INTRODUCTION
1.0 Background

The concept of environment had been fairly strong in all ancient civilisations like Indian, Roman, Greek and Chinese. But during that time man was not so much cautious of the harmful effects of his unwise encroachment into environment. And the concept of environment has been too much associated with conservationist ideas. The problem of environmental pollution gained importance only after industrialisation as an accompaniment to rapid economic expansion. The expanding economic activity and growing human population use increasing amount of natural resources for the satisfaction of the bundle of requirements. This over exploitation of nature led to the imbalance of ecosystem.

The word ‘environment’ was brought into common use in 1972 by the United Nations conference on human environment held at Stockholm. The goal of the conference was to invite the attention of all nations to the problem of worldwide threat of environmental contamination arising out of harsh treatment of environment by human activities for the sake of rapid economic expansion. After this conference, environmentalists and mass media all over the world began giving more emphasis to words like environment, environmental degradation, resources, pollution etc.

Recently the concept of environment has been very much associated with the idea of pollution control. But environmental dimension is neither
a pollution concept nor purely a conservation or protection policy drafted by a group of 'Pessimistic futurologists' with negative attitude towards all developmental policy and action. On the other hand, the term environment can be defined as the totality of human interaction with nature or the sum of all social, biological, physical and chemical factors which constitute the surroundings of man. Each element of these surroundings constitutes a resource which man utilises in different ways to develop and lead a better life (Compendium of environment statistics, 1997). In general the term environment embraces all external resources, conditions and influences affecting the existence and development of living organisms, non living materials and its management.

The unimaginative interaction and intervention with nature defiled the air, water and soil with pollutants. Latest studies and research reveal that environmental pollution has reached such alarming proportions that pose threat to the very existence of life. And now the point has reached where human being must protect the environment in order to protect himself.

The mainstream economic thoughts ignored the problem of environmental externalities of economic activity until 1930’s. When Pigou published 'The economics of welfare' the expressions such as ecological economics, economics of pollution control etc are frequently surfacing in common discussions. In recent years interaction between environment and economics has become more predominant. All the economic policies
reflect sophisticated perception of the way human beings influence the use and conservation of natural resources. As a result of this phenomena the economists have a growing involvement in the design and implementation of environmental policies to support economic development with sound ecological management.

It is widely accepted that economics is no more confined with material well being alone, but the well being of man, both material and non material. The quality and standard of human life greatly depend upon the respective surroundings ie environment. So the naturalness and saturation of the environment improves the quality of human life, but in practice with the aspiration for better living, man use nature both directly and indirectly to transform raw materials into final goods. During this process nature is polluted by emissions and wastes.

Man now recognise that different aspect of environmental quality such as pure air, fresh water and uncontaminated resources tend to be scarce and exhaustible. Here man's relationship with the environment demands the attention of economists (Gregary, 1979). Firstly, the environment is the source of the natural resources some of them are final goods and others are inputs for production, with economic development the need for both categories increases. Secondly, environment provides natural amenities which contribute to the quality of life. Thirdly, most of them human beings use the environment as depository for waste products and if wastes exceed the assimilative capacity, an economic approach is
needed to make an optimum use of the assimilative capacity which in turn is a scarce resource.

1.1 Environment and Economic Development

The catchword of the world in this present century is ‘economic development’. To achieve a better living standard the increasing population draws more and more resources from the environment. The rising levels of production and consumption result in increasing resource flows and discharges of residues. When this discharges increase, the capacity of environment to successfully assimilate will be reduced and the resulting pollution impairs the supply of natural resources and the flow of amenity services. In this view, indefinitely prolonged economic development may be impossible with the finite nature of resource stocks.

The attempt to link development and environmental issues is not simple. Developmental issues range from macro-international to micro project level and there is differences in views among developed and developing countries in their ranking of environment and development. Developing countries in general rank development above environment. Hence, environmental problems faced by nations may vary with their stages of development.

