduced risks of developing chronic diseases such as cancer, cardiovascular disorders and diabetes; (ii) safety consideration regarding the potential harmful effects of the chronic consumption of synthetic antioxidants, such as butylhydroxyanisole and butylhydroxytoluene, in foods and beverages; and (iii) the public's perception that natural and dietary antioxidant are safer than synthetic analogues. Therefore, the food industry is making a great effort to find out new sources of safe and inexpensive antioxidants of natural origin (Rehecho *et al.*, 2011).

Natural antioxidants found in plants and animals are capable of counteracting the damaging effects of oxidation in plant and animal tissues. All living organisms contain complex systems of antioxidant enzymes and metabolites, some to combat oxidative damage to cellular components and others to regulate and sustain natural cellular processes such as oxidative phosphorylation and the formation of disulfide bonds. The evolution of aerobic metabolic processes such as respiration and photosynthesis unavoidably led to the production of reactive oxygen species (ROS) in mitochondria, chloroplasts, and peroxisomes (Halliwell and Gutteridge, 2007).

Non-enzymatic antioxidants include the cellular redox buffers ascorbate and glutathione (GSH), as well as α-tocopherol, flavonoids, alkaloids, carotenoids, and proline. Enzymatic ROS scavenging mechanisms in plants include superoxide

dismutase (SOD), ascorbate peroxidase (APX), glutathione reductase (GR), and catalase (CAT). SODs act as the first line of defense against ROS, dismutating superoxide to H_2O_2. The equilibrium between production and scavenging of ROS may be perturbed by a number of adverse environmental factors. External conditions that adversely affect the plants can be biotic, imposed by other organisms, or abiotic, arising from an excess or deficit in the physical or chemical environment (Choudhary *et al.*, 2011)

Increasing the antioxidant intake can prevent diseases and lower the health problems. Research is increasingly showing that antioxidant rich foods, herbs reap health benefits. Foods may possibly enhance antioxidant levels because foods contain a lot of antioxidant substances. Fruits and vegetables are loaded with key antioxidants such as vitamin A, C, E, betacarotene and important minerals, including selenium and zinc. Fruits, vegetables and medicinal herbs are the richest sources of antioxidant compounds. Herbs are staging a comeback and herbal 'renaissance' is happening all over the world. The herbal products today symbolize safety also compatible with human normal physiology (Sen *et al.*, 2010).

PHYTOMEDICINE AS AN ANTIOXIDANT

Recent researches have shown that the antioxidants of plant origin with free-radical scavenging properties could have great importance as therapeutic agents in several diseases caused due to oxidative stress (Ramchoun *et al.*, 2009). Plant extracts and phytoconstituents found effective as radical scavengers and inhibitors of lipid peroxidation (Dash *et al.,* 2007). Many synthetic antioxidant compounds have shown toxic and/or mutagenic effects, which have stimulated the interest of many investigators to search natural antioxidant (Nagulendran *et al.*, 2007).

2.4 FREE RADICALS AND REACTIVE OXYGEN SPECIES

Overall cell health depends on the balance between formation and elimination of free radicals. ROS are associated with incidence of heart diseases, thrombosis, hypertension, Alzheimer's and Parkinson's diseases and cancer over the radical induced DNA double-strand breaks (Mladenovic *et al.*, 2011).

Reactive oxygen species formed *in vivo*, such as superoxide anion, hydroxyl radical and hydrogen peroxide, are highly reactive and potentially damaging transient chemical species. These are continuously produced in the human body, as they are essential for energy supply, detoxification, chemical signaling and immune function. Reactive oxygen species are regulated by endogenous superoxide dismutase, glutathione peroxidase and catalase but due to over production of reactive species, induced by exposure of external oxidant substances or a failure in the defense mechanisms, damage to cell structures, DNA, lipids and proteins (Kumar *et al.*, 2011).

Generation and sources of free radicals

Free radicals can be formed from both endogenous and exogenous substances. They are continuously forming in cell and environment. Different sources of free radicals are as follows:

- UV radiations, X-rays, gamma rays and microwave radiation.
- Metal-catalyzed reactions.
- Oxygen free radicals in the atmosphere considered as pollutants.
- Inflammation initiates neutrophils and macrophages to produce ROS and RNS.
- Neutrophils stimualated by exposure to microbes.
- In mitochondria-catalyzed electron transport reactions, oxygen free radicals are produced as by product.
- ROS formed from several sources like mitochondrial cytochrome oxidase, xanthine oxidases, neutrophils and by lipid peroxidation.
- Burning of organic matter during cooking, forest fires, volcanic activities.
- Industrial effluents, excess chemicals, alcoholic intake, certain drugs, asbestos, certain pesticides and herbicides, some metal ions, fungal toxins and xenobiotics (Valko *et al.*, 2006).

