1.0. INTRODUCTION

1.1. SEAWEED RESOURCES AND UTILITY

Seaweeds are macroscopic algae, which form an important component of the marine living resource. They are harvested by man for centuries, particularly in Japan and China, where they form a part of the staple diet. The uses of seaweeds as food, fodder and manure are well known in many countries. Marine algae contain more than 60 trace elements in a concentration much higher than in terrestrial plants. They also contain protein, iodine, bromine, vitamins and substances of stimulatory and antibiotic nature. Seaweeds are the only source for the production of agar, alginate and carrageenans. These phytochemicals are extensively used in various industries such as of food, confectionary, textile, pharmaceutical, dairy and paper mostly as gelling, stabilizing and thickening agents. Apart from these biochemicals, and fucoidin are also obtained from marine algae. Now attempts are being made for screening pharmaceutically active compounds form seaweeds (Silas et al., 1987).

India has a 8,085 km long coastline, 51,200 km$^2$ of exclusive economic zone (EEZ). About 8.5 million ha of coastal area is in the form of sheltered bays and lagoons which are ideal for mariculture activities. However, the seaweed industry in India depends entirely on the natural stock of seaweeds and no attempts have been made to increase production through mariculture. About 700 species of marine algae have been reported from different parts of the Indian coast. Of these, nearly 60 species are commercially important and can be utilized as raw material for agar, algin and
carrageenans production and for food, manure and pharmaceuticals. It is estimated that the total standing crop of all seaweeds in Indian waters is more than 100,000 t wet weight consisting of 6,000 t of agar yielding seaweeds, 16,000 t of algin yielding seaweeds, 8,000 t of carrageenans yielding seaweeds and the remaining 70,000 t of edible and green seaweeds (Devaraj et al., in press). In India, seaweeds are exploited commercially only for the manufacture of phycocolloids such as agar and algin. Major species are *Gracilaria edulis, G. acerosa, G. verucosa* and *Gracilaria* sp. for agar production and species of *Sargassum* and *Turbinaria* for sodium alginate production. These weeds are mainly exploited on the south eastern coast, especially in the areas between Vedaranyam to Kanyakumari (Kaladharan and Kaliperumal, 1999). Seaweeds are broadly grouped into green, brown and red macroalgae. Fresh, dried and processed seaweeds are utilized as human food and the food value depends upon the minerals, trace elements, proteins and vitamins present in them. They are eaten as salads, curries, soup and vegetable. Species of *Ulva, Caulerpa, Codium, Hydroclathrus, Sargassum, Porphyra, Gracilaria, Euchema, Halymenia, Acanthophora* and *Laurencia* are used as food in Japan, Indonesia, China, Philippines and other countries of Indo-Pacific region (Subba Rao, 1965; Levring et al., 1969; Michanek, 1975; Chapman and Chapman, 1980). This leads to increasing demand for herbal products with anti-diabetic activity and less side effects.

Good health is the essential of life. History reveals that maritime countries have been using seaweeds as vermifuge, anesthetic and ointment as well as for the treatment of cough, wounds, gout, goiter, venereal disease etc. Sailors have been treating wounds for last several years with seaweeds. Sterols and related compounds
present in seaweeds have ability to lower blood plasma cholesterol level. Seaweed
dietary fibers perform varied range of functions such as anti-oxidant, anti-mutagenic,
anticoagulant, anti-tumor etc. It also plays an important role in modification of lipid
metabolism in the human body. High intake of calcium, potassium and sodium are
associated with lower mean systolic pressure and lower risk of hypertension. All
seaweeds offer an extraordinary level of potassium that is very similar to our natural
plasma level. Worldwide research indicated that seaweed extract is similar to human
blood plasma. Two Japanese surgeons used a novel technique of mixing seaweed
compounds with water to substitute whole blood in transfusion and this was
successfully tried in over 100 operations.

Seaweeds are best natural food source of bimolecular dietary iodine. Some
seaweeds contain 1000 times as much 64 iodine as cod, as average iodine containing
fish. Seaweed provides di-iodotyrosin (DIT) which is precursor to forming the
essential thyroid hormones, Thyrosin (T4) and Triiodothyronine (T3). The hormones
produced by the thyroid gland regulate body metabolism. It also accelerates cellular
reaction, increases oxygen consumption, influence growth and development, energy
metabolism and protein synthesis (Davis, 1991). It is a key factor in the control and
prevention of many endocrine deficiency conditions such as breast and uterine
fibroids, tumors, prostrate inflammation and toxic liver and kidney states. A study was
carried out to demonstrate industrial feasibility of a naturally iodized salt, using
seaweed ingredient as a source of iodine. The results indicated that the level of iodine
in seaweed ingredient is constant, consumer acceptance is good, and clinical studies
showed equal bioavailability of iodine (Mabeau and Fleurence, 1993). Although, the
use of seaweeds in medicines is not as wide spread as it once was, the use of seaweed polymer extract in pharmacy, medicine and biochemistry is well established.

