

High Quality Fuel Components from C₄ Hydrocarbons

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The C₄ cut is a noticeable source of chemicals to be used in several sectors, ranging from fuels to polymers; moreover, C₄'s origin not only from Oil treatment (Fluid Catalytic Cracking or Steam Cracking) but also from Natural Gas, being part of its humid fraction.

In this presentation, I'll summarize the results achieved in more than a decade of investigations in the Eni Group with the aim to convert C₄ olefins (either already present in the C₄ source or produced on purpose by paraffins dehydrogenation) into oxygenated and hydrocarbon products that can be used as high quality components for cleaner gasoline or diesel fuels.

As regards the production of gasoline components, following the historical experience on the MTBE process, which was introduced first by Eni into the market in the early 70's, particular efforts were also recently directed to the production of high quality hydrocarbon compounds :

- either via acid resin-catalyzed selective dimerization of isobutene (followed by hydrogenation) to Isooctane,
- or to the design of new more selective approaches for butenes alkylation, in the presence of soluble acid catalysts.

By integrating these different technologies, some new configuration will be discussed in order to replace the production from field butanes of MTBE, now jeopardized by the ban in California and other bans in the US.

As regards the production of diesel components, our attention was addressed both to oxygenated and hydrocarbon compounds.

High cetane linear ethers were found to display attractive properties and they were achieved through two main pathways:

- 1,3-butadiene telomerization with methanol to achieve an unsaturated octadienyl-ether readily hydrogenated to methyl-n-octyl ether (MOE). Alternatively, this approach can be also useful to achieve 1-octene by selective MOE cracking.
- Selective hydroformylation of n-butenes to n-pentanol, followed by selective etherification of the alcohol to di-n-pentylether (DNPE).

On the other side, n-butenes containing cuts can be oligomerized in the presence of zeolite catalysts to achieve a high cetane diesel cut with excellent properties, similar to the gasoil from Fischer-Tropsch.

Some of these approaches have been also transferred to C₅ cuts in order to achieve the same targets.