2.5 TRADITIONAL MEDICINE VS MODERN MEDICINE

Most of the drugs used in primitive medicine were obtained from plants and are the earliest and principal natural source of medicines. The plants used as drugs are fairly innocuous and relatively free from toxic effects or were so toxic that lethal effects

were well known. The nature has provided the storehouse of remedies to cure ailments of mankind. There is no doubt that plants are a reservoir of potentially useful chemical compounds which serve as drugs (Sasmal *et al.*, 2007).Medicinal plants are of great importance to the health of individuals and communities; many people in the world have difficulty in gaining access to modern medicine; they use traditional medicine, based on the use of medicinal herbs and plants, as an alternative to a conventional treatment for their recovery (Muanda *et al.*, 2011).

Modern medicines have little to offer for alleviation of hepatic diseases and it is chiefly the plant based preparations which are employed for their treatment of liver disorders. But there are not much drugs available for the treatment of liver disorders (Chaudhari *et al.*, 2009). Inspite of tremendous advances in modern medicine, there are no effective drugs available to stimulate liver function, offer protection to the liver from damage or regenerate hepatic cells. In absence of reliable protective drugs in modern medicine, there exists a challenge for pharmaceutical scientists to explore the potential of hepatoprotective activity in plants on the basis of traditional use (Dubey and Batra, 2008).

Traditional medicinal herbs have served as a potential source of alternative medicine and different healthcare products. Knowledge of herbal medicines has derived from rich traditions of ancient civilizations and scientific heritage. According to WHO, nearly 75-80% of world population still depends on herbal medicines. Active constituents from plant sources directly are used as therapeutic agent and phytoconstituents are also served as lead molecule for the synthesis of various drugs. Folk medicine and their use against diseases in different cultures is a vast traditional knowledge, which is based on the necessities, instinct, observation, trial and error and long experience of ancient/tribal people. Indigenous or herbal medicines confer considerable economic benefits to most rural and poor people. WHO noted that about 25% of modern medicines are descended from plants sources used traditionally and research on traditional medicinal herbal plant leads to discovery of 75% of herbal drug (Sen *et al.*, 2010).

2.6 HEPATOTOXICITY

Liver toxicity mainly occurs due to alcohol, virus and induced by drugs. The first is the alcoholic liver damage which is differentiated by three main histological stages, that is, steatosis (fatty liver), acute alcoholic hepatitis and cirrhosis. Steatosis results from the redox imbalance generated by the metabolism of ethanol to acetate. On the other hand, acute alcoholic hepatitis is characterized by hepatocellular injury with associated inflammation and fibrosis. Both these histological stages can completely be reversed on discontinuation of alcohol. When the use of alcohol is quite intensified, inflammation leads to fibrogenesis and if it worsens cirrhosis may occur. In alcoholic liver disease, oxidative stress is caused by pro-oxidant formation, inadequate intake of antioxidants, antioxidant depletion, and alcohol-mediated inhibition of glutathione synthesis. Alcohol-induced liver diseases are mediated by cytokines, which are secreted by liver and other parts of the body (Negi *et al.*, 2008)

CCl_4 is one of the most commonly used hepatotoxins in the experimental study of the liver damage. Trichloromethyl free radicals and trichloromethyl proxy radicals formed during CCl_4 metabolism are capable of binding to proteins and lipids, thereby initiating lipid peroxidation. This causes peroxidative tissue damage resulting in inflammation, cancer, aging, ulcer and cirrhosis (Joshi *et al.*, 2008).

