

GREEN BIO-ECONOMY AND NANO-BIOTECHNOLOGY FOR A MORE SUSTAINABLE ENVIRONMENT

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There is a growing recognition that transitioning to a *green bio-economy* could generate a more sustainable growth, addressing some of the systemic problems of the current economical system, such as the decline/loss of ecosystem services, vulnerability to climate-related risks/disasters, and the scarcity of natural resources. Concurrently, the global financial and economic crisis, rising food, fuel prices, and environmental degradation are leading to significant economic, social, and environmental costs with an increase of people inequality and poverty. Thus, according to the UNEP vision, the *green bio-economy* "show great potential for delivering a *triple bottom line* of job-creating economic growth coupled with environmental protection and social inclusion". This new economical approach, based on the use of raw materials obtained from industrial wastes by the utilization of innovative bio-nanotechnologies and renewable energy, could deliver low-carbon and climate-resilient development by more healthy ecosystems. Following these guard lines our research group has developed innovative cosmetic products, food packagings, and advanced medications, mimicking the biological cross linking processes that occur in nature. In particular, these new structures were made bonding chitin nano fibrils (CN) and lignocellulosic polymers by the use of advanced nano-biotechnologies to obtain skin-friendly block copolymeric nano particles and nano composites, 100% biodegradable. In any way all the polymers used were renewable compounds obtained from the fishery's waste and plant biomass respectively. By the use of different methodologies such as gelation, casting and electrospinning technologies we made innovative nano particles and composites, entrapping different active ingredients. It is interesting to underline that the obtained chitin-lignocellulosic nano compounds have shown interesting defensive and reparative properties when applied on burned or wounded skin, under any kind of form, such as gel/emulsions, non woven-tissues or nano composite films. Moreover, they have been further *characterized* by the entrapment of different active ingredients to specialize the final product, focusing the research work on the areas of nano biotechnology for producing new nano-structured cosmetic emulsions with an anti-aging activity and innovative and functional nano fibers useful for medical purpose or to produce more degradable plastic compounds. The development of innovative medical devices, made by 100% biodegradable, natural and safe fibers, will probably open new future opportunities, being an important economic driver as the merger of pharmaceutical, cosmetic, biotech and medical device companies. Thus on one hand, medicine and novel technologies based on the use of industrial natural by-products will play a more prominent role in the future providing safe new products with added value for consumers. On the other hand nano composites, also usable to make

different containers made by the natural chitin-lignocellulosic polymers, could have a chance of becoming a game-changer for the \$ 374-billion-a-year plastic industry, remembering that lignocellulose and chitin are the most abundantly available raw material on earth. Both these polymers, in fact, offer good possibilities to create an added value in the field of material development caused by the use of new biotechnologies and the low price.

The area of *green social solution* is a key way to achieve both poverty reduction and a *green bio-economy*, supported by the growing global demand for innovation and interdisciplinary solutions. For these reasons biotechnology, expected to help meet the most urgent global challenges, will be an important pillar of Europe's economy by 2030, indispensable to sustainable economic growth, employment, energy supply and to maintaining the biodiversity of species and a better quality of life. Our technologies are going in this direction by the results obtained by three EU research projects named, BioMimetic (www.biomimetic.eu), n-Chitopack (www.n-Chitopack.EU), Chitofarma (www.Mavicosmetics.it). Some results and products, usable in the Medical field of a sustainable and advanced Cosmetic Dermatology, will be reported and discussed.

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