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Biosynthesis of Novel Polyunsaturated Odd-Carbon Dicarboxylic Acids as New Polymer Feedstocks

Abstract.

Fatty dicarboxylic acids (FDCA), composed of hydrocarbon chains terminated on both endswith a carboxylic ac
important components in a variety of products; they hold particular value as components in condensation polym
nylons and polyesters.Most commercially available FDCAs are based upon a saturated (absence of carbon-carb
bonds) and even-numbered carbon skeleton. The overall goal of this research is the development of efficient an
biosynthetic pathways for production of unknown or poorly accessible polyunsaturated and odd-carbon FDCAs
chemical feedstocks, including monomers for high performance polymers. This preliminary research has three c
exploiting a recently elucidated biosynthetic pathway in Lysobacter enzymogenes (Le) to develop a sustainable
method for synthesis of previously unknown polyunsaturated odd-carbon FDCAs; investigating the chemistry o
materials, with an emphasis on generation of new condensation polymers capable of post- polymerization cross
functionalization. The planned research, which takes advantage of UNL research strengths in biosynthesis (Du)
synthesis (Dussault), and polymer synthesis/characterization (Yang), will initially target the biosynthesis and is
previously unreported nine-carbon unsaturated FDCA. The derived monomer will be investigated for condensat
polymerization to form a new Nylon, which will be investigated for post-polymerization functionalization. Shou
permit, the route will also be demonstrated for an analogous thirteen- or fifteen-carbon species. The immediate
the research will be preliminary results that will place the team in a competitive position for future funding fron
DoE, and/or NSF. The long-term outcome of the research is the development of new science and technology as
nationwide transition to sustainable manufacturing practices in which a high fraction of chemical intermediates
from agrochemical and biochemical pathways.