

POLITECNICO DI TORINO
SECOND SCHOOL OF ARCHITECTURE
Master of Science in Architecture Heritage Preservation and Enhancement
Honors theses

New bamboo composite materials for the building and renovation fields

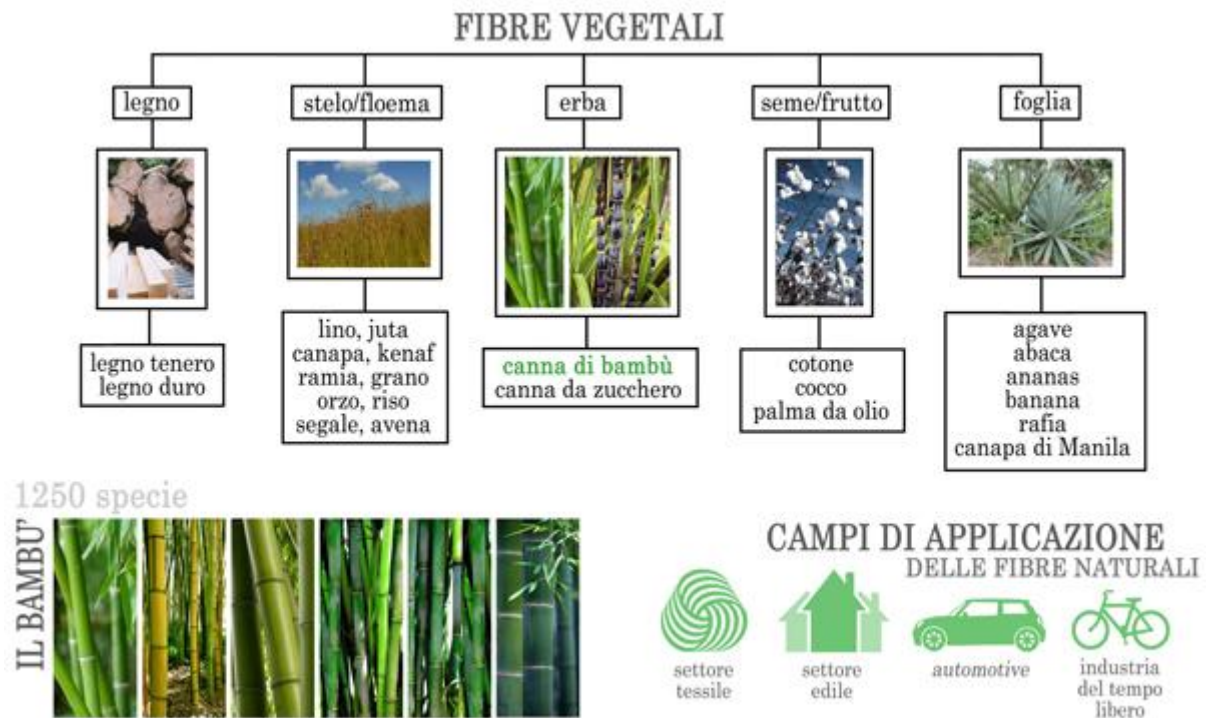
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In the industrial, architectural and engineering fields the research orients itself to find new main materials not obtained from petrol but derived from renewable and eco-friendly sources, that could also be got over without negative effects on the environment or better recycled. The need of new sustainable materials raises the attention of researchers on this important subject, and from the last surveys appears the great role of natural fibres and in particular of fibres derived from bamboo culm. These fibres are obtained from renewable sources, they are abundant on the Earth, and they present other advantages such as a good mechanical resistance and low energy demand on production. Finally, they are a suitable candidate to substitute synthetic fibers (carbon fibers, glass fibers), that are expensive and aren't eco-friendly.

Natural fibers could be used to produce composite materials, that are materials with good performances, based on the union of a polymeric matrix and fibers, where the fibres give resistance to the material, and the matrix keep together the components. Bamboo fibres are appropriate to reinforce many kind of matrices, also derived from eco-friendly polymers such as PLA, and they can be employed to several industrial applications.



Natural fibres typologies and application fields.

Therefore bamboo is an adaptable raw material in every field, quickly renewable (100 tons/hectare every year) and it adsorbs a great quantity of polluting elements, such as nitrates (200 kg/hectare every year); it can be reused, and its crop create a wide amount of jobs (0,5 person employed/bamboo hectare). Comparing to other natural fibres, such as flax or hemp, bamboo crop doesn't deplete soil, it has not to be seed, it isn't subject to weather fluctuation, and it doesn't need pesticides or weed killers. According to these advantages, bamboo fibers have been taken as subject of this research, with the aim to characterize and analyse a new composite material that could substitute for example PVC (that contains toxic elements), widely used to produce building components.

The samples obtained from this survey are PE reinforced with 20% bamboo fibers, and PP reinforced with 35% of bamboo fibers; they have been tested to verify their mechanical properties, and tests have proved that the first one isn't enough strong, but PP with 35% of fibers has appropriate mechanical properties to make it a good for doors and windows production.



Bamboo fibres employed as reinforcement in the composite material samples, with length 2-6 mm (left), and granulated compound of PP reinforced with 35% fibres (right) (Francesca Griotti, NIKON COOLPIX P500, 06/09/2013)

Positive results joined in this survey promise excellent requirements for the realization of a similar composite material made using eco-polymers, such as PLA (derived from sugar fermentation), PBS (obtained from grain fermentation) or PHA (synthesized by bacteria). Researches in this field lays the foundations for production of a eco-friendly material, that doesn't employ main materials derived from petrol but obtained from renewable sources on the Earth, and bamboo, according to its many traits, can be the raw material of the future.



Aesthetic samples PP / 35% bamboo fibers (Francesca Griotti, 04/09/2013)

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