1.2. BROWN SEAWEEDS

The brown seaweeds belonging to phaeophyceae are good sources for the phycocolloids alginic acid or the salt form namely alginate and a reserve food material namely mannitol. Algin is the main polysaccharide occurring in the cell walls of brown algae. It consists of D-mannuronic acid and 2-guluronic acid in various proportions. The sodium, potassium and magnesium salts of alginic acid are soluble in water and they give viscous solutions without gel formation. Calcium alginate and other salts of copper, cobalt, mercury, etc are insoluble in water. Species of *Sargassum, Turbinaria, Dictyota, Padina, Cystoseira, Hormophysa, Colpomenia, Spatoglossum* and *Stoechospermum* are some of the algin-yielding seaweeds occurring in Indian water. Of these, *Sargassum* and *Turbinaria* are utilized as raw material for the manufacture of algin in India, since they are high-yielding varieties and also available in large quantities (Chennubhotla et al., 1987). Alginates of seaweeds have a soothing and cleansing effect on the digestive tract in humans (Skoryna et al., 1971). Sulphated polysaccharides from seaweeds have been used in the films that are placed between the bones to be grafted in order to accelerate the growth of the connective tissue. The combination of hydrocolloid dressing and alginate compress was found to have significant advantages as regards conditioning the exposed bone surface (Jens et al., 2002). The polysaccharides are also used to treat arthritis as they are active in promoting and aiding the body.
1.3. DIABETES MELLITUS

Diabetes was known even in ancient times. The name of this disease, which is characterized by excessive flow of urine and insatiable thirst, it was coined by the Graeco-Roman physician Aretaeus of Cappadocia (approx. 80 - 130 A.D.) and it is derived from the Greek word *diabainein* (‘to flow through’). The adjective *mellitus*, which comes from Latin and means ‘honey-sweet’, was added by the German physician Johann Peter Frank (1745-1821) in order to distinguish diabetes mellitus, or ‘sugar diabetes’, from diabetes insipidus. Johann Peter Frank, who was in 1790, by introducing yeast fermentation test for the quantitative determination of urinary glucose, relieved the physicians of his time from the need to taste their patients’ urine. In diabetes insipidus an excessive amount of urine is produced as a result of a disturbance of the hormonal control of reabsorption of water in the kidneys. Untreated diabetes mellitus, in contrast, which is characterized by high blood glucose, levels either due to diminish or absent of insulin production or reduced effectiveness of insulin in the body.

Diabetes is a chronic disorder of carbohydrate, fat and protein metabolism characterized by fasting elevations of blood sugar (glucose) level and greatly increased risk of heart disease, stroke, kidney disease, and loss of nerve function. Diabetes can occur when the pancreas does not secrete enough insulin, or if the cells of the body become resistant to insulin; hence, the blood sugar cannot get into the cells which then leads to serious complications. The classic symptoms of diabetes are frequent urination, excessive thirst and appetite. Because these symptoms are not very serious, many with diabetes do not seek medical care. In fact, of the more than 10 million
Indians with diabetes, fewer than half know that they have diabetes or ever consult a physician. Diabetes mellitus (DM) is prevalent in all countries of the world. More than 30 million people are said to be affected throughout the world with this disease. It is presently the most common non-communicable disease worldwide and it is the fourth or fifth leading cause of death in most developed countries (Amos et al., 1997). DM is divided into two major categories: type I and type II. Type I or Insulin-Dependent Diabetes Mellitus (IDDM) occurs most often in children and adolescents. Type II or Non-Insulin Dependent Diabetes Mellitus (NIDDM) usually has an onset after 40 years of age. The treatment of DM is based on oral anti-hyperglycaemic agents and insulin. However, DM is also treated in Indian traditional medicine using anti-diabetic medicinal plants (Nagarajan et al., 1987). The oral anti-hyperglycaemic agents currently used in clinical practice have characteristic profiles of serious side effects (Pickup and Williams, 1991).

