CHAPTER 5

APPLICATION OF AGAVE FIBRE REINFORCED
EPOXY MATERIALS

5.1 FABRICATION OF HOUSEHOLD TABLE

The increasing environmental awareness in the world new global agreement, and international governmental policy and regulations has been the driving force behind the interest in better composite material. Attractiveness of plant based fibre as an alternative to reinforcement material comes from its high specific strength and stiffness, natural availability, and being bio degradable. Agave fibre is used as a low cost fibre to fill composite that form table parts in the house hold applications.

The table mould was cleaned and dried before it is put to use. Then a release agent, polythene sheet was placed as lay-up (Figures 5.1 to 5.3). Epoxy and hardener was thoroughly mixed giving sufficient time and in the ratio of 4:1. After that, the mixture was mixed with short Agave fibre that is 3mm in length and stirred thoroughly. The short Agave fibre epoxy mixture was laid on the table mould and cured for 24hours (Figure 5.4). After curing, the table parts were taken from the mould and parts were assembled. The beautiful household table fabricated from short Agave fibre reinforced epoxy composites biodegradable, cost effective with aesthetic natural look (Figures 5.5 and 5.6).
Figure 5.1 Table upper plate mould

Figure 5.2 Table leg mould

Figure 5.3 Table leg lay with polyethylene sheet
Figure 5.4  Table leg lay with short Agave fibre/epoxy mixture

Figure 5.5  Household table parts made of short Agave fibre/epoxy composites

Figure 5.6  Assembled household tables made of short Agave fibre/epoxy composites
5.2 FABRICATION OF HOCKEY STICK

Traditionally hockey sticks have been made from wood, more specifically from Mulberry wood. As the game has developed, technology is improved and the movement towards playing on both sand and water based artificial surfaces has firmly taken hold, a number of additional materials have been introduced into the manufacture of hockey sticks. Composite hockey sticks have experienced a very rapid evolution from rather heavy and bulky beginnings to profiles and weight that are almost identical to traditional hockey sticks.

The present invention relates to an improved sports stick and more specifically a sports stick made out of reinforced epoxy composite materials. The invention also relates to the process of producing the sports stick using reinforced epoxy composite materials. Sports sticks, for example hockey sticks, known in the prior art have been made from wood. A wood stick is solid and can be made from a multi ply lamination in order to improve strength. Wood has been a convenient and traditional material to use but it is limited in strength and weight. The hollow tubular construction offers a lighter weight and also forms an easy attachment for the blade and handle. More recent sports sticks are made up of composite materials such as fiber reinforced resins like carbon fiber in an epoxy resin.

Fibre reinforced polymeric composites have received widespread attention in the past four decades because of their high specific strength and modulus. The main reason for many potential users to choose a natural fibre reinforced composites is because of the assumed environmental benefits that these materials can provide. The general feeling of many people on materials like Agave fibres is that they will be friendly for employees in the processing industry, for instance giving no skin irritation like glass fibres.
In another embodiment, the process of manufacturing is detailed wherein, the mould is covered with polythene sheet to avoid contact between resin and wood surface and 3mm length of Agave fiber composites is treated with 5% NaOH. The Agave Fiber and epoxy resin are thoroughly mixed for sufficient time and equally laid on the mould. The mould will be left undisturbed for a period of 24 hours to cure. Upon curing of the fiber and epoxy composite materials, the sports stick made of Agave fiber reinforced epoxy composite hockey will be obtained (Figures 5.7 to 5.11). Faster damping of vibrations provided by fibre reinforced polymers reduces the shock transmitted to the player’s arm in hockey stick and provides better feel for the ball. The Agave fiber composites have better mechanical properties; it is used to fabricate a sports stick. Agave fiber in composites will help produce a new generation of ecofriendly appliances which are bio-degradable.

Figure 5.7 Wood mould for Hockey stick

Figure 5.8 Hockey stick mould lay with polythene sheet
Figure 5.9  Hockey stick mould laid with short Agave fibre/epoxy composites

Figure 5.10  Hockey stick mould filled with short Agave fibre/epoxy composites

Figure 5.11  Hockey stick made of short Agave fibre/epoxy composites
5.3 FABRICATION OF TWO WHEELER BUMPER

It is estimated that the world car production rate per annum will reach 85 million vehicles by 2015. New regulation such as the EU End of life vehicles (ELV) regulations are forcing automotive manufactures to consider the environmental impact of their production and possibly shift from the use of synthetic materials to the use of agro based materials. The main functions of a bumper system are to protect the vehicle body and passengers against collision. An automobile bumper is a structural component with intended function to absorb kinetic energy during vehicle collision. Currently, most of the research is focused on the substitution of new material such as polymeric based composite to achieve higher energy absorption capacity. The automotive industry is in the driving seat of green composites because it is here that the need is greatest. Faced with pressures to produce fuel efficient, low polluting vehicles, the industry has used fibre reinforced plastic composite to make its product lighter. However, producing the composites is energy intensive and polluting, difficult to recycle and hard to dispose of. From present indications, that could turn out to be green composites based on fibres and resins are derived from plants. The automotive industry is generally known for its innovative application of new materials. Natural fibres have the potential to reduce vehicle weight (up to 40% compared with glass fibre, which accounts for the majority of automotive composites), while satisfying increasingly stringent environmental criteria. Much less energy is used in growing, harvesting, and preparing natural fibres than in producing glass fibre.

The bumper beam is a key structure that helps to absorb the kinetic energy from a high impact collision and to provide bending resistance in a low impact collision, and hence the bumper is a structural component.
Analysis of the real impact damping behaviour in an automotive bumper system is quite complicated and depends on different parameters, which include quantity, direction, contact area and position of the applied load. The benefits of natural fibre and its potential physical advantages led to the fabrication of a two wheeler bumper using Agave fibre reinforced epoxy composite materials. Selection of materials is an area of design research interest over the years. In automotive industries, utilization of thermo set resin as a matrix is currently predominating, because of availability, easy processing, low materials cost, low viscosity, shrinkage, better fibre impregnation and proper surface resin wetting. With an intention to replace the conventional materials, in the present study, a model of an automotive bumper made up of biodegradable short Agave fibre reinforced epoxy composite is designed.

Figure 5.12 shows the two wheeler bumper mould made of wood. The mould should be covered with polythene sheet to avoid contact between resin and wood surface and it also helps for easy removal of the composite material. Since it is obviously proven that 3mm length and 5% NaOH treated Agave fibre composites have better mechanical properties, it is chosen to fabricate a two wheeler bumper. To facilitate easy assembly of bumper into a vehicle, a steel collar is inserted into the mould before laying the fibre and resin mixture. The fibre and epoxy are thoroughly mixed for sufficient time and uniformly laid on the mould. The mould was left undisturbed for 24hours to cure properly. The Figures 5.13 and 5.14 show the Agave fibre reinforced epoxy composite two wheeler bumper that has low weight than that of the steel bumpers regularly used.
Figure 5.12  Wooden mould for two wheeler bumper

Figure 5.13  Two wheeler bumper made of short Agave fibre/ epoxy composites
Figure 5.14 Short Agave fibre reinforced epoxy composites Bumper attached with two wheeler