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New process to make polyamides monomers by oxidative cleavage of fatty nitriles

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Polyamides commonly known as nylon, are long chain polymers constituted by amides units obtained from polymerization of the acid group of a hydrocarbon chain with an amine function. Polyamides are characterized by the length of their methylene $(-CH_2)_n$ chain, the most known structures being PA 6, PA 6,6, PA 6,10, PA 9, PA 11, PA 12 and PA 13. These polymers are unquestionably among the most important "engineering plastics" in the thermoplastic industry. The polymer PA11, Rilsan® designed by ARKEMA, which the starting material is castor oil, is applied in the industry of textile, electronic devices, automotive, energy and sports due to its attractive mechanical properties such as flexibility, high temperature and pressure resistance, good resilience, low creep and an excellent resistance to wear due to a low coefficient of friction.

The oxidative cleavage is an attractive strategy to access to monomers from fatty compounds.

Arkema's interests on nitrile compounds, using H_2O_2 as a green oxidant led to a new synthetic route to obtain PA 11 and PA 12 from fatty acids into saturated hydroxylated fatty acids. The conversion of a natural oil rich in unsaturated hydroxylated fatty acids into saturated hydroxylated fatty acids is obtained by hydrogenation in presence of a metal-based catalyst. This is followed by ammoniation of the fatty acids with concomitant dehydration of the hydroxyl group in order to obtain mono-unsaturated fatty nitrile. Finally nitrile-acids are obtained by oxidative cleavage of the latter's using a solution of hydrogen peroxide and tungstic acid catalyst. Process optimization will be discussed.