The extensive exploitation of natural resources for economic development ultimately results in substantial damage to the environment. In fact, environmental pollution and economic development goes together
(Sen, 1992). The thinkers like Gandhi and Schumacher have opined that the relationship between environment and economic development should be based on the principles of harmony, co-operation, co-existence and of non violence. But in the present mad-race for industrialisation, which is synonymous to economic development, till recently the spirit of development was the maximum exploitation of natural resources and dominance of man over nature. This resulted in disharmony, exploitation, non sustainability and violence. This environmentally neutral development policy ultimately leads to environment degradation.

The environment has the capacity of assimilating or neutralizing the wastes produced by human activities, but this natural process has limits. It can assimilate only a limited quantity of harmful substances from environment. Virtually all human activities are expected to release some pollutants to the environment. But this become a problem when human beings overtaxing or over burdening the environment through their activities by adding foreign substances to the air, water or land media in such quantities as to render that resources unsuitable for specific or established uses (World Bank, 1978).

The above concept about the link between economic development and environment is based on the assumption that the level of technology remains static. But the introduction of a combination of sound policies, advanced planning, technology and judicious investment have changed the concept about the links between economic development and environment.
The introduction of a matured technology for recycling with economic development will not only cut down the waste load placed as disposal but also reduce the amount of virgin resources drawn from the environment for a given level of production.

Andrew Steer (1996) has pointed out that there is a crucial and potentially positive link between environment and economic development. Some pollution problems noticed during the early stages of a country's development tend to diminish when economy gains adequate resources to abate these problems. This happens because at low level of income, people tend to value development over environmental quality and when income increases they are willing to spend more resources for environmental quality improvements.

1.2 Urbanisation and Environmental Pollution

The urbanisation took momentum from industrial revolution that ushered in the last quarter of the 18th century and progressed at an ever increasing pace throughout 19th and 20th centuries. The metropolitanization by the gradual influx of people from rural and semiurban areas into large cities and commercialisation of medium and small towns also helped the process of urbanisation. The developing countries of the third world experienced rapid urbanisation only in recent past. The speedy economic growth and the population boom are the reasons behind this trend. The most striking feature of urbanisation lies in the process of accretion of the
rural population in a few large urban areas resulting in a disproportionate base and unbalanced eco system. The crisis of ecosystem increases in magnified volume when urbanisation accelerates and the availability of natural resources for urban development declines.

Pollution has been with us since human beings built the first fire, smoke rising from the fire and ashes left on the ground changed the natural environment. The wandering hunter gatherers contaminated the water streams and faced health risks as a consequence of slaughtering animals and living in smoke filled dwellings (Barrow, 1999). When water and air pollution became a problem in one location, people moved to other un polluted area. As long as people could move to newer, cleaner sites easily, pollution cannot be considered as a problem. But when population increased and technology necessitated more stationary production sites, pollution became a matter of concern to society (Downing, 1984). The cities are considered as the main symbol of human civilisation and centres of incubating growth and innovation. The cities are the most insatiable consumers of natural resources and by far the most important sources of pollution to our common environment. Now the cities are considered as the most important centres of productive activity for economic growth. The serious environmental problems faced by them threaten the sustainability of future growth and development.

Cities exhibit certain common features, like congestion or unplanned physical sprawl abounds, shortage of basic requirements, promiscuous
fashion of industrial growth and the steady influx of population with varying social and environmental backgrounds. Problems that cities face are very acute and extremely difficult to handle. The chief among them is air pollution, water pollution, soil pollution, pollution caused by solid and hazardous waste and noise pollution.

Most of the urban centres are situated along the banks of rivers or in the vicinity of lakes. In a healthy water system, a cycle of natural processes turns wastes into useful or harmless substances. But when cities discharge abundant volumes of wastes into water sources, the natural cleansing process cannot function properly. In many localities the ground water of cities are contaminated with sewage or seepage of pollutants into water. The cities along the costal areas discharge effluents into sea causing marine pollution.