2.6.1 ETIOLOGICAL FACTORS FOR HEPATOTOXICITY

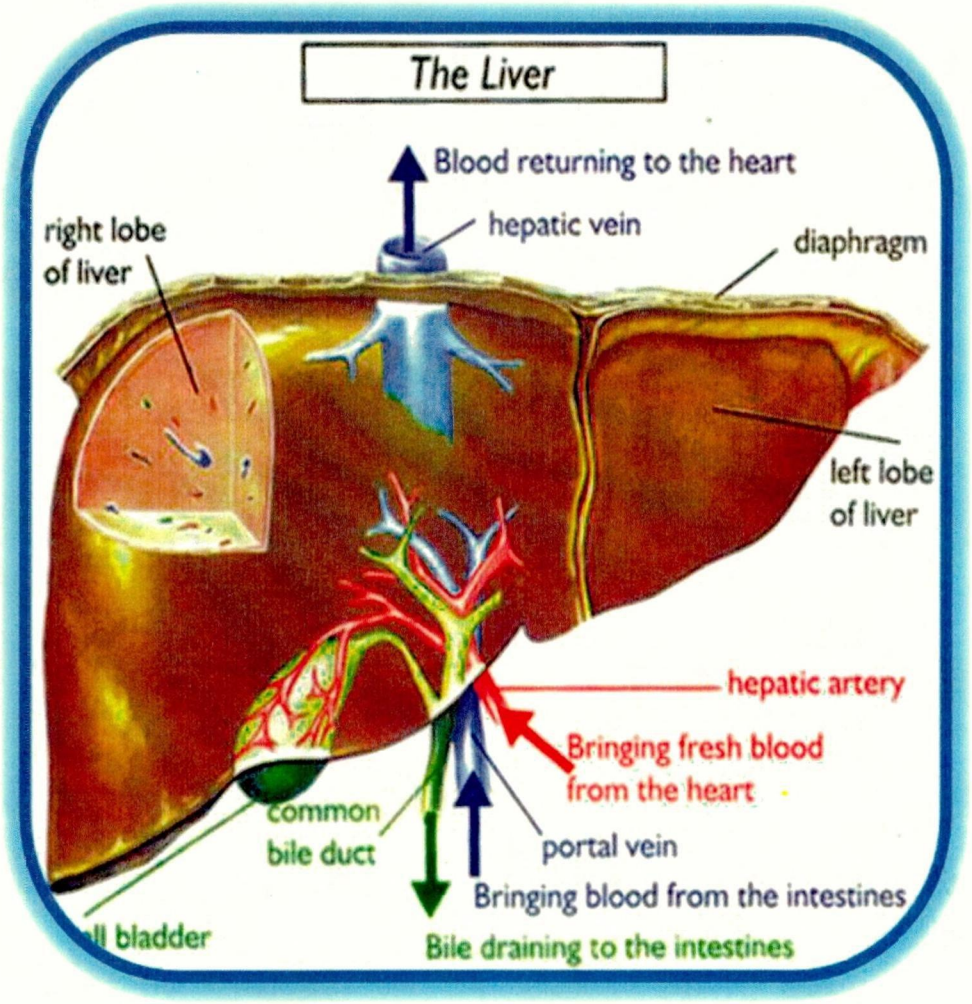
The composition of P450s in gut and liver can have a major influence on the efficacy and toxicity of a drug. (Mohit *et al.*, 2011).Drug interactions occur when two drugs are co administered and both are processed by the same P450.One drug can then inhibit the metabolism of another drug (Lynch and Price, 2007).

Other factors are:-

- Inherited birth imperfections
- Metabolic complaints
- Bacterial infections
- Alcohol or poisoning by toxins
- Certain medications that is toxic to the liver
- Nutritional paucities

FIGURE I

ANATOMY OF THE LIVER



2.6.2 HEPATOTOXIC AGENTS

CCl_4 Induced hepatotoxicity: Carbon tetrachloride (CCl_4) induced liver damage has been lengthily used as an experimental model. CCl_4 is used as a model drug for the study of hepatotoxicity in acute and chronic failure. CCl_3 is metabolized by CYP2E1, CYP2B and possibly CYP3A, to form the trichloromethyl radical, CCl_3.This CCl_3 can also bind to cellular molecules damaging crucial cellular progressions. This radical can also react with oxygen to form the trichloromethylperoxy radical CCl_3OO, a highly reactive species. The metabolites of CCl_4 cause the hepatic injury in the CCl_4 acute liver injury model (Weber *et al.,* 2003)

Hepatoprotective Agents (Pharmacotherapy for Hepatotoxicity)

Allopathic Treatment: Ursodeoxycholic Acid, UDCA(Uesodiol): At present UDCA is only one allopathic treatment of primarily biliary cirrhosis(PBC) or hepatoprotection.It is increasingly being used to treat all cholestatic conditions because it improves serum liver (Paumgartner *et al.*,2002).

