Italian-Chinese synergy for agricultural applications

Film from waste oil

Thanks to the agreement recently signed with IBFC (Institute of Bast Fiber Crops), belonging to the Chinese Academy of Agricultural Sciences, the development of biodegradable plastic films for intensive farming is now the firm objective of the Science and Technology Park of Sicily (Italy). The Chinese institute is in the forefront of fabric research and produces non-woven textiles basically made of hemp, cotton and linen, whilst the Sicilian Park has recently patented an innovative method for the production of biodegradable plastic films from renewable sources.
In the laboratories of the two research centres, in particular in the Italian one where a pilot plant is operating, testing will be performed on the chemical-physical characteristics of mulching films obtained by treating the Chinese non-woven textiles with the biodegradable and biocompatible polyhydroxyalkanoate (PHA) produced by the Science Park. The Sicilian researchers intend to develop a highly innovative product, in compliance with the strictest environmental regulations and that combines the waterproofing of the biopolymer with the strength of the Chinese fibre, thus creating a material which could last as long as the commonly used synthetic polymers.
This product is expected to enjoy success on both the markets because the European Union, and more recently the Chinese government too, have focused their attention to the environmental problems linked to the use of plastics in farming. The higher cost of this product will be offset by the savings obtained by not having to arrange for its collection and disposal, as it will decompose in the soil, not to mention the environmental benefits.

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The two centres are also studying the possibility of combining PHA with recycled paper which would create an even cheaper product. Indeed, whilst the production cost of a biocomposite film (picture 1) made of PHA (picture 2) and non-woven cloth (picture 3) would be between 3.50 and 3.80 euro/kg, a film made of PHA and recycled paper would cost around 3 euro/kg.
PHA is one of the flagship products of the Science and Technology Park of Sicily and it is the result of cooperation between the Park itself, the Sicilian universities (Catania, Messina and Palermo), the National Research Centre of Naples and Pozzuoli and a few specialised companies. This strong synergy has led to the development of a completely new method of producing PHA that has actually been.
Organic polyesters, with characteristics similar to the common polypropylene of petrochemical origin, are produced by a variety of micro-organisms in conditions of nutrient imbalance and excess of carbon sources: carbon is then accumulated as energy storage in the cytoplasm of the organism in the form of PHA granules.
The carbon source utilised in the laboratories of the Sicilian Park is a mixture of waste food oils while the bacterium synthesizing the polymer is a tomato pathogen, Pseudomonas corrugata PSTS A1 (it is possible to extract up to 50% of PHA from its lyophilised biomass). This specific strain, modified in the Sicilian laboratories, produces an enzyme (lipase) which is the most suitable for the degradation of waste oils.

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In economic terms, producing PHA from waste oils has the double advantage of reducing the production costs (the carbon source is almost cost-free) and valorising waste materials as renewable sources. From a chemical-physical point of view, unlike other polyesters, this polymer has a side chain of medium length and can therefore be processed at lower temperatures.
The use of waste materials as carbon source is essential for a commercial diffusion of PHA, since current production using nobler sources would make the biopolymer price prohibitive. A lower cost of the raw material therefore would allow the polyhydroxyalkanoates to gain a larger slice of the fast-growing biopolymer market. Whilst in 2001 European consumption was around 25.000 tons, with the help of favourable legislation, forecasts suggest a growth up to 1 million tons in 2010 and even to 5 million tons in 2020. This will also be possible thanks to increasingly innovative production processes.
The STPS is trying to further decrease the cost of PHA by using Escherichia coli, a more versatile and productive bacterium than pseudomonades. Moreover, the production of PHA in vegetal fabrics is being tested. Indeed, PHA synthase genes have been transferred to plants such as Arabidopsis thaliana and tests with textile plants are planned for the future.

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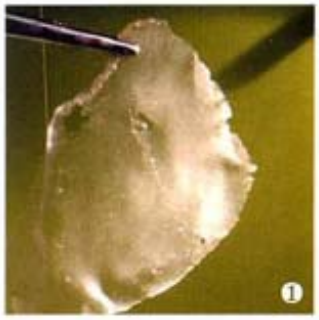
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From virtual to real

Last October, at the Polytechnic Design School (SPD) in Milan, inauguration was held of Matrec, the first Italian excellence centre for recycled materials and products. This meant that the initial idea, virtually started in 2002 with the launch of the related web portal, came true.
Recycled materials coming from bottles, cans, newspapers, tyres, clothing, furniture and so on are now visible and, more important, they can be touched and smelled. These reclaimed materials turns into seats, flooring, insulation panels, lamps and many other innovative and, more significant, environmental-friendly items.
In short, this is what the Matrec project stands for. Started as the first on-line, free database on eco-design matters, now it is regarded as the first Italian excellence centre for recycled materials and products.
Matrec's aim is to serve companies, designers, universities, professionals and even those citizens who simply are curious about recycling topics, either upstream or downstream the process itself.
A sort of library wishing to spread knowledge and education concerning mechanical valorisation of materials and, even more, potentialities of innovative materials originated from separate collection.
At the SPD, a dedicated area is destined for exhibition of