Air pollution is more widespread in its effect than other forms of pollution. The severity of air pollution depends on the number, kind and concentration of pollution sources. Urban growth translates, more vehicles, causing more traffic, more factories, refineries, chemical plants and more people cooking and heating (World Bank, 1990). The pollutants arising from these sources cause damage to vegetation and have adverse effect on human health. The largest and gravest source of air pollution in urban areas is the motor vehicles.
Another problem challenging the urban environmental scenario is related to solid waste. With increasing population and income the life style of urban residents are also changing. The quality and volume of solid waste is directly related with the affluence of population (Cheremisinoff, 1976). The problem of solid waste existed since Adam discarded the first apple core, prehistoric man simply piled his discards in heaps of shards, bones and shells. But the problem of solid waste accelerated with the onset of the industrial revolution in 18th century concomitant with urbanisation process.

1.3 The problem of urban solid waste pollution

Among the many environmental crises tormenting the cities of the world, solid waste pollution is the most important one. A waste is viewed as a discarded material which has no consumer value to the person abandoning it (Cointreau, 1982). An apt definition of solid waste is “mater in the wrong place”, implying that a material becomes waste only when specific owner ceases to have a use for it (Trivedi and Gurdeep Raj, 1996). The economist’s definition of waste relates to a substance which is cheaper to be condemned than to make further use of it. Ecologically, waste is a misplaced resource which could be recycled and reused with a given right economic frame work (Purushottam Khanna and Vijay Kulkarni, 1991).

Solid waste components are often grouped into three common categories, viz - garbage, rubbish and ash. Garbage is defined as the
organic fraction of waste. Rubbish in general means inert constituents excluding ashes, paper, plastics, metals etc. And ashes are the residues from the burning of wood, coal or other combustible materials for heating and cooking purpose. In the early part of the 20th century most of the urban solid waste came from the kitchen and consisted mainly of food scraps and coal ashes. After 1950's the convenient packing materials such as paper, metals, glass and plastic have become the new components of trash.

It is difficult to get the accurate data concerning the quantities and characteristics of urban solid waste. The available data indicate that the generation of solid waste is highly correlated with the growth of economic activity. In 1990 the total municipal solid waste generated by industrialised countries come to 408 million tons. Out of this 48% was generated in North America, 37% in Europe and 15% in the pacific area. The United States with 43.5% share is the single largest municipal solid waste generating country among industrialised nations. The first five industrialised countries contribute 73% of the total solid waste of the world and first ten add upto 90% of the total (Arango and Bertuzzi, 1994).

The composition of solid waste is also considered as a crucial element for defining the problem. In all countries, organic materials account for a significant share of total waste. But when an economy improves, residents generate more amount of recyclable waste. Table 1.1 shows the composition of waste in some cities representing from high, medium and low income countries.
Table 1.1 Urban refuse composition data (percentage)

<table>
<thead>
<tr>
<th>Sl. No</th>
<th>Cities</th>
<th>Higher Income</th>
<th>Middle Income</th>
<th>Lower Income</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Brooklyn</td>
<td>London U.K.</td>
<td>Singapore</td>
</tr>
<tr>
<td>1</td>
<td>Paper</td>
<td>35</td>
<td>37</td>
<td>43</td>
</tr>
<tr>
<td>2</td>
<td>Glass and Ceramics</td>
<td>9</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Metals</td>
<td>13</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Plastics</td>
<td>10</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>Leather and Rubber</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6</td>
<td>Textiles</td>
<td>4</td>
<td>2</td>
<td>9</td>
</tr>
<tr>
<td>7</td>
<td>Wood, bone and straw</td>
<td>4</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Non food total</td>
<td>74</td>
<td>57</td>
<td>63</td>
</tr>
<tr>
<td>8</td>
<td>Food and putrescible</td>
<td>22</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Miscellaneous inert</td>
<td>4</td>
<td>15</td>
<td>32</td>
</tr>
<tr>
<td></td>
<td>Compostable total</td>
<td>26</td>
<td>43</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: Values are rounded to the nearest whole numbers.
During the last few decades, the quantity of domestic, industrial and urban wastes have increased tremendously in Indian cities. According to the central pollution control board estimate, the total quantity of solid waste generated by 23 large cities in India is of the order of 30,058 tons per day. Mumbai generates the maximum with 5,355 tons per day and Visakapatnam, with 300 tons per day is the lowest as shown in table 1.2. From table it is also clear that Chennai ranks first in per capita generation of solid waste with 0.657 kgs per day while Nagpur ranks the lowest with 0.272 kgs per day among 23 large cities. Moreover, the problem of waste disposal from both domestic and industrial sources have become quite acute in some towns and cities with disposal facilities lagging far behind the total quantity of waste generated. On an average the total collection efficiency is only 60 percent in some towns and cities in India. It is clear that systematic efforts are needed for effective disposal of solid waste.
Table 1.2 Solid waste generation in major metros of India

