

Technical Brief

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Continuous process for the manufacture of Azelaic acid - an API and Industrial Additive

Technology Summary

CSIR NCL has developed one of the best ever catalyst-free syntheses of azelaic acid by ozonolysis of oleic acid without the need for cryogenic conditions or high temperatures, making the process highly scalable.

Background

Azelaic acid is a naturally occurring dicarboxylic acid that is synthesized by yeast present on skin. It can also be found in whole grain cereals, rye, barley and animal products. Azelaic acid has many beneficial properties, such as being comedolytic (prevents comedones), keratolytic (decreases keratin), anti-inflammatory, and has antioxidant properties. It is widely used as a topical treatment for acne and other skin problems. Azelaic acid is conventionally synthesized in batch mode through oxidation of oleic acid with various oxidizing agents in the presence of a catalyst and solvent. However, currently available methods usually have very long reaction times and less yield. So, there is a need to develop a process for the oxidation of fatty acids with less reaction time, recoverable or no catalyst and with high yield.

Technology Description

CSIR-NCL has developed an efficient, catalyst-free process for the rapid oxidation of oleic acid to afford azelaic acid, with 80-100% conversion of oleic acid to form azelaic acid and nonanoic acid. The process is co-oxidant-free, and allows for complete recovery of the solvent. The reaction can be carried out either in batch or continuous (flow) mode. The reaction involves reacting oleic acid, dissolved in an ozone-oxygen mixture, for a period of 2-60 min at a temp in the range of - 78 to 30 deg C to obtain the corresponding products, wherein the conversion of the fatty acid is in the range of 80% to 100.

Market Potential

The worldwide market for Azelaic Acid is expected to grow at a CAGR of roughly 7.7% over the next five years, will reach 210 million US\$ in 2024, from 130 million US\$ in 2019.

(<https://www.absolutereports.com/global-azelaic-acid-market-13856553>)

Value Proposition

- Current technology can be used for oxidative cleavage of other unsaturated fatty acids.
- 100% conversion of oleic acid with more than 99% pure azelaic acid and pelargonic acid.
- The process is catalyst free and co-oxidant free, making the process easily scalable at an industrial scale.
- Reaction time of 2-60 minutes
- Continuous flow process also shown
- In-line quenching of ozonoids and safe process
- Complete recovery and reuse of solvent. The reused solvent mixture was used at least 3 times with no detectable change in the yield, making it a much greener process.
- No toxic effluents come out during or after the reaction, and so no further treatment is needed

Applications

Azelaic acid finds extensive application as an API in dermatological medication, skincare cosmetics, as a plasticizer and lubricant, and other applications such as polyamide sutures and cable/wire jacketing.

Technology status

- Demonstrated and validated at 50 gm/hr scale.
- Pilot plant of few Kg/day developed.
- Patent protected.
- Seeking industry partners interested in technology licensing