Studies also showed that various herbal extracts could protect organs against CCl4 induced oxidative stress by altering the levels of increased lipid peroxidation and enhancing the decreased activities of antioxidant enzymes, like superoxide dismutase (SOD), catalase (CAT) and glutathione-S-transferase (GST) as well as enhanced the decreased level of the reduced glutathione (GSH). In the modern medicine, plants occupy a significant berth as raw materials for some important drug preparations (Ganie *et al.*, 2011).

2.6.3 SILYMARIN

Fruit and seeds of this plant are major source of silymarin, though it can also be found in trace amounts in other parts of the plant (Kaur and Agarwal, 2007). Silymarin, a mixture of three isomeric flavonolignans, was first isolated from milk thistle seeds in 1968. Silymarin consists primarily of three flavonolignans: silybine (Silibinin), silychristin (silichristin) and silidianin. Silybine is the most biologically active component with regard to milk thistle's antioxidant and hepatoprotective properties. Silymarin prevents hepatic fibrosis through suppression of inflammation and hypoxia in the fibrotic liver. Silymarin was found to be poorly absorbed from the GI tract, with bioavailability estimated as 23-47% (Laithy *et al.*, 2011).

Silymarin flavonoid extracted from the milk thistle Silybum marianum been reported to prevent liver injuries induced by various chemicals or toxins including ethanol.Although the hepatoprotective properties of silymarin have been reported both from in vitro and in vivo studies, its mechanism of action still has not been established. Two major mechanisms that have been proposed include functioning as an antioxidative scavenger of free radicals and as a regulator of immune functions by modulating cytokine production. Silymarin enhances the activity of hepatocyte RNA-polymerase T complexes toxic-free iron, protects the cell membrane from radical-induced damage, and blocks the uptake of toxins such as Amanita phalloides toxin. A

potent scavenger, it prevents lipid peroxidation and normalizes the lipid profile of hepatocyte membranes (Yadav *et al.*, 2008).

Observed that, after toxic liver damage in human, the administration of silymarin resulted in a significantly accelerated normalization of serum glutamate-oxalacetate-transaminase and glutamatepyruvate- transaminase values. The valuable effects of silymarin on liver functions and metabolic factors have led researchers to use silymarin for the treatment of metabolic and hepatic disorders (Dehghan *et al.*, 2011).

2.7 HEPATOPROTECTIVE ACTIVITY OF MEDICINAL PLANTS

The association of medical plants with other plants in their habitat also influences their medicinal values in some cases. One of the important and well-documented uses of plant products is their use as hepatoprotective agents. Hence, there is an ever increasing need for safe hepatoprotective agent (Phaneendra, 2011).

The histopathological damage of liver and the number of apoptotic hepatocytes were also significantly ameliorated by echinacoside treatment a phenylethanoid isolated from the stems of *Cistanches salsa* (Yu *et al.*, 2007). CCl_4 induced liver injury in rats was treated with methanol and aqueous extracts of *A. lineata* orally at a dose of 845 mg/kg/day. The activities of extracts were comparable to a standard drug (Sangameswaran *et al.*, 2008). *Cleome viscosa* Linn (Tickweed) The hepatoprotective activity of the *Cleome viscosa* Linn (Capparidaceae) extract was assessed in CCl_4 induced hepatotoxic rats. The test material was found effective as hepatoprotective, through in vivo and histopathological studies. The extract was found to be effective in shortening the thiopental induced sleep in mice poisoned with CCl_4. The hepatoprotective effect of ethanolic extract was comparable to that of silymarin, a standard hepatoprotective agent (Gupta *et al.*, 2009).

Ptrospermum acerifolium (Kanak champa) the hepatoprotective activity of the ethanol extract of the leaf of *Ptrospermum acerifolium* (Sterculiaceae) was investigated in rats. Ethanol extract of *P. acerifolium* leaves were administered to the experimental rats (25 mg/kg/d p.o. for 14d). The Hepatoprotective effect of these extracts was evaluated by liver function biochemical parameters (total bilirubin, serum protein, alanine aminotransaminase, asparatate aminotransaminase and alkaline phosphates activites) and histopathological studies of liver. In ethanol extract treated animals; the

toxicity effect of carbon tetrachloride was controlled significantly by restoration of the levels of serum bilirubin and enzymes as compared to the normal and standard drug silymarin-treated groups (Kharpate *et al.*, 2007).