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Cities</th>
<th>Municipal solid waste (tons/day)</th>
<th>Percapita waste generation (kg/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mumbai</td>
<td>5,355</td>
<td>0.436</td>
</tr>
<tr>
<td>2</td>
<td>Delhi</td>
<td>4,000</td>
<td>0.475</td>
</tr>
<tr>
<td>3</td>
<td>Culcatta</td>
<td>3,692</td>
<td>0.383</td>
</tr>
<tr>
<td>4</td>
<td>Chennai</td>
<td>3,124</td>
<td>0.657</td>
</tr>
<tr>
<td>5</td>
<td>Bangalore</td>
<td>2,000</td>
<td>0.484</td>
</tr>
<tr>
<td>6</td>
<td>Ahmedabad</td>
<td>1,683</td>
<td>0.585</td>
</tr>
<tr>
<td>7</td>
<td>Hyderabad</td>
<td>1,566</td>
<td>0.482</td>
</tr>
<tr>
<td>8</td>
<td>Kanpur</td>
<td>1,200</td>
<td>0.640</td>
</tr>
<tr>
<td>9</td>
<td>Lucknow</td>
<td>1,010</td>
<td>0.623</td>
</tr>
<tr>
<td>10</td>
<td>Surat</td>
<td>900</td>
<td>0.600</td>
</tr>
<tr>
<td>11</td>
<td>Pune</td>
<td>700</td>
<td>0.312</td>
</tr>
<tr>
<td>12</td>
<td>Jaipur</td>
<td>580</td>
<td>0.398</td>
</tr>
<tr>
<td>13</td>
<td>Bhopal</td>
<td>546</td>
<td>0.514</td>
</tr>
<tr>
<td>14</td>
<td>Nagpur</td>
<td>443</td>
<td>0.272</td>
</tr>
<tr>
<td>15</td>
<td>Varanasi</td>
<td>412</td>
<td>0.400</td>
</tr>
<tr>
<td>16</td>
<td>Vadodara</td>
<td>400</td>
<td>0.389</td>
</tr>
<tr>
<td>17</td>
<td>Ludhiana</td>
<td>400</td>
<td>0.384</td>
</tr>
<tr>
<td>18</td>
<td>Madurai</td>
<td>370</td>
<td>0.392</td>
</tr>
<tr>
<td>19</td>
<td>Coimbatore</td>
<td>350</td>
<td>0.429</td>
</tr>
<tr>
<td>20</td>
<td>Indore</td>
<td>350</td>
<td>0.321</td>
</tr>
<tr>
<td>21</td>
<td>Kochi</td>
<td>347</td>
<td>0.518</td>
</tr>
<tr>
<td>22</td>
<td>Patna</td>
<td>330</td>
<td>0.360</td>
</tr>
<tr>
<td>23</td>
<td>Vishakapatnam</td>
<td>300</td>
<td>0.400</td>
</tr>
</tbody>
</table>

Source: Central pollution control board (1998)
1.4 Impact of solid waste pollution

From the economic point of technology, it has now become cheaper to make new products than reconditioning or cleaning them. So the materials once used will be wasted and consumption remnants are directly thrown to the environment. Every year in the United States, people throw away 7 million cars, 30 million tons of paper, and 48,000 million tin cans. Recently solid wastes are changing from wood, paper and iron to rustable alloys, glasses and plastics, which neither rot nor burn. (Skukla and Srivastava, 1992). The improper handling and disposal of these wastes render negative externality in the form of health damages and aesthetic impairment from unsightly litter and trash accumulation.

