Post Consumer Plastic Recycling

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Jonny Goyal
Associate Director

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Jonny Goyal, Associate Director

Abstract

Plastics have become one of the most ubiquitous materials in our everyday lives. However, the proliferation of plastics that are entering and clogging our rivers, oceans, and landfills each year has also brought adverse environmental impacts. An estimated 8.3 billion metric tons of plastic has been produced in total since the 1950s, and recent research shows that only 9% has been actually recycled, 12% has been incinerated, and the remaining roughly 80% has largely ended up in landfills, in the oceans, or loose in the environment. This is a major global challenge and it has sparked strong interest in more efficient production, use and disposal of plastics, in line with the principles of the circular economy. There is also increasing regulatory pressure regarding recycling quota and recyclability along with strong commitments from global chemical industries towards increasing the share of recycled material in their offerings. As pressure builds on chemical makers to solve the plastic waste problem, firms are increasingly exploring chemical recycling as a complement to traditional mechanical techniques that reforms it into a usable pellet only.

This report discusses chemical recycling of plastics (mainly polyolefins from mixed waste plastics) using pyrolysis (thermal and catalytic depolymerization). The objective of this report is to evaluate the process economics of associated technologies. We present a comprehensive description on the technology aspects, current industry status across globe, and major risk factors related to technology implementation. Following cases are covered in this report:

1. Case I—Plastic Energy’s TAC Process (to produce TACOIL for refineries cracker)

2. Case II—Klean Industries SPR Plastic Pyrolysis Process

3. Case III—Agilyx pyrolysis process to produce synthetic crude oil from mixed waste plastics.

We have used Aspen Hysys and IHS Markit’s internal tools to work out a process design and its economics. We have tried to put forward the behaviours of lights ends, medium ends, and heavy ends produced from pyrolysis using these tools and have assigned plus compared their market prices accordingly. The main challenges associated with the economics of plastic pyrolysis processes remain with the selection of proper feedstock, plant capacity, and tipping fee. There are many plants coming up across globe to recycle waste plastics but they are yet to be expanded to operate on an industrial scale. Most of the pyrolysis players have modular units’ approach (10–50tpd). Due to their smaller scale, it has been easier for companies to keep some pilot facilities running. To bring it to an industrial scale, chemical recycling needs to strike a balance between economic viability, regulatory compliance, and environmental impact.

With chemical recycling, we break down plastic to its core building blocks down to the molecular level. It can take a higher degree of contamination (organic & non-organic materials) than mechanical recycling and also allows plastic to be recycled an infinite number of times. But specific plastics like PET and PVC have limits that may increase the upstream pretreatment cost. Moreover, being a fairly

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new processes, chemical recycling needs to be conceptualized in the legislation, so that its output material is clearly defined and distinguished from energy recovery. Chemical recycling should be seen as a complementary solution to mechanical recycling when the latter proves to be inefficient in case of difficult to recycle plastics, i.e., not properly sorted, multilayered or heavily-contaminated waste. At the same time, increased collection of high-quality waste and design for recycling should remain the two priorities in order to increase the recycling rates for plastics.

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Europe, Middle East, and Africa: +44 (0) 1344 328 300
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