Integration – Reformer - Cracker

N-paraffins are the most suitable naphtha feed components as their ethylene + propylene yield is the highest compared to iso-paraffins and naphthenes. As a result n-paraffins produce the least amount of heavy by-products. Thus it would be more desirable if naphtha cracker was fed with n-paraffins only.

Technology to extract n-paraffins from hydrocarbon streams such as diesel already exists (13). This technology has been extended to naphtha by UOP with a process called MaxEne™(1). Non-normal portion of naphtha is an ideal feed to catalytic reformer which converts them to gasoline with higher octane number. Thus an integration of MaxEne™ with n-paraffins based cracker and non-normal based catalytic reformer would result in the most efficient use of naphtha.

There are several advantages of cracker designed for n-paraffins as the feedstock. Besides utilizing the lowest amount of feedstock, the cracker will have lower capital investment cost than the regular naphtha cracker. The n-paraffin furnace coke lay-down is 25%+ lower than that of the regular naphtha indicating significantly higher run length for n-paraffin furnace compared to regular naphtha furnace(1). Obviously quench oil and quench water sections will have much lower capacity for n-paraffins compared to regular naphtha case.

Probably the burden of handling by-products is not well appreciated. For example, just a few years ago disposal of pyrolysis gasoline was such a trouble that the crackers were looking for upgrading pyrolysis gasoline. N-paraffins as cracker feed minimizes pyrolysis gasoline production. As our hydrocarbon resources become scarce integrated complexes which are highly feed efficient will survive in the long run. There are several naphtha crackers with an ethylene capacity of 400 to 500 kTA who can use this strategy to improve their economics.

References

Figure 1 – Integration of cracker and reformer with paraffin separation