Generally solid waste management come under the control of local authorities. But they are overburdened with responsibility of much higher priorities, waste management then is neglected to the end of the list. Lack of proper management for collection, transportation and disposal aggravates the problem.

The most obvious environmental damage caused by solid waste is by uncontrolled dumping of wastes. It spoils the attractiveness of surrounding areas and creates health problems to residents of neighbouring areas. Deposition of waste along river banks and abandoned areas leads to leaching of chemical and biological contaminants into water. Inhabitants
living near dumpsites also suffer from inhalation of volatile compounds and aerosols (Rushbook and Michaelpugh, 1999).

Decomposition of organic and putrescible materials release carbon dioxide, carboxylic acid and methane (Rushbook, 1998). The open burning of municipal solid wastes are very common, this emits air pollutants to the atmosphere. Moreover, the stink emanating from heaps causes an environmental nuisance to human beings. Further, garbage heaps become the breeding ground for disease carrying vectors and microbes, the vector borne diseases are more prevalent in urban areas. It is reported that about 45 human diseases are associated with solid waste pollution.

Workers handling waste are considered as the direct victims of waste disposal. Studies have shown that such workers suffer from skin diseases, respiratory and ophthalmic problems, ulcers and infected wounds due to contacts with waste (Giroult, nd). Waste collectors also suffer from injury and health hazards when they deal with waste materials (Bhide, 1990). Among them diseases like worm infections, viral hepatitis, gastro enteritis, skin diseases etc. are relatively common. Apart from this, the practice of mixing hospital waste with municipal waste results in unprecedented health hazards to the people who have direct contact with such waste.

The modern convenience consumerism contributes a large portion of plastic waste to the stream of solid waste. These plastics take more than
hundred years to decompose. The accumulation of non-biodegradable plastics in land disrupt the growth of plants. The floating of plastic bags in water streams chokes the free flow of water or cause problems to aquatic environment. The burning of plastic releases lethal dioxins which leads to various ailments including impairment of the immune system, genetic defect and even cancer. Plastic bags also pose a grave danger to cows and other animals wandering the city streets for food.

Incineration is now considered as an ultimate disposal option usually adopted for those wastes that cannot be recycled, reused or safely deposited in landfill site. It is a high temperature thermal oxidation process in which the waste are converted in the presence of oxygen into gases and incombustible solid residue. Incineration generates emission of particulates, acidic gases, unburned waste, and toxic inorganic gases. Thus incineration leads to vulnerable conditions than land disposal of waste.

As solid waste directly give rise to pollution, it is inevitable to manage solid waste in a proper manner. Co-ordinated and convergent efforts are essential for evolving an integrated policy as well as action plan for management of solid wastes to ensure a better urban environment.

1.5 Significance of the Study

After the second world war, three developments have taken place in world economy. Namely decolonization, industrialisation and urbanisation. Among them urbanisation plays a major role. The first known urban
growth evolved about five thousand years ago on the banks of Indus, Nile, Tigris and Euphrates rivers, when traditionally nomadic peoples began to cultivate crops (Brown and Jacobson, 1987). The pace of urban growth is now undergoing a rapid explosion on a scale unknown to preceding centuries. In the mid 1700’s only 3 percent of the world’s inhabitants lived in urban areas. By 1950 it increased to 29 percent and 40 years later cities contained 44 percent of total population. It is expected that by the year 2025 about 60 percent of the world population will live in and around cities. And by the end of the next century homosapiens will become a predominantly urban species.

