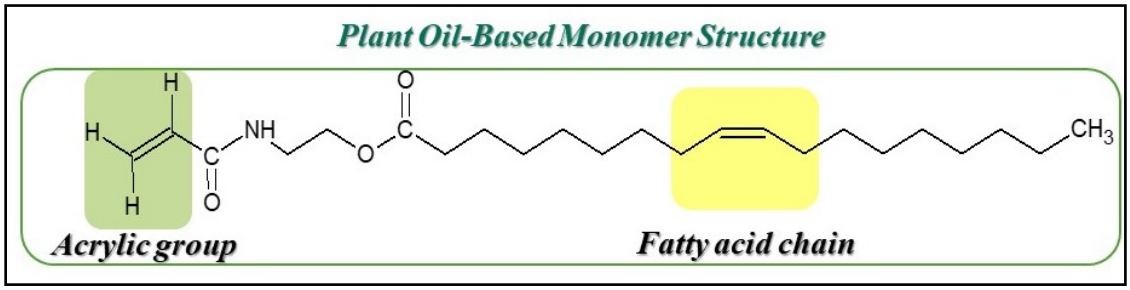
ACRYLIC MONOMERS DERIVED FROM PLANT OILS - SYNTHESIS AND USE IN HIGH VALUE POLYMERS
(RFT-462)

Technology:

Triglycerides derived from plant oils and fats are difficult to convert into low molecular weight acrylic monomers. Current production of fatty acrylates utilizes multistep synthesis. For example, the production of a well-known fatty monomer, stearyl acrylate, includes saponification, neutralization, reduction, acylation, and other procedures which are quite expensive. NDSU's one-step method can be performed using a batch set-up designed for biodiesel production, providing a simple and well-understood path to substitute bio-based monomers for petroleum-based monomers in production of existing and new acrylic polymers.



Invention Summary:

Scientists at NDSU have developed an efficient and cost-effective one-step method to convert plant oils into acrylic monomers that can be used to produce latexes, latex adhesives, surfactants, emulsifiers, rheology modifiers, sizing agents, resins, binders, and other products that utilize acrylic polymers. Incorporating relatively small amounts of these monomers into polymeric materials enables specific and targeted shifts in thermomechanical and physical properties such as polymer material flexibility (elasticity), hydrophobicity, surface activity, film-forming temperature, viscosity etc., to optimize a product's performance without radically changing its behavior. The NDSU monomers contain two types of double bonds that aren't present in petroleum-based monomers. The double bond within the acrylic group is reactive in conventional addition free radical polymerization, which allows formation of linear polymers. The double bonds within the fatty chain remain unaffected during free radical polymerization, so remain available for additional post-polymerization tuning of the polymer performance characteristics through autoxidative cross-linking. This is in contrast to existing plant oil-based monomers, which produce branched and cross-linked polymers (due to fatty chain double bonds reactivity during the polymerization reaction).

NDSU Research Foundation
1735 NDSU Research Park Drive Dept. 4400 PO Box 6080 Fargo, ND 58108-6050
701.231.8173 or 701.231.6659 Fax 701.231.6661 www.ndsuresearchfoundation.org

This method can use essentially any plant oil, animal fat, or other fatty esters as the raw material. Monomers derived from olive, high oleic soybean, canola, sunflower, soybean, corn, linseed, and other plant oils have been made and tested.

Applications:

- Cosmetics (e.g. eyeliner, lipstick, foundation)
- Hair styling products
- Polymeric emulsions (e.g. latexes)
- Resins
- Paints and coatings
- Plastics
- Adhesives
- Chemical binders

Benefits:

The performance attributes of the linear structure derived from the NDSU monomers provide significant benefits as compared with competing plant oil-based polymers.

- Simple, one-step conversion of plant oils and other triglycerides into acrylic monomers
- Plant oils can be selected to enable specific post-polymerization strategies and functionalities (i.e. the lengths and degree of unsaturation of FA side chains from different plant oils leads to different polymeric material properties)
- Monomers are direct substitutes for petroleum-based monomers in conventional synthesis, with no need to change the manufacturing process
- Monomers contain two types of double bonds which aren't present in petroleum-based monomers, and which are sequentially used to first integrate the monomers into linear polymers and then to adjust functionality and performance through post-polymerization adjustments
- Enables production of specialty additive that can hydrophobize and plasticize the material at the same time
- Provides internal plasticizing of polymeric material by softening the end product as desired
- Integrate monomers to improve water/moisture resistance, material barrier properties
- Simultaneous water-resistance and grease-resistance (when cross-linked) of polymer layers, films and coatings on various substrates
- Enables rheology modification, and thickener properties
- May be used to produce amphiphilic polymers with surface-active properties that can be used as emulsifiers, stabilizing agents, and for solubilization of compounds that are normally poorly water-soluble
- Outstanding film-forming properties on hair, with ability to easily adjust degree of 'hold'

- Testing of cosmetics applications shows small amounts of monomer lead to improved durability and quality, with excellent oil-resistance, water-resistance, film-forming, and flexibility

Patents:

This technology is the subject of Issued US Patent Nos. 10,315,985and 10,584,094.
This technology is also patent pending in Europe (EP3183310) and is available for licensing/partnering opportunities.

Contact:

Saurabhi Satam
Business Development and Licensing Associate
ssatam@ndsurf.org
http://www.ndsuresearchfoundation.org/
701-231-8173