2.8 BIOSAFETY SCREENING OF MEDICINAL PLANTS

Artemia salina the brine shrimp is an invertebrate component of the fauna of saline aquatic and marine ecosystem. It plays an important role in the energy flow of the food chain. And it can be used in a laboratory bioassay inorder to determine the toxicity by the estimation of the medium lethality concentration LC_{50} (Rmachandran *et al.*, 2011).Brine shrimp lethality assay have been used as a bench-top bioassay for the discovery and purification of bioactive natural products, and they are an excellent choice for preliminary assessment of toxicity of herbal drugs/ consumer products. Brine shrimp (*Artemia salina*) assay has been suggested as a valid method to evaluate the cytotoxic activity of plant extracts. Brine shrimp tests are normally conducted to draw inferences on the safety of the plant extracts and further to depict trends of their biological activities (Chaitali *et a*l., 2010).

The high toxicity can also be beneficial in the therapy of some ailments involving cell or tumour growth. It has been found out that medicinally active natural products are most times toxic to *Artemia silina* nauplii (Onocha *et al.*, 2011). It is also considered a veritable tool for the isolation of bioactive compounds from plant extracts. The method is, simple, inexpensive, detects small amount of toxins and can be performed in microcells scale (Kamba and Hassan, 2010). The brine shrimp have been used to detect general toxicity, in teratology screens; ecotoxicology and detection of plant extract toxicity for the past 30 years (Carballo *et al.*, 2002). It has been established as safe, practical and economic method for determination of bioactivity of plant product (Subhan *et al.*, 2008).

2.9 THROMBOSIS AND THROMBOLYSIS

A blood clot (thrombus) developed in the circulatory system due to failure of hemostasis causes vascular blockage and while recovering leads to serious consequences in atherothrombotic diseases such as myocardial or cerebral infarction, at times leading to death. In India, though SK and UK are widely used due to lower cost,

as compared to other thrombolytic drugs, their use is associated with hyper risk of hemorrhage (Prasad *et al.*, 2007).

Thrombosis, a condition created by a formation of a clot inside a blood vessel, has been reported as the leading cause of death in the United States. It is also reported that the death rate due to thrombosis is almost twice the rate of death due to cancer, which is the second leading cause of death in USA. Heparin is a commercially available drug that is being used for thrombosis (Ekanayake *et al.*, 2008).

Thrombosis, the blockage of blood vessels with clots, can lead to acute myocardial infarction and ischemic stroke, both leading causes of death. Other than surgical interventions to remove or by pass the blockage, or the generation of collateral vessels to provide a new blood supply, the only treatment available is the administration of thrombolytic agents to dissolve the blood clot. In recent years, thrombolytic therapy with fibrinolytic (thrombolytic) agents has revolutionized the treatment of diverse circulatory disorders such as pulmonary embolism, deep-vein thrombosis and myocardial infarction. These circulatory disorders are increasingly becoming the leading causes of mortality in modern societies worldwide. Thrombolytic agents have the unique ability to activate the components intrinsic to the fibrinolytic system, resulting in the degradation of blood clots, which restores blood flow through the occluded vessels. (Kunamneni *et al.*, 2007)

The benefit of lytic therapy, however, may be limited because of failed reperfusion in 25–40% of the patients and the high incidence (30%) of reocclusion. Furthermore, because of the activation of the plasminogen-plasmin system, the mechanism for the cardioprotective effect of thrombolytic therapy remains unresolved (Hong *et al.*, 2005).

Fibrin is the primary protein component of a blood clot, which is formed from fibrinogen by thrombin. When accumulated in the blood vessels, fibrin causes thrombosis leading to myocardial infarction and other cardiovascular diseases. Fibrinolytic enzymes are agents that dissolve fibrin clots. The three enzymes that are currently being used for these purposes include urokinase, streptokinase, and genetically engineered tissue plasminogen activator (Cui *et al.*, 2008).

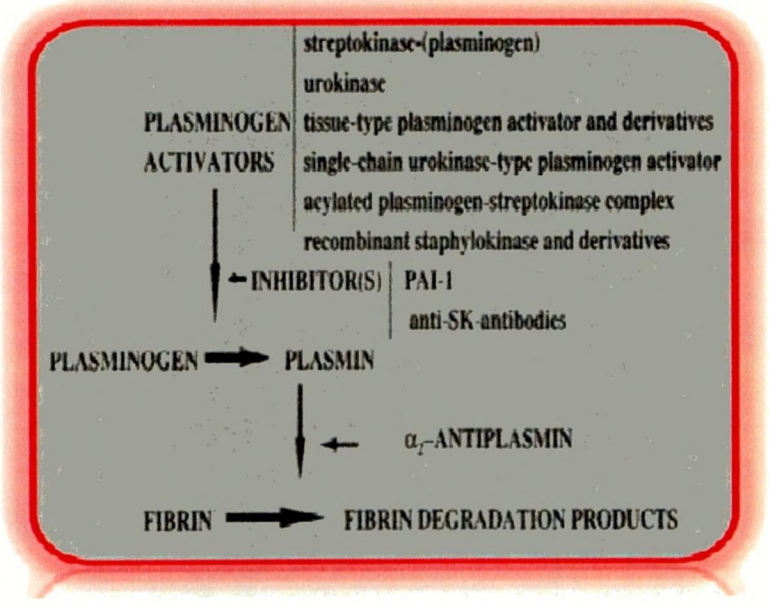
Thrombolytic therapy serves as an attractive means to treat acute myocardial infarction, one of the predominant causes of death. Recombinant tissue plasminogen