The dramatic change of urban life has occurred in both rich and poor countries. But the proportionate growth rate of urban population is greater in developed than in developing countries. The developing countries have now 41 percent of urban population, while the developed nations share is 76 percent of the total population. This means more people in developed nations migrate from their villages to start a new life in urban areas.

As a developing country India is often portrayed as a land of villages and hamlets, nevertheless in reality it is equally appreciated as a land of towns and cities. With 12,000 urban settlements having a population of 5,000 or more India has an urban infrastructure of gigantic magnitude. It is the second most populated country of the world and ranks fourth after China, U.S.S.R and U.S.A in terms of absolute size of urban population.
Indian urbanisation trend attained its climax during the Mughal period. When British came to India it was perhaps the less urbanised nation in the world. They added several new towns and cities in addition to generating newer urban forms in the existing cities.

The unprecedented increase of India’s urban population since its independence is highly notable. Some cities like Bangalore and Surat registered more than 50 percent of population growth continuously during the last 3 census decades. The total urban population in 1951 was reported to be about 60 million and the rate had increased from 17.29% in 1951 to 25.72% in 1991. In absolute numbers 25.85 million peoples lived in towns during 1901. By 1991 it increased by more than eight times to 217.18 million. The urban population has almost doubled during the last two decades from 109.11 million in 1971 to 217.18 million in 1991 (Census of India, 1991).

Compared to other states of India, Kerala has been witnessing rapid urbanisation since 1950, more than one fourth of the population of Kerala lives in urban areas and this is higher than the all India proportion. One distinct factor of Kerala’s level of urbanisation is its high relativity of town density. Comparing to other states of India Kerala ranked first in terms of town density. Another special feature that can be noticed in the pattern of urbanisation in Kerala is the decennial growth rate of urban population during 1981-91, it is highest among Indian states with 60.89 percent while
Indian growth rate of urban population is 36.19 percent (Census of India, Series-12-1991).

The increasing trend of population and the rapid industrialisation accompanied by urbanisation resulted in a disproportionate base and unbalanced ecosystem of urban centres. Further unsustainable consumption pattern in urban areas created more pressure on the existing natural amenities. This resulted in an increasing amount of pollution problems. Among the challenging problems governing the urban environmental scenario, the most important one is solid waste pollution. With increasing population and income the life style of urban residents changed and now the urbanities become a throwaway society. The larger and more affluent the population, the greater the volume of solid waste (Cheremisinoff, 1976).

The problem of solid waste is not limited to large cities of the world, it is also seeped into small towns. The main constituents of wastes are similar throughout the world, but the proportions vary widely from country to country and even within a city. The only difference between developed and developing countries with respect to solid waste is that in large cities they have some sort of knowledge regarding waste management, but this is totally lacking in small towns or in satellite urban areas.

Solid waste management becomes the major concern of urban planning, the proper collection and disposal of waste is the topic of
discussion among city planners and environmental engineers. Many cities of India practice the primitive method of solid waste disposal. It is highly unhygienic and involving manual handling of wastes. In this conventional approach solid waste management is considered only as a handling problem and characterised by the maxim ‘out of sight and out of mind’. But gradually this attitude began to change and much progress has been made over the last decades with changing nature of non biodegradability of waste and vastly increased public opposition as seen by ‘Not in my backyard Syndrome’.

