JRF GLOBAL

SYNTHETIC CHEMISTRY

(Chemical Synthesis)

Chemical synthesis is a purposeful execution of chemical reactions to obtain a product, or several products. This happens by physical and chemical manipulations usually involving one or more reactions. In modern laboratory usage, this tends to imply that the process is reproducible, reliable, and established to work in multiple laboratories.

A chemical synthesis—synthesis, in its present meaning originating with chemist Hermann Kolbe—begins with the careful selection of the target, based on the relationship of possible targets of chemical, functional, or therapeutic interest to the broader aims of the research effort, whether industrial or academic; various further practical concerns come into play, including manpower available for the campaign, as well as availability of material resources (necessary equipment, starting materials and bulk chemicals, etc.), and along with these, budget for these practical necessities. For instance, a prior developed reaction methodology may highlight particular man-made or natural compounds that would serve the purposes of the effort, in highlighting the breadth of the new methodology; alternatively, grant or unit budgetary or timeline constraints may necessitate aiming for a simpler member of a family of complex natural products, or practical constraints such as the lack of suitable starting materials may necessitate a semi-synthesis over a total synthesis, etc. Once the target or targets are established, the next critical phase begins, that of synthetic design, typically in modern efforts, in the area of organic synthesis, using retrosynthetic analysis, as championed by E.J. Corey and others.

An eventual step is selection of compounds that are known as reagents or reactants. Various reaction types can be applied to these to synthesize the product, or an intermediate product. This requires mixing the compounds in a reaction vessel such as a chemical reactor or a simple round-bottom flask. Many reactions require some form of work-up procedure before the final product is isolated. The isolation (purification) of the product then proceeds via a variety of methods.

The amount of product in a chemical synthesis is the reaction yield. Typically, chemical yields are expressed as a weight in grams (in a laboratory setting) or as a percentage of the total theoretical quantity of product that could be produced. A side reaction is an unwanted chemical reaction taking place that diminishes the yield of the desired product.

Many strategies exist in chemical synthesis that go beyond converting reactant A to reaction product B in a single step. In multistep synthesis, a chemical compound is synthesised though a series of individual chemical reactions, each with their own work-up. For example, a laboratory synthesis of paracetamol can consist of three individual synthetic steps. In cascade reactions multiple chemical transformations take place within a single reactant, in multi-component reactions up to 11 different reactants form a single reaction product and in a telescopic synthesis one reactant goes through multiple transformations without isolation of intermediates.

For further reference, refer: https://en.wikipedia.org/wiki/Chemical_synthesis