1.4. OBESITY

Obesity is a worldwide epidemic with prevalence increasing year after year. WHO estimated that by 2015, there will be more than 1.5 billion people overweight, incurring health costs beyond $117 billion per year in the US alone. The opportunities for scientifically substantiated food products used for body weight management are impressive. Diet and lifestyle changes remain the cornerstone of therapy for obesity, but the resultant weight loss is often small and long-term success is extremely uncommon and disappointing. Drug therapy has been considered for individuals with a body mass index (BMI) greater than 30 kg/m2, or 25 to 30 kg/m2 if person suffers from other co-morbidities. Antiobesitic agents can be used for some patients to help
achieve and maintain meaningful weight loss, but these pharmaceuticals are of limited effectiveness in the face this worldwide problem. At present, only two drugs, orlistat and sibutramine, are approved for long-term use in the treatment of obesity, and each of these typically promotes 5% to 10% loss of total body weight (WHO, 2006). Although very effective in promoting clinically meaningful weight loss, reduction in waist circumference and improvements in several metabolic risk factors, Rimonabant, a cannabinoid-1 receptor antagonist, was withdrawn from the market due to concerns about its safety, including risk of suicide and seizures (Rucker et al., 2007; Padwal and Majumdar, 2007).

Herbal technology is one of the most important fields in biotechnology which deals with the study and manipulation of plants. Studies have revealed that herbal remedy could be effective in humans with no adverse side effects. India is gifted with eminent wealth of phytomedicine and traditionally these plants have been used as medicines against various types of diseases especially in obesity. Obesity is a metabolic disorder affecting carbohydrate, fat and protein metabolism. It represents a heterogeneous group of disorders having hyperglycemia, which is due to impaired carbohydrate utilization resulting from a defective or deficient insulin secretory response (Reaven, 1988).

1.5. MYOCARDIAL INFARCTION

Myocardial infarction may occur at virtually any age, but the frequency rises progressively with age. Coronary atherosclerosis, dynamic-coronary artery changes and initial injury are regarded as the principal events leading to acute thrombotic occlusion that causes myocardial infarction. Myocardial ischemia occurs when an
imbalance develops between myocardial oxygen supply and demand. In the presence of a fixed coronary artery stenosis, increase in heart rate, blood pressure and left ventricular wall stress can lead to an imbalance in the supply or demand ratio, resulting in ischemia. Myocardial infarction is one of the leading causes of death for human beings, due to changing lifestyles in developing countries, such as India, and particularly in urban areas (WHO, 2006a). Myocardial infarction is making an increasingly important contribution to mortality statistics (Levy et al., 1984).

Phytochemical screening has clearly revealed that seaweeds have pharmaceutically potent secondary metabolites, these metabolites may be useful in containing metabolites infection, act as hypolipemic and hypoglycemic agents, reduce blood pressure, and regulate blood cholesterol levels (Krishnamurthy, 2005). So there is a need for a detailed study of some of these medicinal properties of seaweeds. Hence the present investigation was undertaken to assess the medicinal properties of the most commonly available brown seaweed Sargassum wightii (Greville) J. Agardh, in the Gulf of Mannar region of the Hare Island, Tuticorin Bay.

Objectives:

1. Fluorescence analysis, of the dried powdered seaweed Sargassum wightii sample, treated sample and its extract in various solvents like chloroform, hexane, acetone, ethanol and distilled water.

2. Quantitative determination of moisture content, different ash types and extractive values from chloroform, hexane, acetone, ethanol and water.

3. Phytochemical screening of Sargassum wightii extract obtained from soxhlet extraction in successive solvents like chloroform, hexane, acetone and ethanol.
4. Quantification of protein, carbohydrate, lipid, nitrogen, organic carbon, fibre content, calorific value, phenol, tannin, anthocyanin, minerals (K, Ca, Mg and Na), vitamins (A, B3, C, and E) present in the *Sargassum wightii* powdered sample.

5. Evaluation of active compounds in *Sargassum wightii* by High Performance Thin Layer Chromatography (HPTLC) for Alkaloid, Flavonoid, Glycoside, Saponin, Steroid and Terpenoid confirmation.

6. Identification and quantification of amino acid and fatty acids in *Sargassum wightii* by High-Performance Liquid Chromatography (HPLC).

7. Evaluation of antidiabetic (antioxidant and hypoglycaemic) activity of ethanolic extract of *Sargassum wightii* in alloxan induced diabetic rats.