Resource recovery through recycling is now considered as a sound option for conserving resources and decreasing the pollution caused by solid waste in conventional method. The important consideration for recycling is that it adopted a conservation technology for processing and treatment of waste with a view to harnessing its potential and achieving a significant reduction in volume of waste to be disposed. For the functional performance of recycling system, three components are necessary. First one is the consistent and reliable source of recyclable material. Second is the adequate method for processing the recovered materials into a form suitable for further use. And finally a market for the reprocessed material. The collection is considered as the infrastructure process in the sequence of recycling. Any failure to achieve a viable and economical collection system disturbs the recycling process and leads to dumping of non degradable materials into landfills.
Like other urban centres, the Calicut city also face the problem of solid waste pollution. The growing volume of refuse in Calicut corporation causes difficulties in collection, transportation and disposal. The local authority concerned is handicapped to enforce provisions against this problem. Lack of adequate funds, expertise, administrative machinery, political will and enlarging volume of waste is the major reason behind the failure. The prevalence of Weil's disease and other epidemics reported from Calicut corporation area attracted newspaper headlines. The studies conducted on the problem of solid waste pollution in Calicut corporation concentrate upon sociological and technological aspects of the problem. No study has been conducted to explore the economic aspect of solid waste management in Calicut city. As a major part of the solution to the problem of solid waste, recycling got its importance. In this context it is worth to analyse the economics of recycling in comparison with the formal system of waste management in Calicut corporation area.

1.6 Scope of the study

Successful implementation of a solid waste management program requires careful economic evaluation of all alternative waste solutions. It has been realised that resources of the world are finite and in order to maintain a stable economic growth and a better living standard it is imperative to use the resources very carefully. Here the recycling of waste has become very important as what may be treated as a waste under one
situation may prove to be a valuable product under another situation. Moreover, the solid waste management activities provide employment for a large number of people, with the potential of benefitting many more.

The problem of municipal solid waste is becoming one of the main areas of environmental policy debate. This study intents to analyse the problem of solid waste management in Calicut corporation from a new perspective i.e., economic perspective. The economic approach is one of the important aspects of solid waste management as the problem entails a complex combination of economic, judicial, technological and environmental issues.

The present study analyses the economic and social implications of solid waste management system in Calicut corporation. The formal solid waste management system in the study area involves primary and secondary collection followed by transport to a landfill site where the garbage is processed to produce bio-fertiliser. The formal sector is complemented by a complex and unorganised system of waste picking and collection. This informal system reclaims and recycles much inorganic and non biodegradable waste materials. In this context, the existing recycling system relating to urban solid waste in Calicut corporation is examined with a view to incorporate the role of ragpickers and itinerant buyers.
The study further attempts to analyse the socio-economic condition of waste collectors, who collect the recyclable materials within the study area. The major theme of the study is the estimation of various kinds of costs involved in collection, processing, and reprocessing of waste in the informal sector. For this purpose various processing and reprocessing activities are analysed and costs estimated in the light of the information collected from different stages of recycling process.

1.7 Objectives of the study

From the technological point of view several waste management options are available. Each option presents economic and environmental problems and advantages. The present study is undertaken with a view to evaluate the economic status of formal and informal system of solid waste management in Calicut corporation. The study also aims to find out the volume of employment opportunities created through the waste recycling activity. The study also analyses the existing system of solid waste management such as, different types of costs incurred during the processing of waste materials and the socio-economic conditions of the persons engaged in informal system of waste management. The specific objectives of the study are:

1. To analyse the present mode of managing the waste by formal and informal sector of the Calicut corporation.
2. To find out the volume and composition of waste handled by informal sector.
3. To identify the role that waste collectors play in streamlining the process of waste collection and management.

4. To analyse the socio economic condition of waste collectors within the study area.

5. To identify the various costs like collection cost, processing cost and reprocessing cost of informal system of waste management.

6. To study the nature and extent of employment creation through the waste management practices, and

7. To calculate the performance of recycling of solid waste management.

1.8 Methodology

The study uses both the Primary and Secondary data.

Primary data

Primary data for the study are collected by using both sampling and census method. For analysing the socio economic condition of waste collectors primary data have been collected through a sample survey using interview schedule. Apart from the socio economic status the schedule used for waste collectors included items like factors that led to ragpicking, harassment experienced during waste collection and leisure time activities.

To find out the volume and economic aspects of informal sector waste management, data have been collected from retailers and wholesalers of waste materials through a complete enumeration method by interviewing them with the help of a pre tested schedule. Sample survey is
used to collect information about reprocessing activity. Apart from these, the information obtained from informal talks with medical practitioners, N.G.O activists and general public residing in the area are also substantiated.