activator (tPA), urokinase, streptokinase (SK) and their derivatives are some of the approved thrombolytic drugs. These blood clot dissolving agents are plasminogen activators, which convert inactive plasminogen to plasmin that eventually dissolve fibrin in the blood clot (Deshpnade *et al.*, 2009).

All of the thrombolytic agents have undesirable side effects, show a low specificity for fibrin, and are very expensive. Therefore, the search for other fibrinolytic enzymes from diverse sources continues. In recent years, potent fibrinolytic enzymes have been studied in various sources, such as fermented food products like Japanese 'Natto', Korean 'Chunkook-jang', and Chinese 'Douch', food-grade microorganisms, insects, polychaete, earthworms, and snake venom (Choi *et al.*, 2011)

FIGURE II

SCHEMATIC REPRESENTATION OF FIBRINOLYTIC SYSTEM



3.0 *Alternanthera sessilis* – "A Miracle of the World"

Alternanthera sessilis Linn. (Sessile joy weed) belongs to the family Amaranthaceae is a popular leafy vegetable in Sri Lanka and also used as traditional medicine in China, Taiwan, India and Sri Lanka. It is used for simple stomach disorders, diarrhoea, and dysentery and as a plaster for diseased or wounded skin parts, against fever and also for the treatment of diabetes mellitus by the local people (Kumar *et al.*, 2011). The shoots and leaves are often eaten as vegetables (Unni *et al.*, 2009).

The plant spreads by seeds, which are wind and water-dispersed and by rooting at stem nodes. It is a weed of rice throughout tropical regions and of other cereal crops, sugarcane and bananas. Although it is a weed, it has many utilities. Young shoots and leaves are eaten as a vegetable in Southeast Asia. The young tips are eaten as a vegetable. The leaf is very rich in iron, vitamin A and dietary fiber. The plant contains protein and soups made with the leaf are given to anaemic patients in rural areas. It contains abundant carotene, therefore it is used for curing night blindness. The plant enhances the secretion of milk in new mothers and it is used as a remedy against intestinal cramps and externally as a cooling agent to treat fever. *Alternanthera sessilis* is used internally against intestinal inflammation, externally to treat wounds, to treat hepatitis, tight chest, bronchitis, asthma, lung troubles, to stop bleeding and as a hair tonic (Singh *et al.*, 2009). The plant has been scientifically proven to consist of chemical constituents like α-and β- spinasterols, lupeal isolated from roots. Apart from the above, plant also contains β- sitosterol, stigmasterol etc. The leaves are used in eye diseases; in cuts and wounds; antidote to snake bite and scorpion sting (Jalalpure *et al.*, 2011).

It has been used in Indian traditional system of medicine since a long time in diseases due to vitiated blood and ulcers. Its active principles, extracted in oil, were used to treat infected wounds and the herb also proved styptic in colitis; its nutritive values make the herb a potent tonic with a wide range of applications. Poultice of pounded fresh material is used in sprains, burns and eczema, carbuncle, erysipelas and acute conjunctivitis. It is also used as a cholagogue (increases bile flow in liver), abortifacient (causes abortion) and febrifuge (reduces fever) and to treat snakebites, dysentery, diarrhea, skin problems inflamed wounds and boils, and applied externally on acne and pimples. In some parts of Bihar (India) the plant is used for hazy vision, night blindness, and post-natal complaints (Nayak *et al.*, 2010).

CLASSIFICATION:

- Kingdom : Plantae
- Phylum : Magnoliophyta
- Class : Angiospermae
- Order : Caryophyllales
- Family : Amaranthaceae
- Genus : *Alternanthera*
- Species : *Alternanthera sessilis*