Sustainable UV Stabilizers Based on Isosorbide

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A new class of sustainable resource derived UV stabilizers, based on the cinnamic acid esters of isosorbide is under investigation. This work is part of a larger program to identify commercially relevant corn sugars based chemistries. The Iowa Corn Promotion Board (ICPB) is the lead organization that has been supporting research designed to develop cost-effective corn based chemistries and processes relevant to the commercial polymer and related industries. ICPB has licensed technology developed at Pacific Northwest National Laboratory (PNNL) to manufacture isosorbide. This research was funded by the Iowa Corn Promotion Board, US Department of Agriculture and the US Department of Energy. ICPB has partnered with the New Jersey Institute of Technology (NJIT) to identify and assess potential polymer applications for isosorbide.

The project is centered on defining the cost-performance of isosorbide derived compounds that improve the performance characteristics of commercial systems. The work will positively impact the feasibility of fuel production in an existing biomass processing facility by creating applications for high-value chemical building block derivatives co-produced with liquid fuels. The work builds on inventions and concepts of the ICPB-PNNL and ICPB-NJIT partnerships where several patents have been filed and more are pending. Isosorbide is a versatile, GRAS, dianhydrosugar compound, derived from sorbitol, with broad application as a building block for the polymer and pharmaceutical industries. Isosorbide currently sells for about $2.00/pound; it is expected that the new process could lead to volume pricing of less than $1/pound. The properties of isosorbide are summarized in Figure 1.

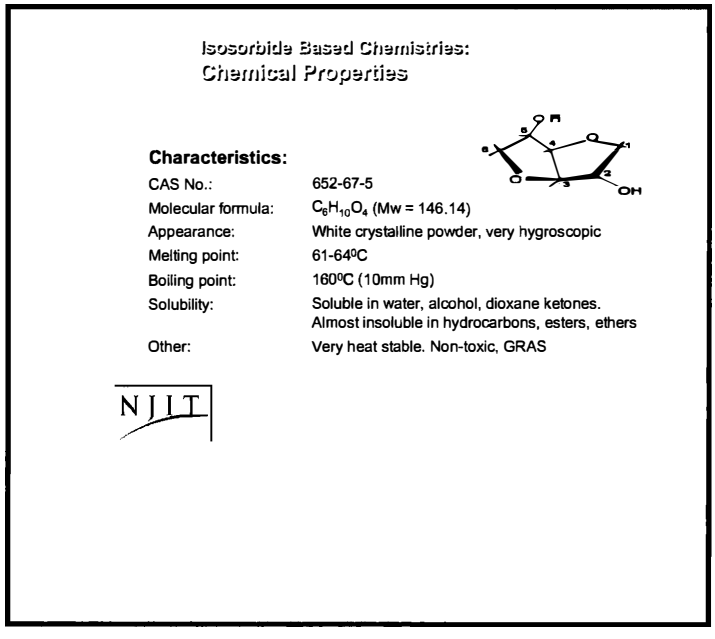

Figure 1 – Structure and Properties of Isosorbide

Figure 2 shows the proposed generic reaction route for attaching cinnamic acid moieties to isosorbide.

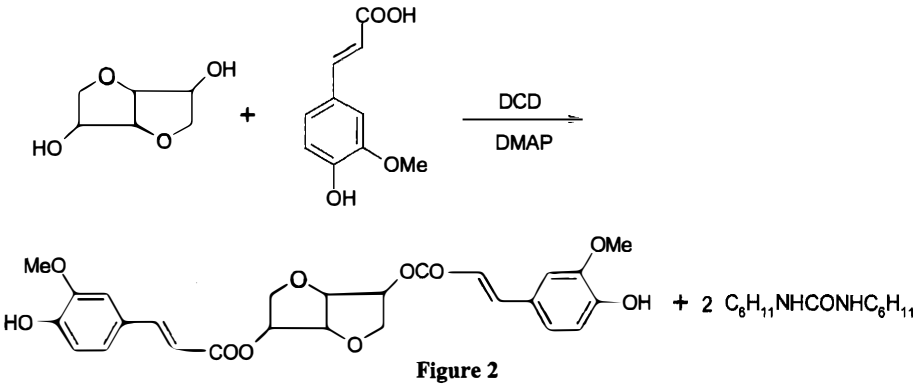

Figure 2

Preliminary characterization indicates that these compounds are hydrophilic, thermally stable compounds that are compatible with many polymer and cosmetic base materials. A typical UV spectrum is shown in Figure 3.

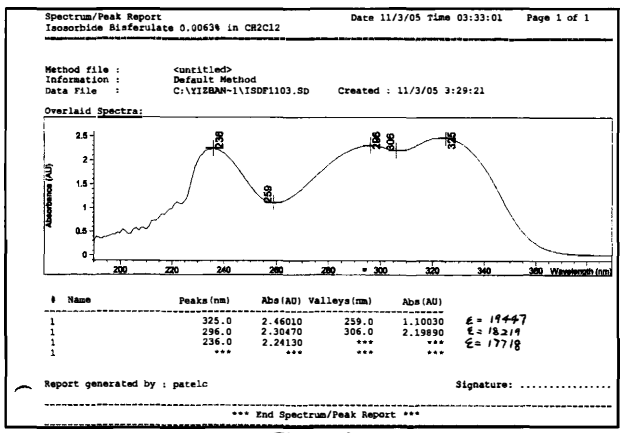

Figure 3

It is expected that this family of compounds will effectively absorb both UVA and UVB and be suitable for both cosmetic and polymer applications. We have also developed technology for the controlled monoesterification of isosorbide, leaving the second unreacted hydroxyl as an active site for the addition of compatibilizing, plasticizing or other functionally active moieties. This isosorbide based chemistry then provides a template for "designer" UV stabilizers based on GRAS core material.