Itaconic acid-based monomers and polymers

By:

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The mission of Advanced Polymer Materials (APM), a company formed in 2007 as a spin-off for new business initiatives proposed by researchers of the University of Ferrara (Italy), is to provide technical assistance for processing and quality control of several kinds of polymer materials, such as thermoplastic commodities, thermosets and UV curable mixtures. Today APM is a dynamic company satisfying different needs in the field of plastics by applying methods for the determination of physical-chemical properties, rheological, morphological and thermomechanical properties of thermoplastic polymers, elastomers and thermal- and UV-curable monomers for the production of paints, inks and adhesives.

In recent years, APM has also developed, in collaboration with several small and medium-sized Italian companies, new polymer materials for areas of application having special attention to polymer materials with low environmental impact used for flexible packaging of food and drink. Since October 2013 APM has been the project leader of BiMoP (European project Life12/env/it/600), which is focused on the applications of itaconic acid (IA) and its derivatives as monomers for the production of thermo- and UV-curable mixtures used for coatings, inks and adhesives, in collaboration with Polynt and Imperial italian companies.

The commercially available IA, derived from the biotransformation of starch-based biomasses from agricultural surpluses or non-food industrial processes, has been used by Polynt for the production of unsaturated polyester resins and di-alkylester derivatives as monomers. These new biomaterials are suitable to be used in combination with biodegradable and compostable thermoplastic polymers as sustainable and safe materials for packaging applications, such as polylactic acid (PLA).

Finally, another important aspect of the project BiMoP is the proposal of new polymers completely derived from renewable resources as crosslinking agents, for biocomposite polymer matrices, as an alternative to conventional materials, so avoiding emissions during the production of styrene with harmful effects to human health and the environment.

Furthermore, IA has been used as modifier for polyolefins, replacing the maleic anhydride for hot melt adhesive applications. The bio-based unsaturated polyesters and monomers have been used for the production of flexible abrasive tapes (Imperial) and laminates in line with European regulations suggesting an emission decrease of formaldehyde by replacing the phenol-formaldehyde resins with water-based epoxy resins having IA derivatives as curing agents. Preliminary studies have demonstrated that IA–based monomers and unsaturared polyesters can be successfully applied as thermo- and UV-curable resins for surface coatings, inks and adhesives for food packaging film and bottles (see fig. 1), whilst maintaining the biodegradability and compostability properties as requested by the EN 13432.

Fig. 1
Biobased UV curable mixtures used as white inks for PLA bottles.

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