Sample design

Keeping the characteristics of waste collectors the purposive random sampling procedure is used for data collection. Using the technique 160 sample units were selected for data collection, the samples were divided into 62 ragpickers, 75 itinerant buyers 20 buyers cum ragpickers and 3 waste sack collectors.

Secondary data

Secondary data pertaining to the key areas of the study were collected from the files and documents of the corporation office and public health centres of the area. Some information were also collected from the government publications such as census reports and corporation level development reports.

Analysis of data

The data regarding the socio economic condition of waste collectors are mainly qualitative in nature as such the technique used is analytical. However, statistical techniques like percentages, ratios, and tables have been used wherever necessary to make the data more precise. To analyse
the economic aspect of formal and informal waste management some cost and benefit calculation methods are also applied.

The socio-economic condition of waste collectors is analysed with the help of inequality in income and expenditure distribution among waste collectors. It is facilitated by employing the measurement of Gini coefficient as

\[
G = 1 + \frac{1}{p} - \frac{2}{p^2} \left[ py_1 + (p-1)y_2 + \ldots + 2y_{p-1} + y \right] \quad \text{(Nagar and Das, 1988)}
\]

Where

\[
\begin{align*}
p &= \text{total no. of persons} \\
y &= \text{total income and} \\
y_1 \leq y_2 \leq \ldots \leq y_p
\end{align*}
\]

The differences of categories of waste collectors with respect to variables as income, total expenditure and expenditure on food is analysed by Wilks' lambda test, a multivariate analysis of variance test. The 'F' approximation to Wilks' lambda is computed following Roa's 'R' statistic as

\[
F = \left\{ \frac{(n-q-p)}{(q-1)} \right\} \times \left\{ \frac{(1-\text{lambda})}{\text{lambda}} \right\} \quad \text{(Johnhson and Wichern, 2001)}
\]

Where

\[
\begin{align*}
n &= \text{no. of cases} \\
qu &= \text{no. of groups} \\
p &= \text{no. of variables}
\end{align*}
\]

To see the differences among categories of waste collectors Scheffe test for the variables is performed (Snedecor and Cochran, 1968). Stepwise forward method of multiple regression analysis and ANOVA test is also
employed to analyse them influence of other variables on the income of waste collectors and differences with respect to different categories of waste collectors. With the result of multiple regression analysis the log income of waste collector can be predicted by the equation.

\[ \log y = a \cdot \text{category} + b \cdot \log \text{TE} + C \] (Gujarati, 1995)

All the above statistical analysis are performed with the computer package stataica for windows (Tulsa, 1995).

1.9 Limitations of the study

Any study of the multidisciplinary nature like this involves many problems and limitations. The major limitation of the study relates to the non availability of upto date census data. The non availability of the list of waste collectors which compelled the investigator to adopt purposive sampling technique is another limitation of the present study.

The subject under consideration of the present study is a multidisciplinary one and need awareness of economics, technology, health science and chemistry. On account of the gaps of knowledge about some variables the study delimit to the economic aspect of solid waste management. However, utmost care has been taken to make this study as objective as possible.
1.10 chapter scheme

The study report is divided into eight chapters for the sake of clear and meaningful presentation.

The first chapter deals with a general introduction, significance, scope, objectives, methodology and limitations of the study.

The second chapter attempts to review the available literature and related studies in the area.

The third chapter presents the tools and techniques used to evaluate the economics of recycling activity.

Fourth chapter provides the profile of the study area by giving stress on environmental issues.

Fifth chapter provides a description of existing solid waste management system in Calicut corporation and the economic aspect of formal system of waste management.

The sixth chapter deals with the socio economic condition of waste collectors who channelise recyclable materials for recycling sector.

The seventh chapter examines the relative cost and revenue from recycling activities, the performance of recycling and related economic aspects.

In the last chapter a summary and conclusion of the study is provided.
REFERENCES


